# OPEN SOURCE SENSOR ASSEMBLY

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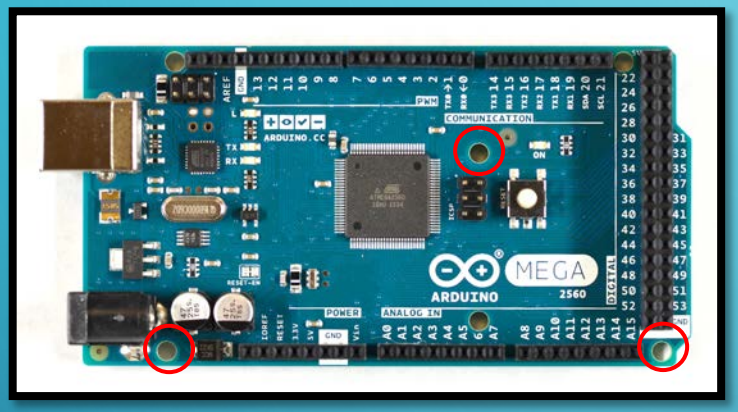
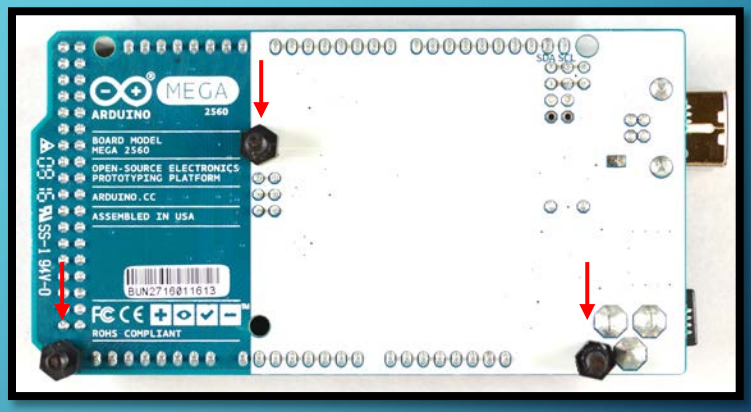
science in ACTION

INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

# ARDUINO

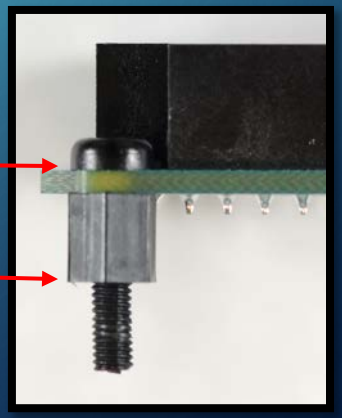


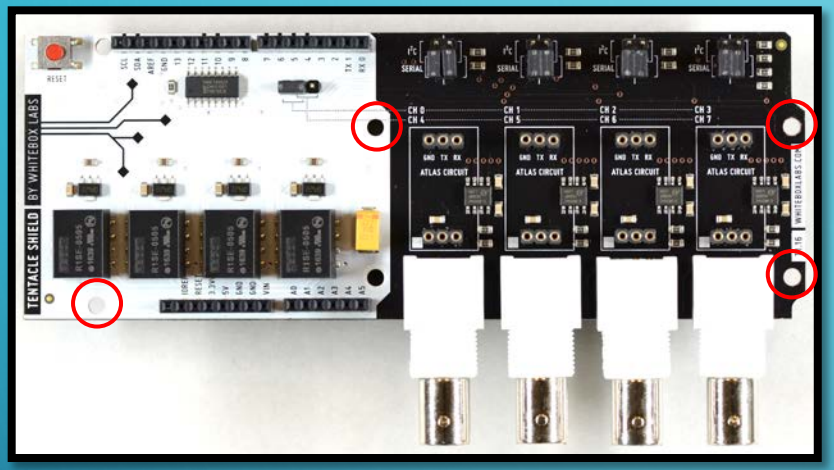

Attach 3 standoffs (spacers) to Arduino microcontroller for mounting to enclosure.

M3 x 6mm screw

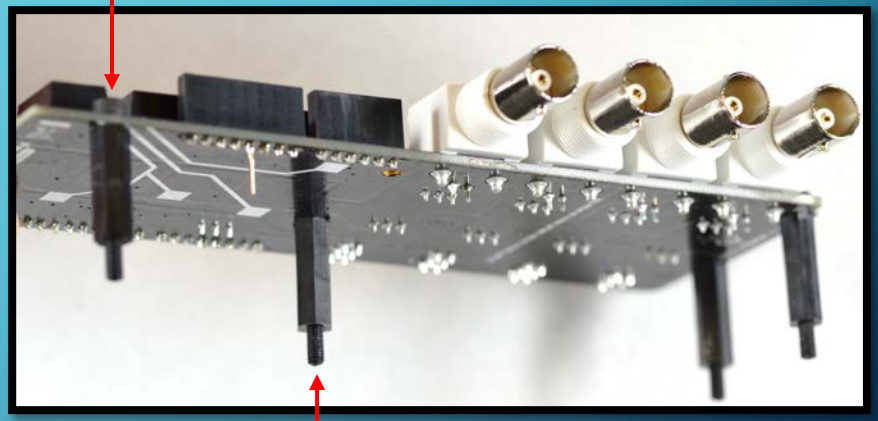
M3 x 6mm female/male threaded Standoff



# TENTACLE SHIELD



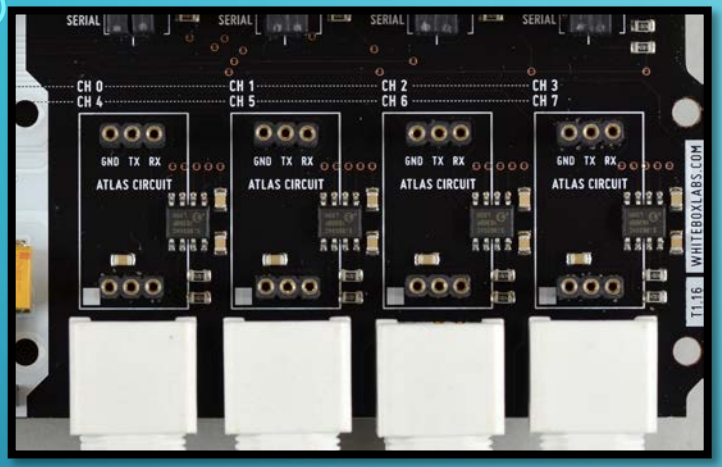

M3 x 6mm screw

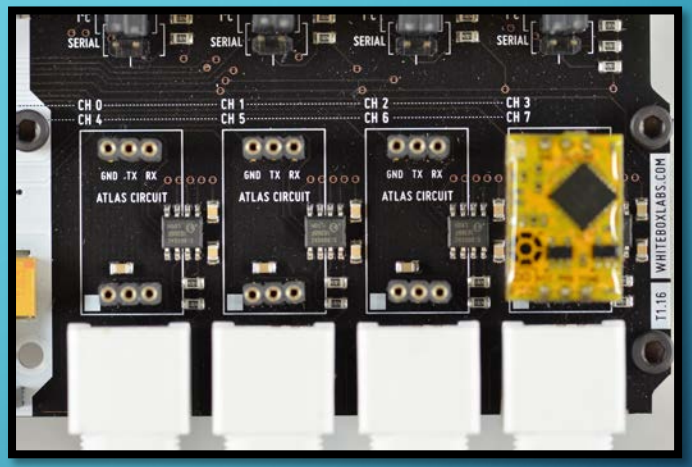


M3 x 16mm female/male threaded Standoff

Attach 4 standoffs (spacers) to Tentacle Shield for mounting to enclosure.

# TENTACLE SHIELD/ATLAS SCIENTIFIC CIRCUITS

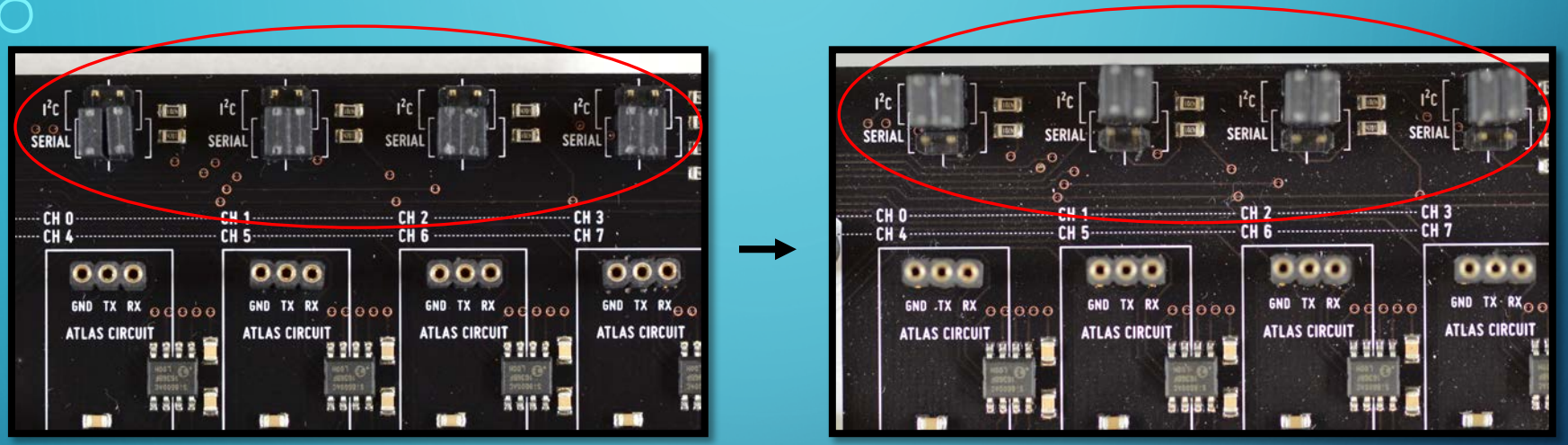




Insert Atlas Scientific circuits into designated space on Tentacle shield. **Order does not matter, but orientation does!**

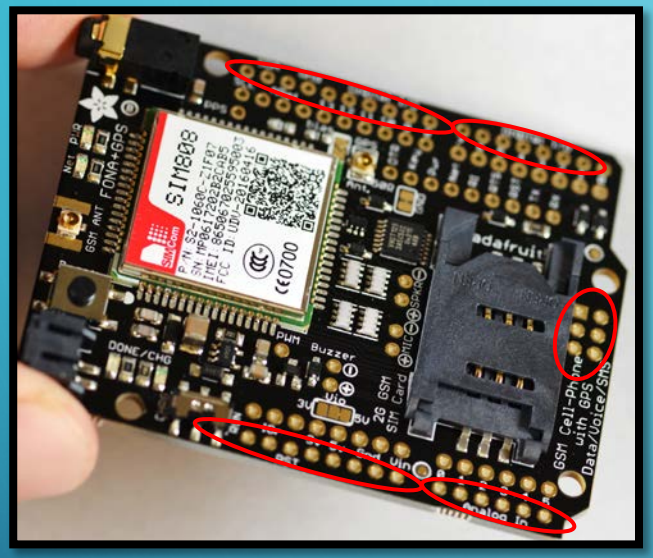
# TENTACLE SHIELD/I²C CONFIGURATION

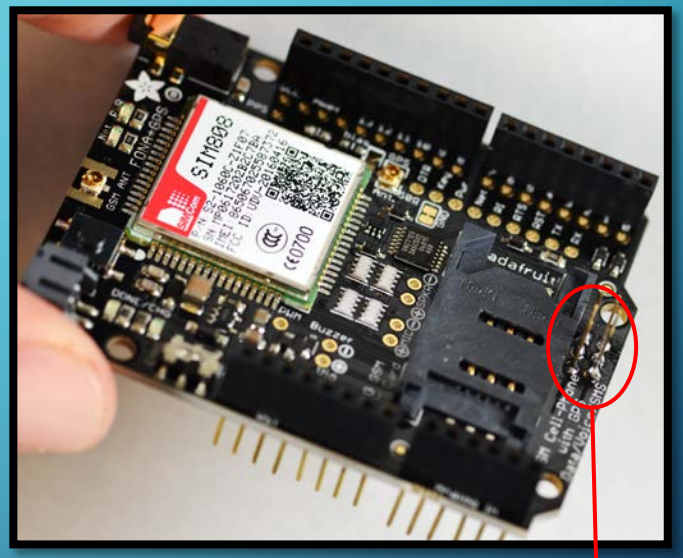



Ensure the communications jumpers are moved from the "Serial" setting to the "I²C" setting. Circuits have already been configured for I2C communications for you! To complete this step on your own, follow the tutorial provided by Whitebox Labs:

https://www.whiteboxes.ch/tentacle/#switch-i2c

# FONA 808 MODEM HEADERS



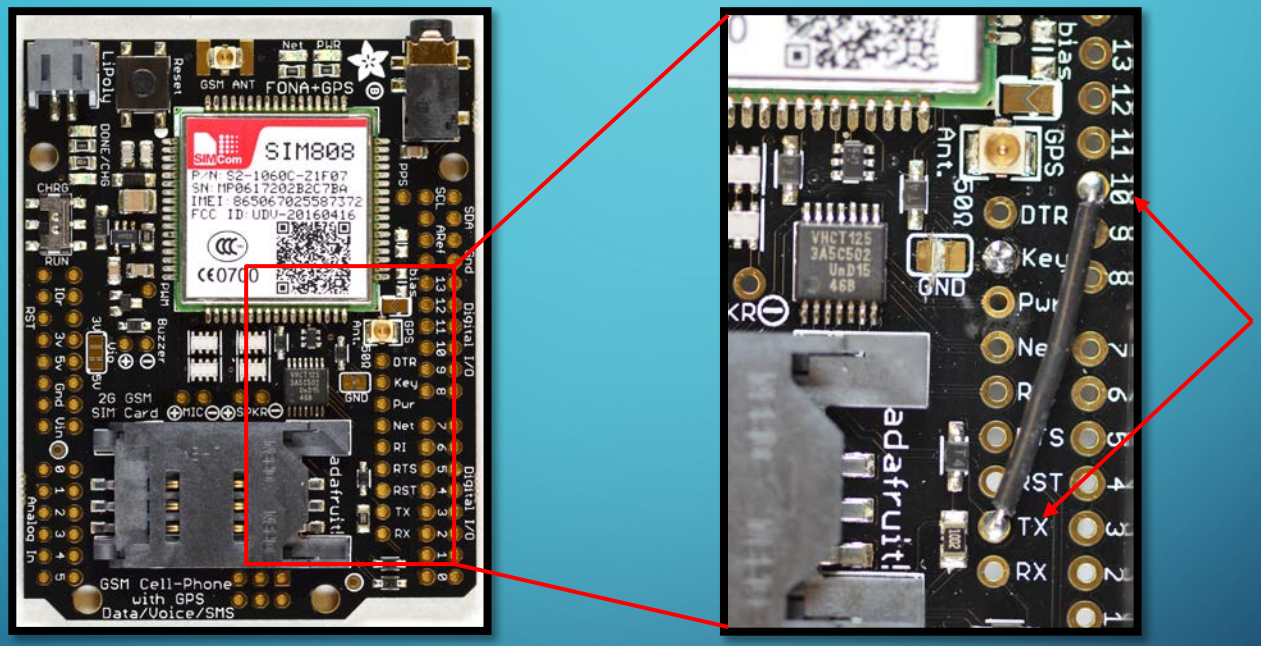


Install stackable headers on FONA 808 shield and solder in place. This has already been done for you. To learn about soldering best practices you can visit the following tutorial from Adafruit Industries:

https://learn.adafruit.com/adafruit-guide-excellent-soldering

ICSP/SPI Header is installed from the bottom

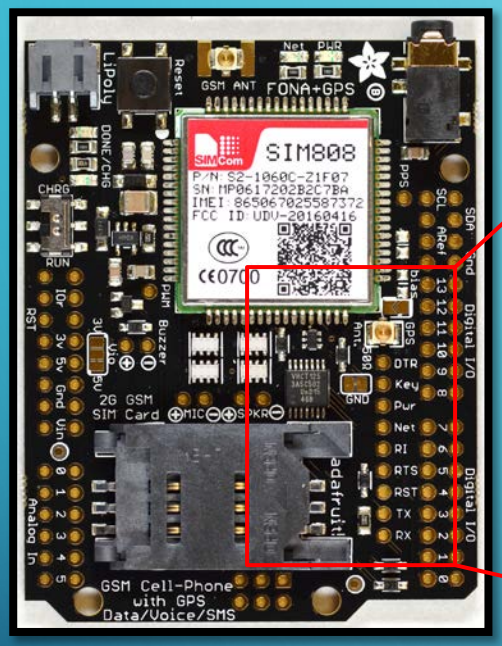
# FONA 808 TX PIN RECONFIGURATION



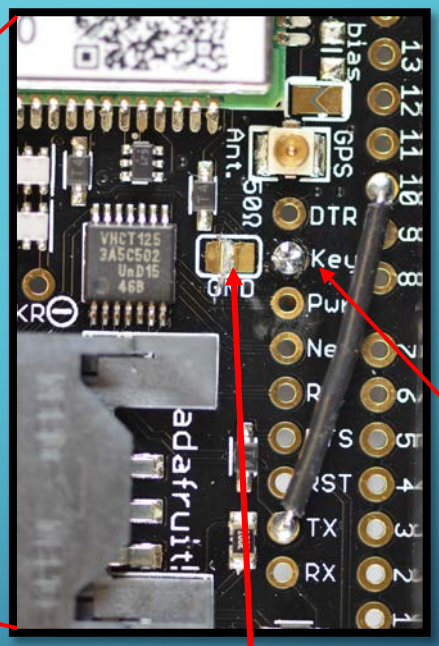

Solder jumper wire from **Tx** pin to pin **10**

- The FONA 808 was designed for the Arduino UNO
- The **Tx** pin needs to be reconfigured to a pin that supports software serial on the Arduino Mega 2560
- **<u>These changes must be reflected in the Arduino Sketch!!</u>**

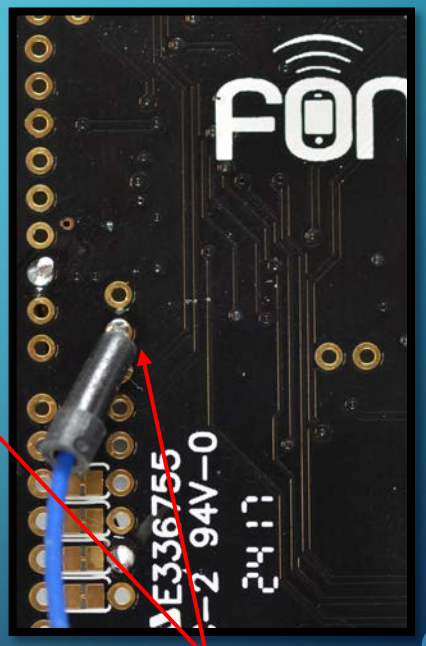
# FONA 808 KEY PIN CONFIGURATION




(Top View)




(Bottom View)

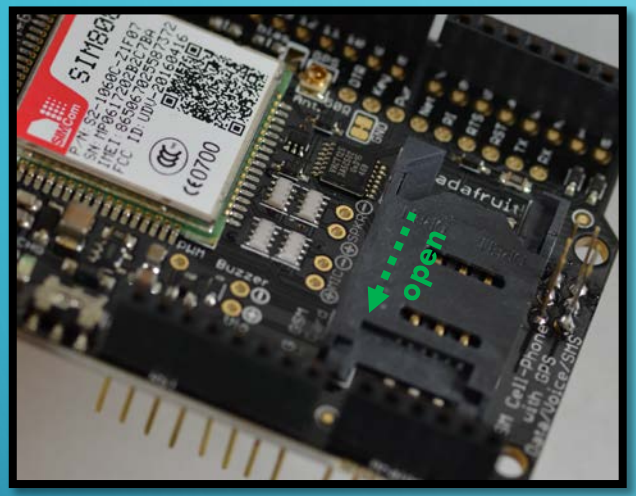


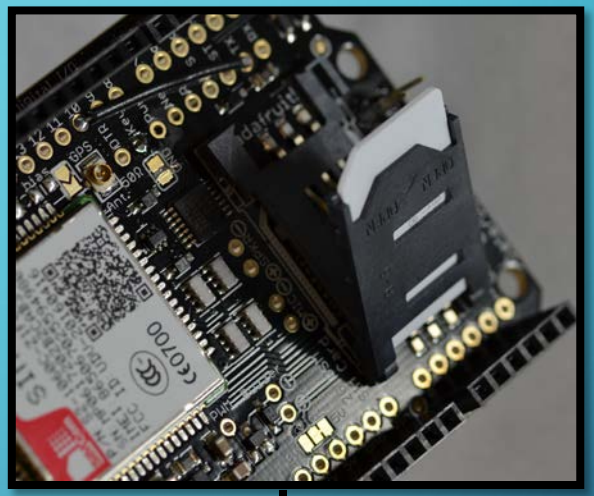
Use razor blade to cut **GND** trace pads connected to **Key** pin

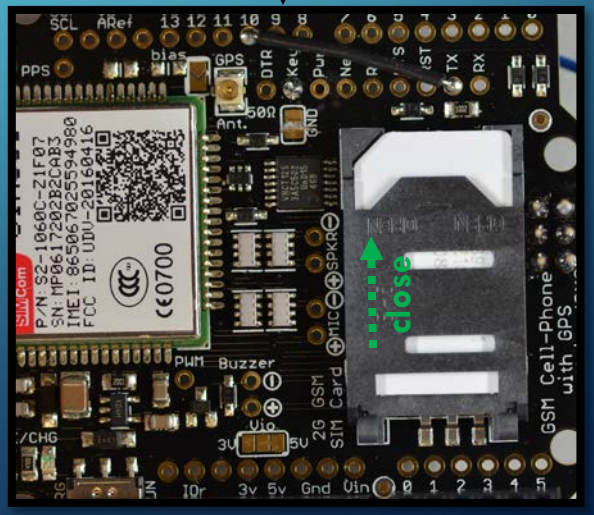
Solder jumper wire to **Key** pin

Connecting a wire from the **Key** pin on the FONA 808 shield to a digital pin on the Arduino allows us to toggle the power to the modem when not in use.

# FONA 808 SIM CARD INSTALLATION

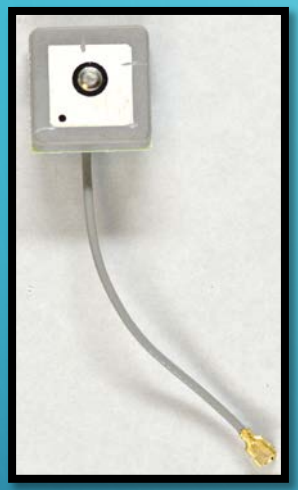




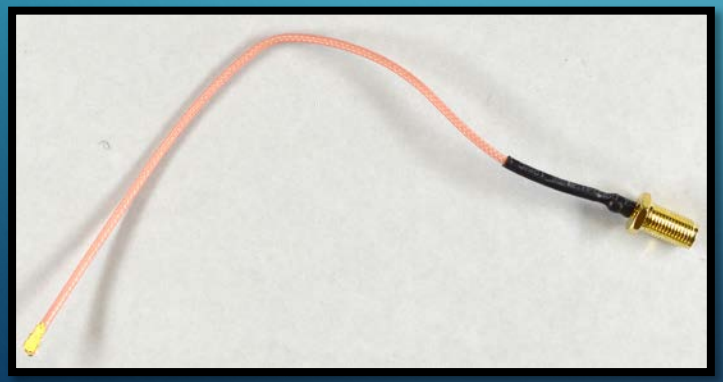

Install a 2G compatible 25mm x 15mm Mini SIM card into card holder by sliding back upper hinge, lifting and inserting card, and sliding back into place until it clicks.

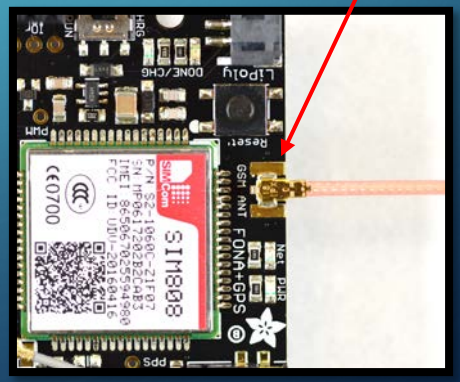
# FONA 808 GPS/GSM ANTENNA INSTALLATION



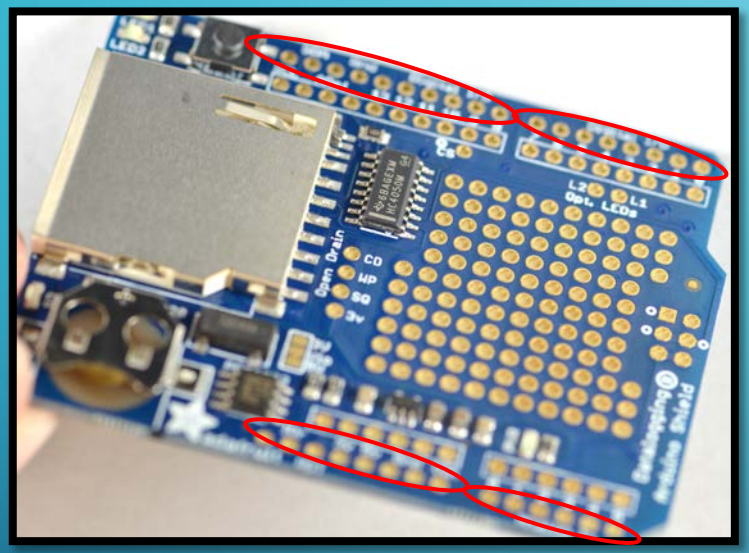

Snap passive GPS antenna to uFL port labeled “GPS ANT”

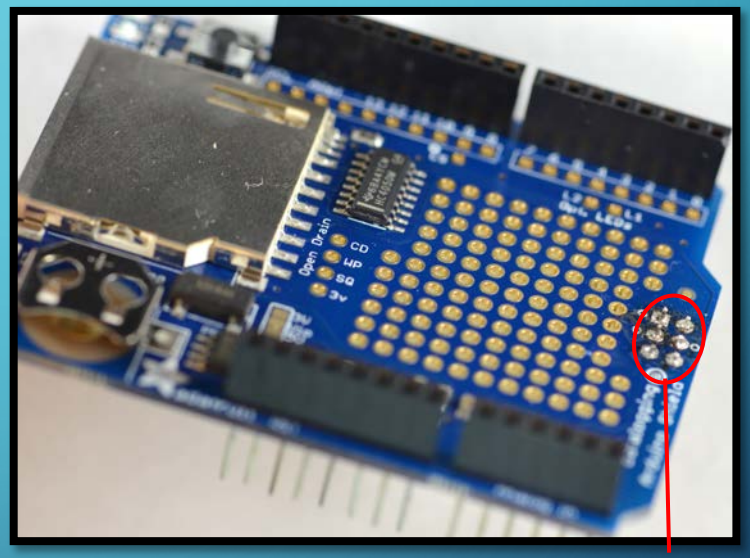
Snap uFL to SMA adapter cable to uFL port labeled “GSM ANT.” SMA GSM/Cell antenna will be mounted externally





# DATA LOGGER HEADERS



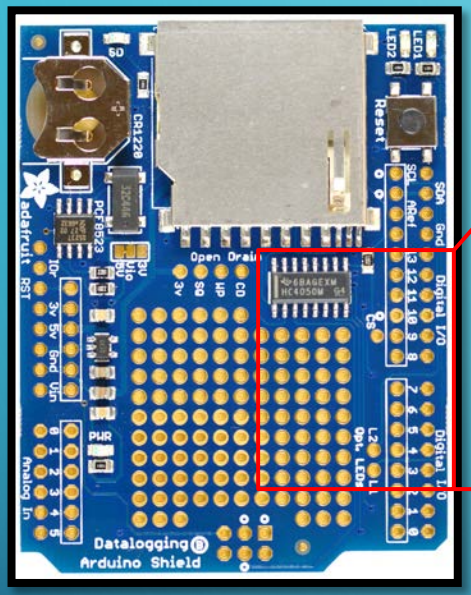


ICSP/SPI Header is installed from the bottom

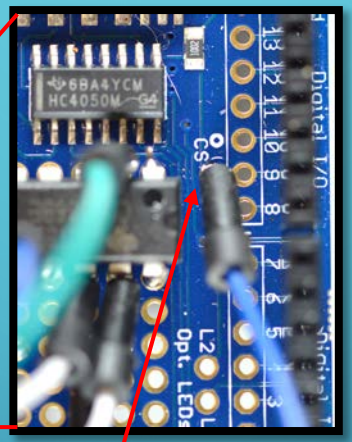
Install stackable headers on Data Logger shield and solder in place. This has already been done for you. Detailed instructions for this step can be found in the Adafruit Industries Data Logger Manual:

https://learn.adafruit.com/adafruit-data-logger-shield/for-the-mega-and-leonardo?view=all

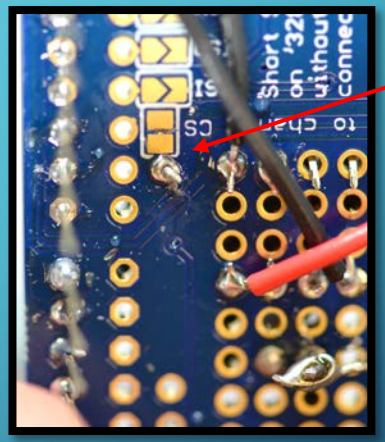
# DATA LOGGER CHIP SELECT CONFIGURATION




(Top View)



(Bottom View)

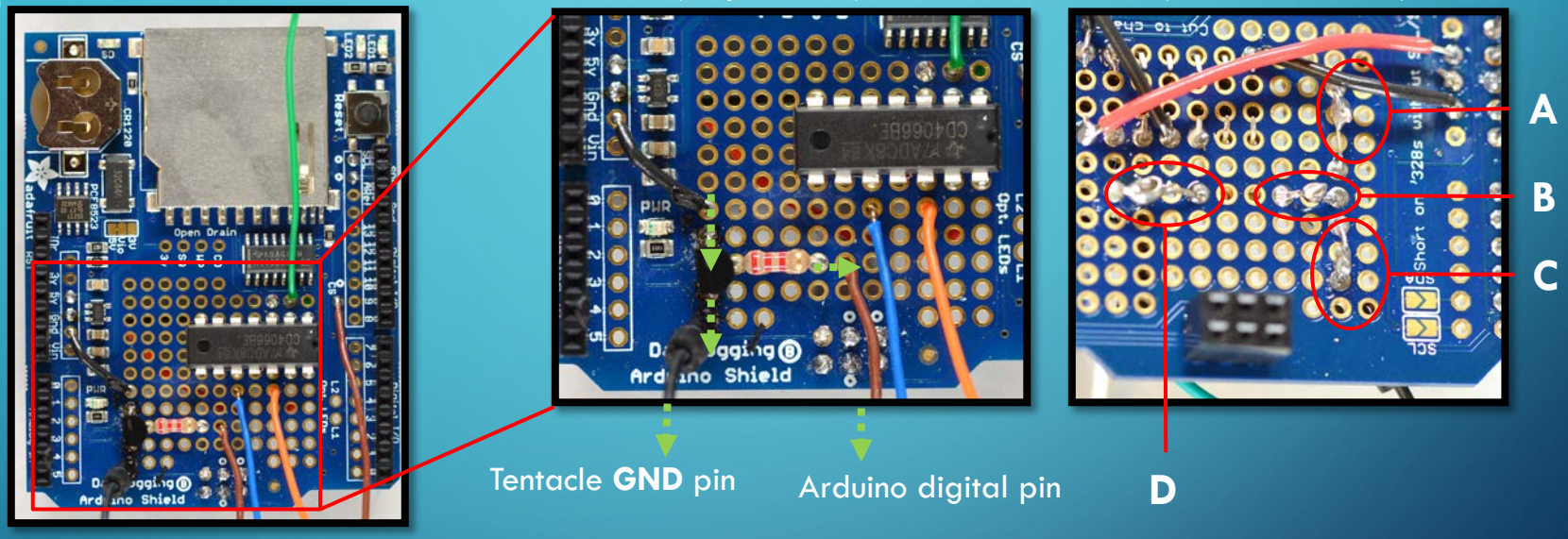


Use razor blade to cut **CS** trace pads connected to **CS** pin

Solder jumper wire to **CS** pin

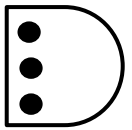
- The default chip select pin for the Arduino Mega is pin **10**
- Pin **10** is now used for **Tx** on the FONA 808
- Can reconfigure the chip select pin to any other digital pin
- **<u>These changes must be reflected in the Arduino Sketch!!!</u>**

# SWITCH POWER CIRCUITRY




A. Solder jumper wire from **GND** pin to "emitter" pin on transistor
B. Solder "base" pin on transistor to 2.2kΩ resistor
C. Solder "collector" pin on transistor to free jumper wire to plug into Tentacle Shield **GND** pin
D. Solder 2.2kΩ resistor to free jumper wire to plug into a digital pin on Arduino

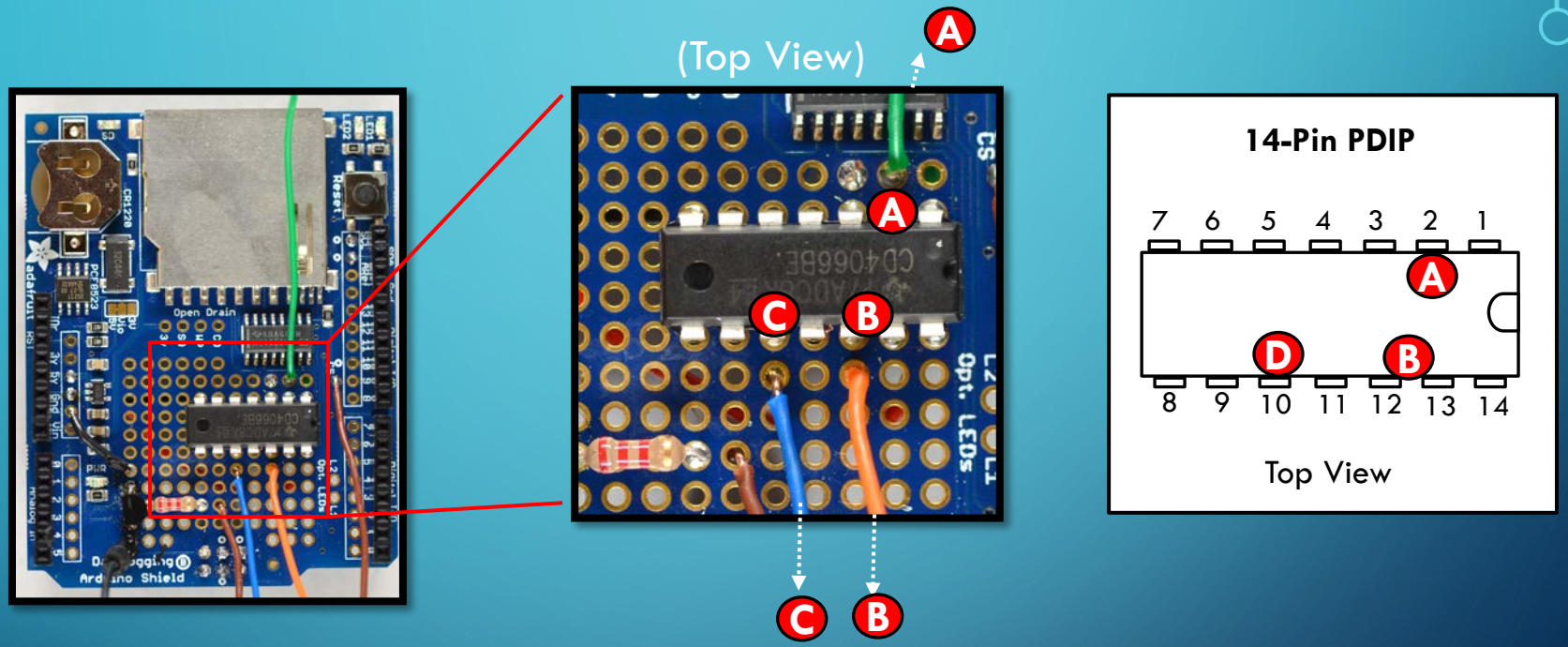
NPN-Type Transistor Pinout




Top View

**1:** emitter
**2:** base
**3:** collector

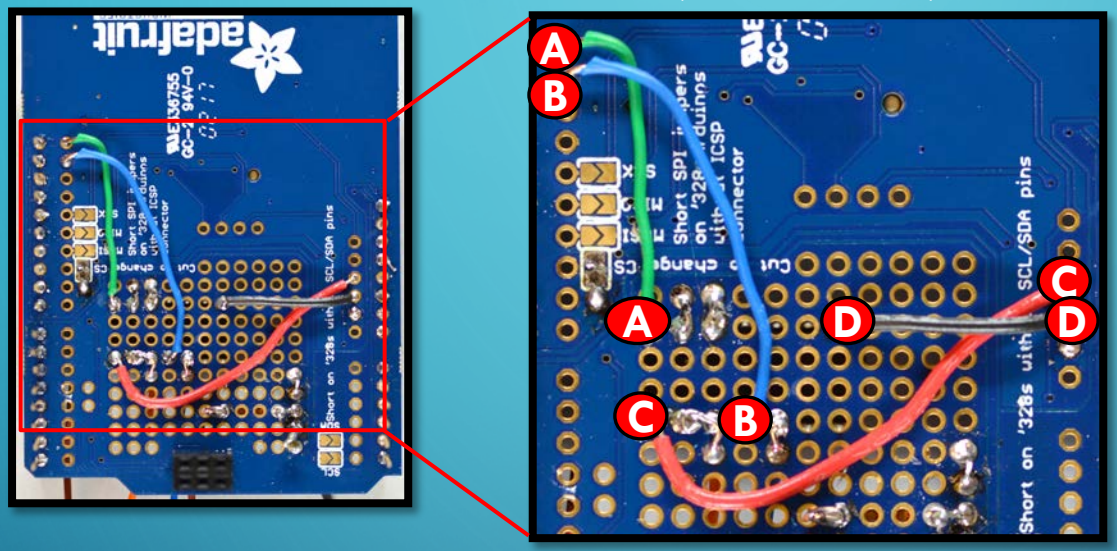
# I²C TOGGLE SWITCH CIRCUITRY

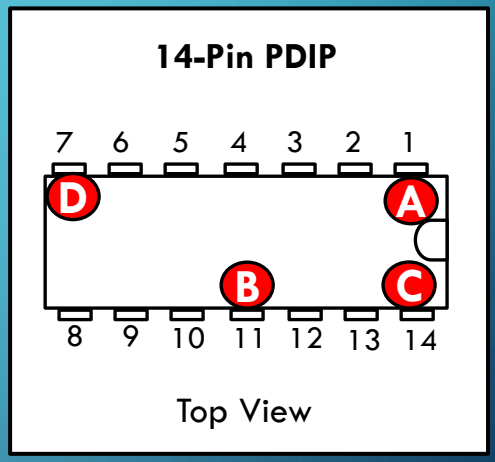



A. Solder jumper wire to pin **2** on PDIP to plug into **SCL** pin on Tentacle Shield
B. Solder jumper wire to pin **12** and **13** on PDIP to plug into a digital pin on Arduino
C. Solder jumper wire to pin **10** on PDIP to plug into **SDA** pin on Tentacle Shield

# I²C TOGGLE SWITCH CIRCUITRY CONTINUED

(Bottom View)

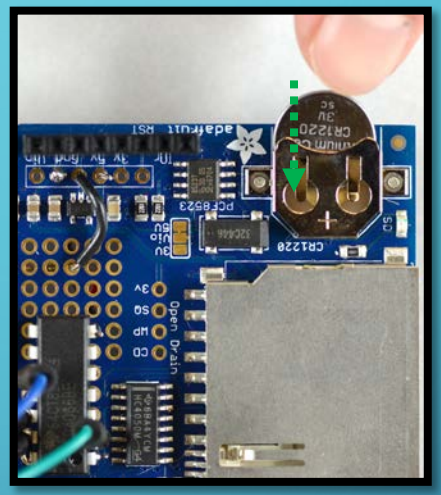


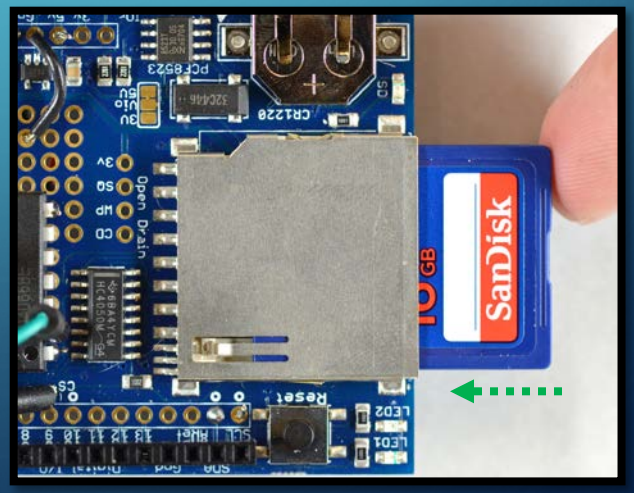

A. Solder jumper wire from pin **1** on PDIP to **SCL** pin on Data Logger Shield
B. Solder jumper wire from pin **11** on PDIP to **SDA** pin on Data Logger Shield
C. Solder jumper wire from pin **14** on PDIP to **5V** pin on Data Logger Shield
D. Solder jumper wire from pin **7** on PDIP to **GND** pin on Data Logger Shield

# RTC BATTERY & SD CARD

Insert CR1220 3V Lithium coin cell into battery port for “Real-Time-Clock (RTC)” backup power. RTC requires a battery to work, even if it is a dead one!

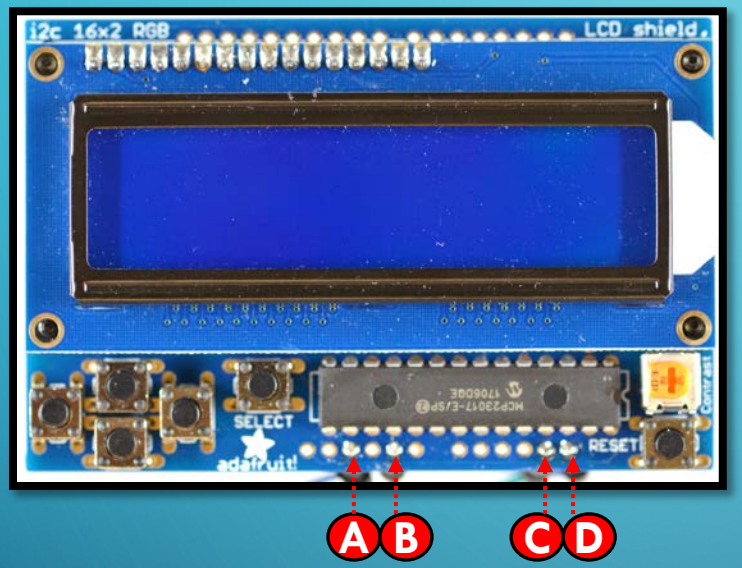


Insert SD card into card read/write port. Ensure that the SD card is formatted as either FAT16 or FAT32!

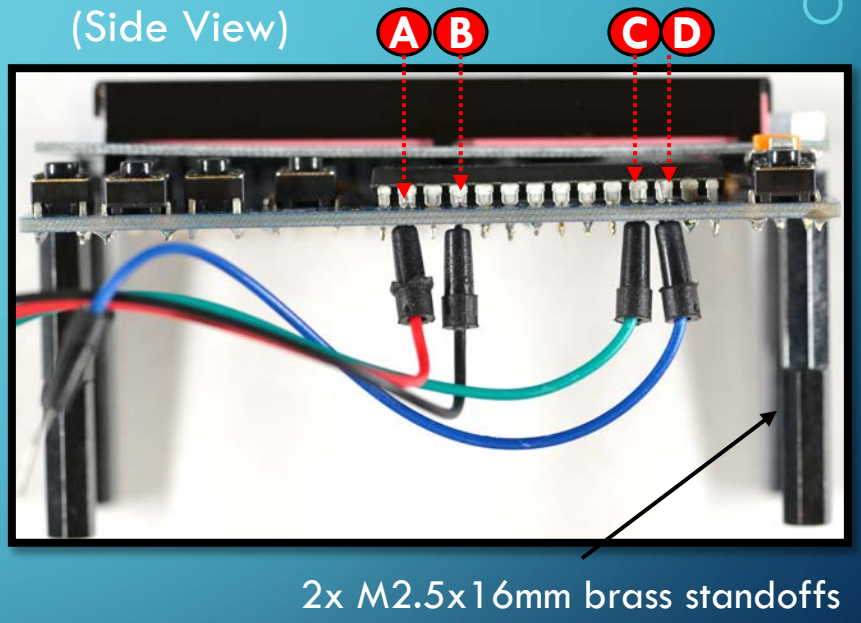


# LCD SCREEN

(Top View)




(Side View)



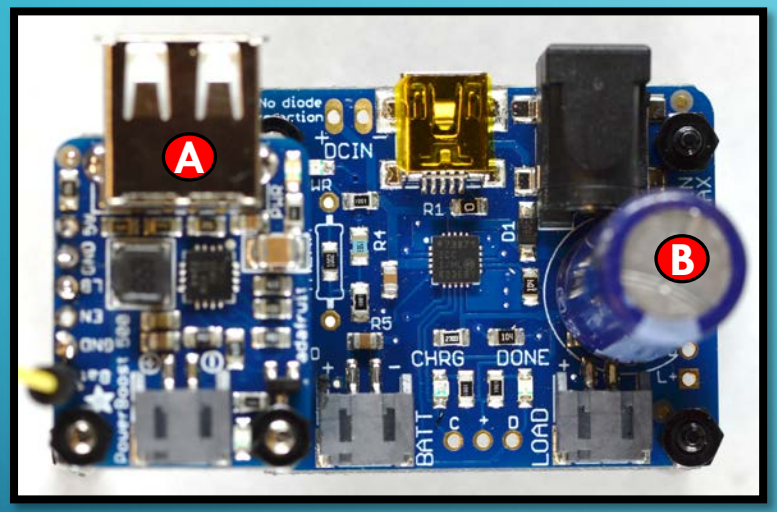

Detailed instructions for LCD screen assembly can be found in the manual provided by Adafruit Industries:

https://learn.adafruit.com/rgb-lcd-shield/assembly

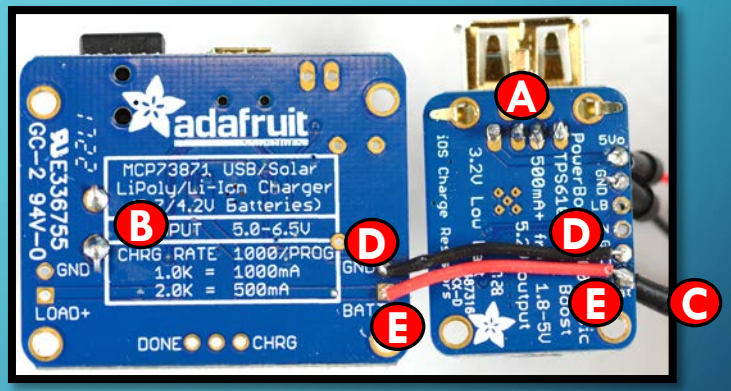
A. Jumper wire to digital pin on Arduino (for toggling LCD on/off)
B. Jumper wire to **GND** pin on Arduino
C. Jumper wire to **SDA** pin on Arduino
D. Jumper wire to **SCL** pin on Arduino

# SOLAR CHARGER & 5V BOOST CONVERTER

(Top View)

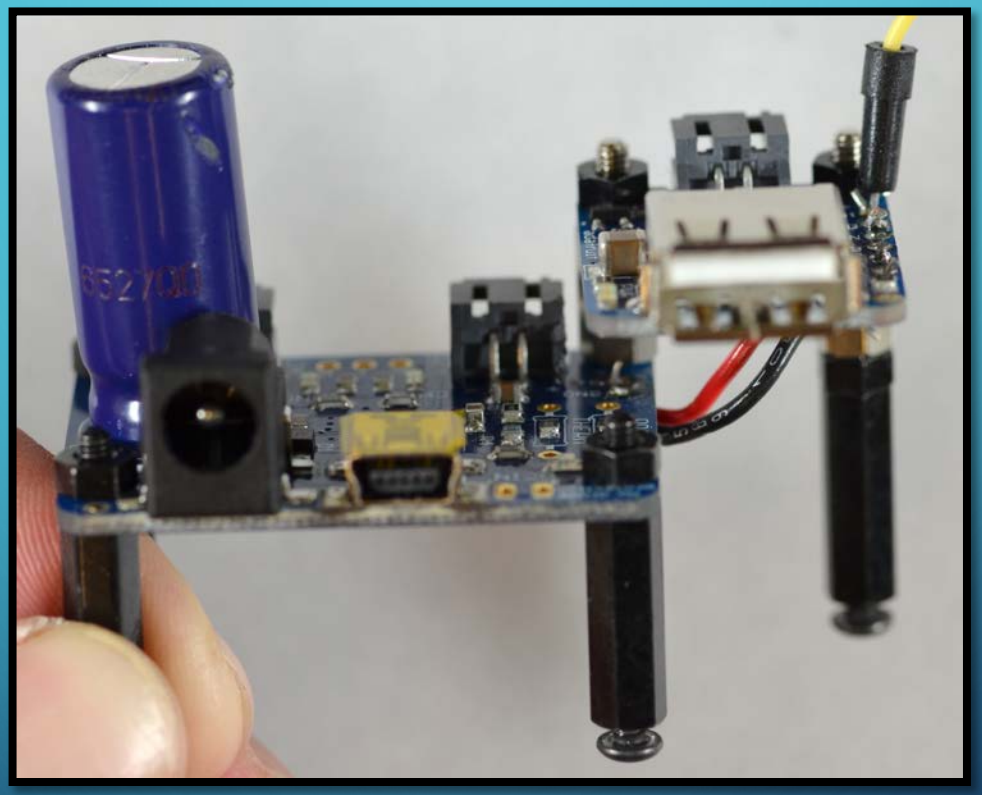



(Bottom View)




A. Solder USB port in place.
B. Solder Capacitor in place. Ensure correct polarity!
C. Jumper to Analog pin on Arduino (monitors battery voltage)
D. Jumper wire connecting **GND** on charger to **GND** on boost converter
E. Jumper wire connecting **BATT+** on charger to **BATT+** on boost converter

# BATTERY CHARGER/BOOSTER UNIT

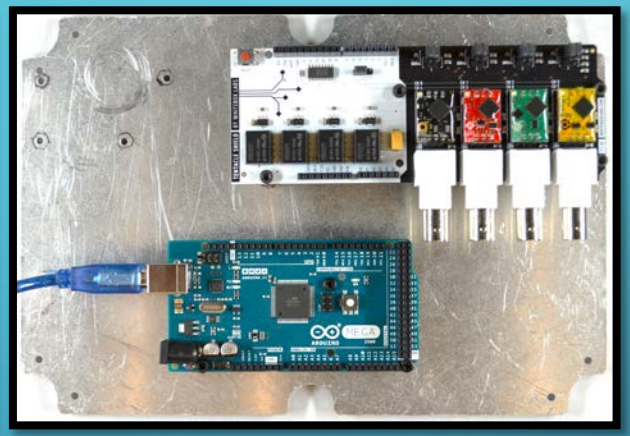


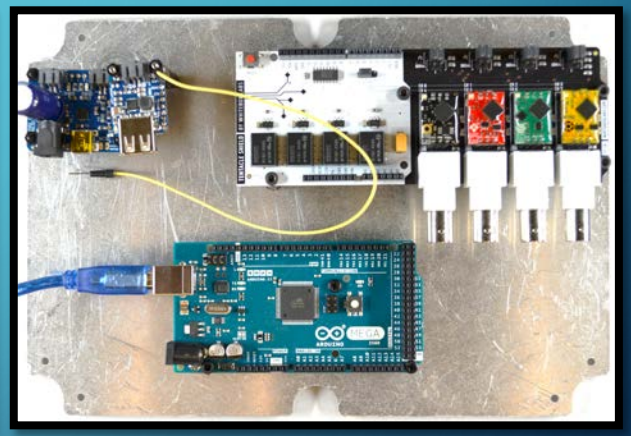
Add standoffs and mount to backboard as one solar charger and voltage booster unit.

# CIRCUITRY LAYOUT

- Mount circuitry to backboard
- No “right” configuration
- Consider space for components, wire placement, wire length, access to USB/SD card, maintenance, etc.
- Use standoffs to prevent electrical shorts!

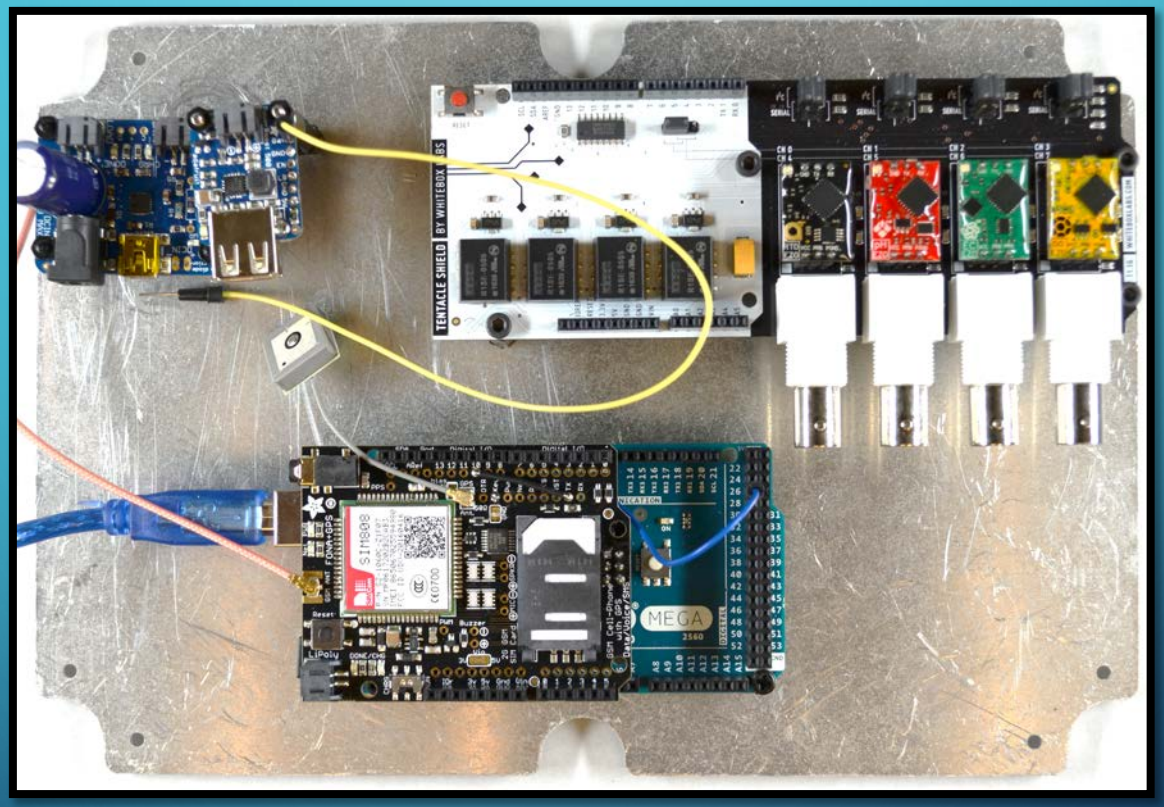
# MOUNT MAIN COMPONENTS TO BACKBOARD





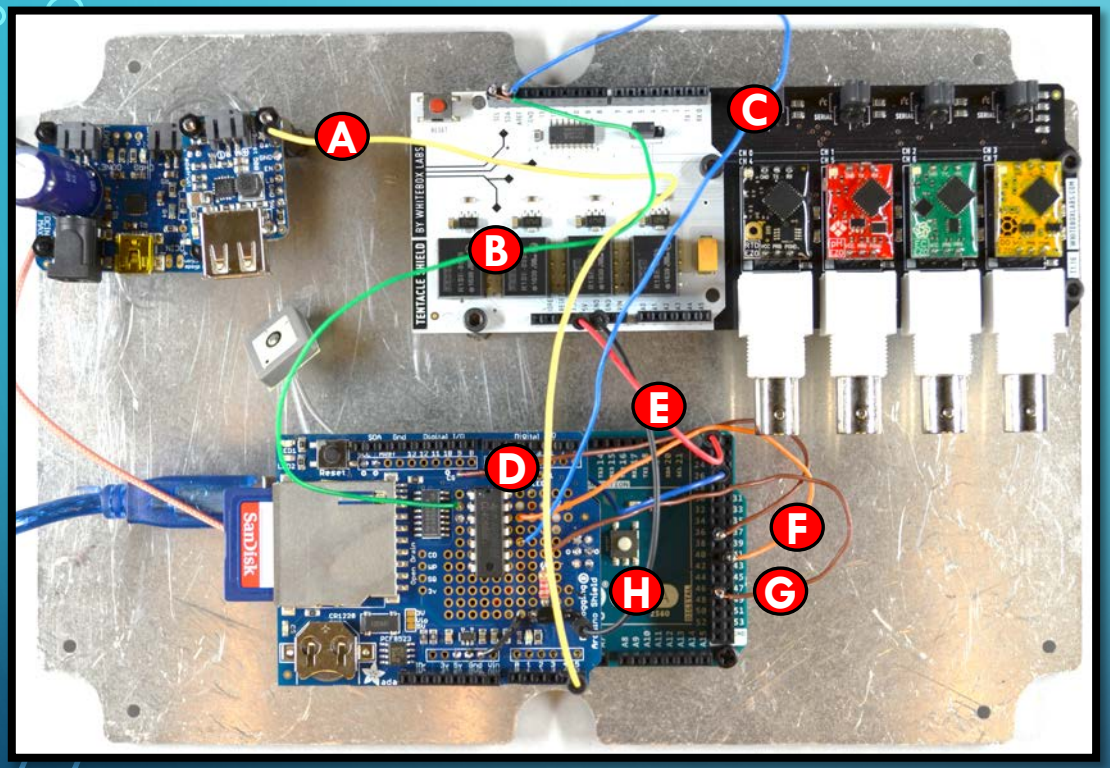
- Tentacle shield should be oriented so that probes can be easily connected and disconnected from BNC ports without damaging the cables
- Solar Charger and 5V Power Boost should be oriented in a way that the LiPo battery and USB cable can be plugged in as well as the Solar Panel via DC Barrel Jack.

# MOUNT FONA 808 MODEM SHIELD




Plug FONA 808 shield onto Arduino and **Key** power jumper cable into Arduino digital pin **24**

# MOUNT DATA LOGGER SHIELD




| | | |
|---|---|---|
| A | Batt Voltage | Arduino pin A5 |
| B | I2C - SCL | Tentacle pin SCL |
| C | I2C - SDA | Tentacle pin SDA |
| D | Chip Select | Arduino pin 34 |
| E | 5V Power | Tentacle pin 5V |
| F | I2C - Logic Switch | Arduino pin 39 |
| G | Power Switch | Arduino pin 44 |
| H | Tentacle Ground | Tentacle pin GND |

Plug Data Logger shield onto Arduino and plug jumper wires into appropriate pins. Pins used must match pins defined in Arduino sketch!

# WATERPROOF ENCLOSURE

¼” hole drilled for SMA cell antennae

Drill ¾” holes for cable glands & vent plug

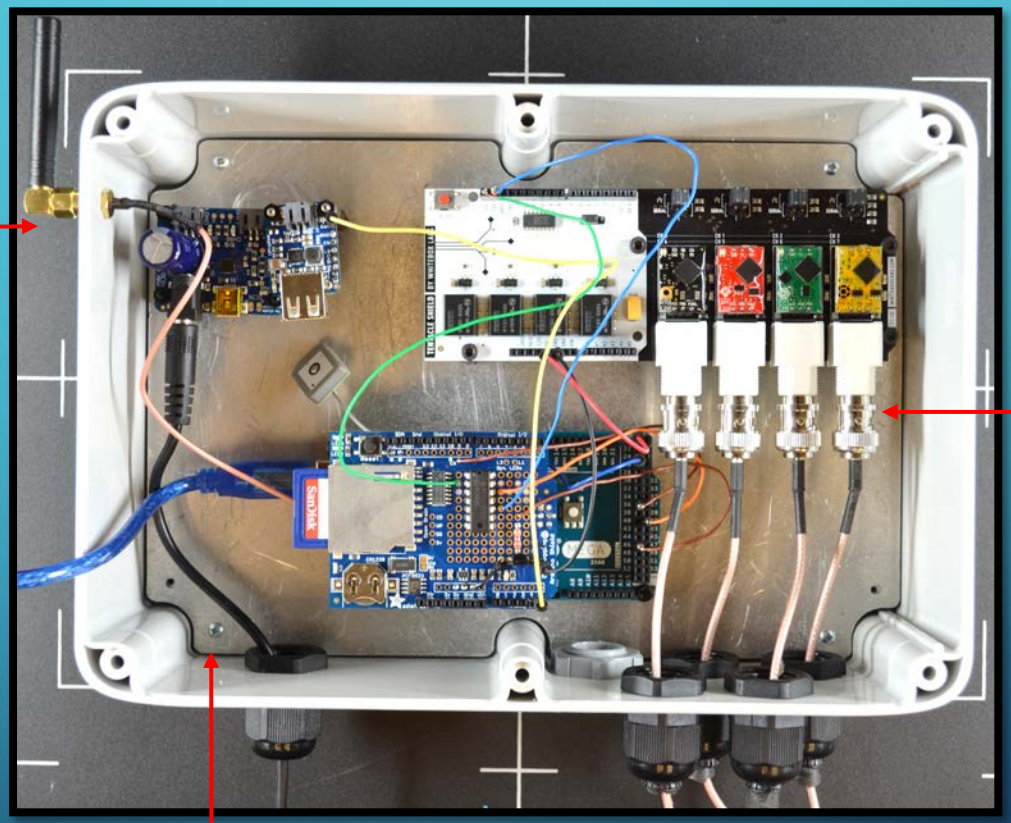
Cable gland for solar panel

Vent plug

Cable glands for probes

# INSTALL CIRCUITRY

Ensure SMA antenna adapter cable is mounted to side of enclosure & install antenna

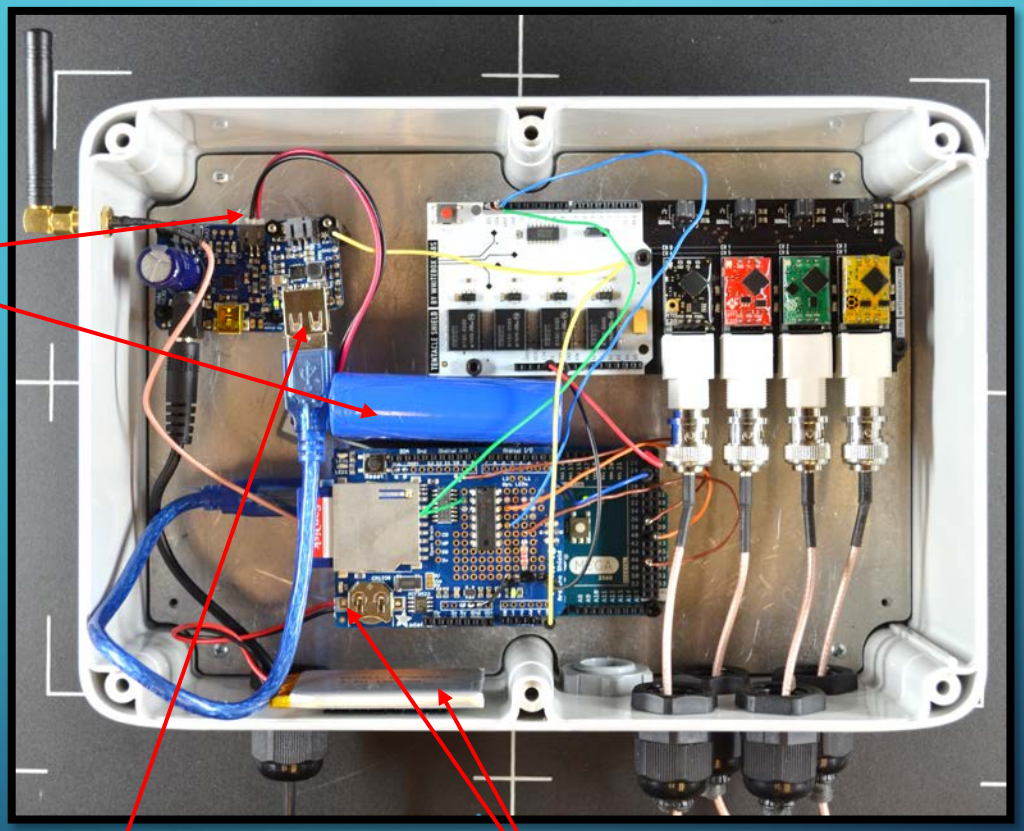


Connect cables to respective BNC connection

Carefully place mounted electronics into enclosure and fasten backboard

Using silicon sealant on cable glands and antenna port can help with further waterproofing

# POWER UNIT



Velcro 6600mAh LiPo battery backboard & plug into battery charger JST port

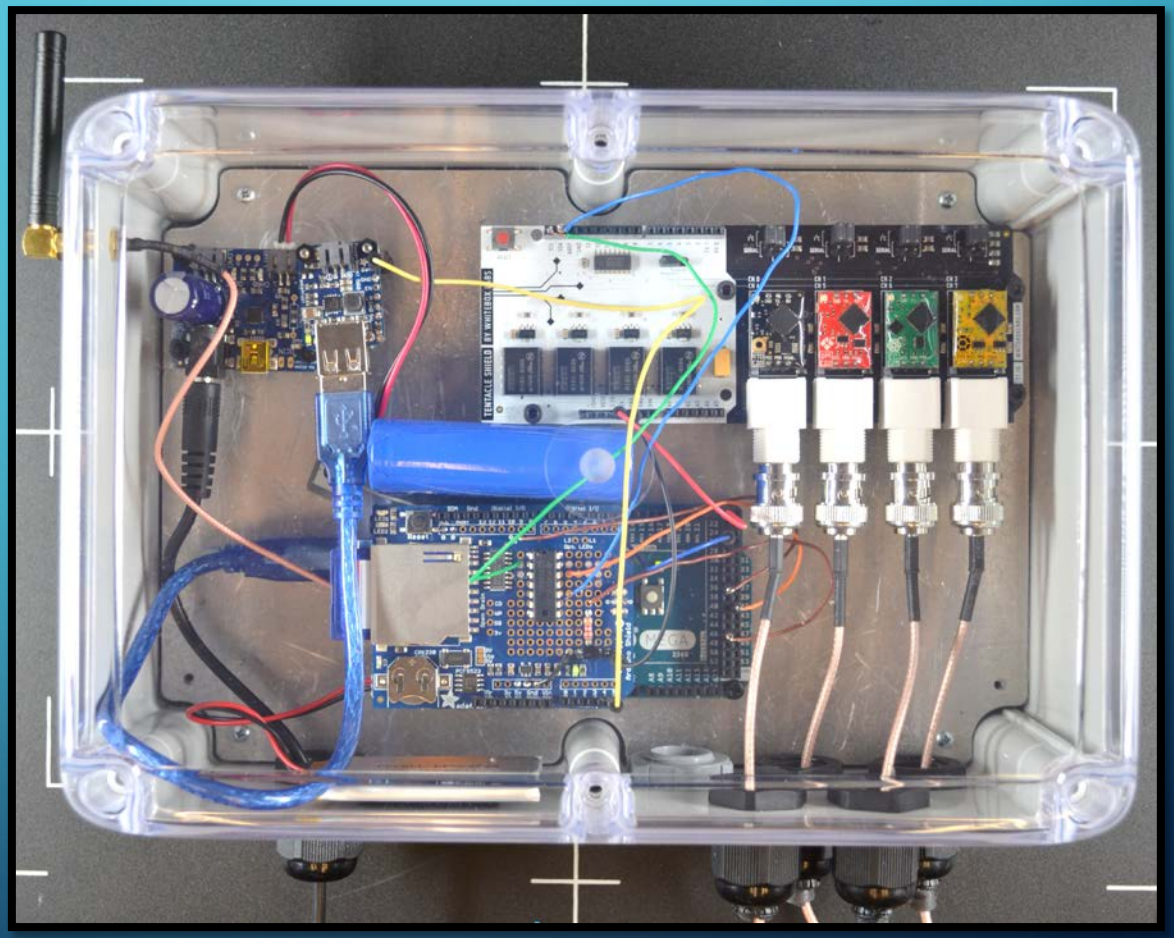
**Ensure correct Polarity when plugging batteries into JST ports!!!**

Plug USB into 5V boost to power unit

Velcro 1200mAh LiPo to side of enclosure & plug into FONA JST port

# INSTALL LID

Install weatherproof lid onto enclosure before deploying



# LOGGING

- Once a sketch is uploaded to the Arduino the sensor is ready to begin logging once the system is powered
- Ensure lid to enclosure is properly seated before deployment to ensure weatherproofing
- Desiccant packs can also be added for moisture control