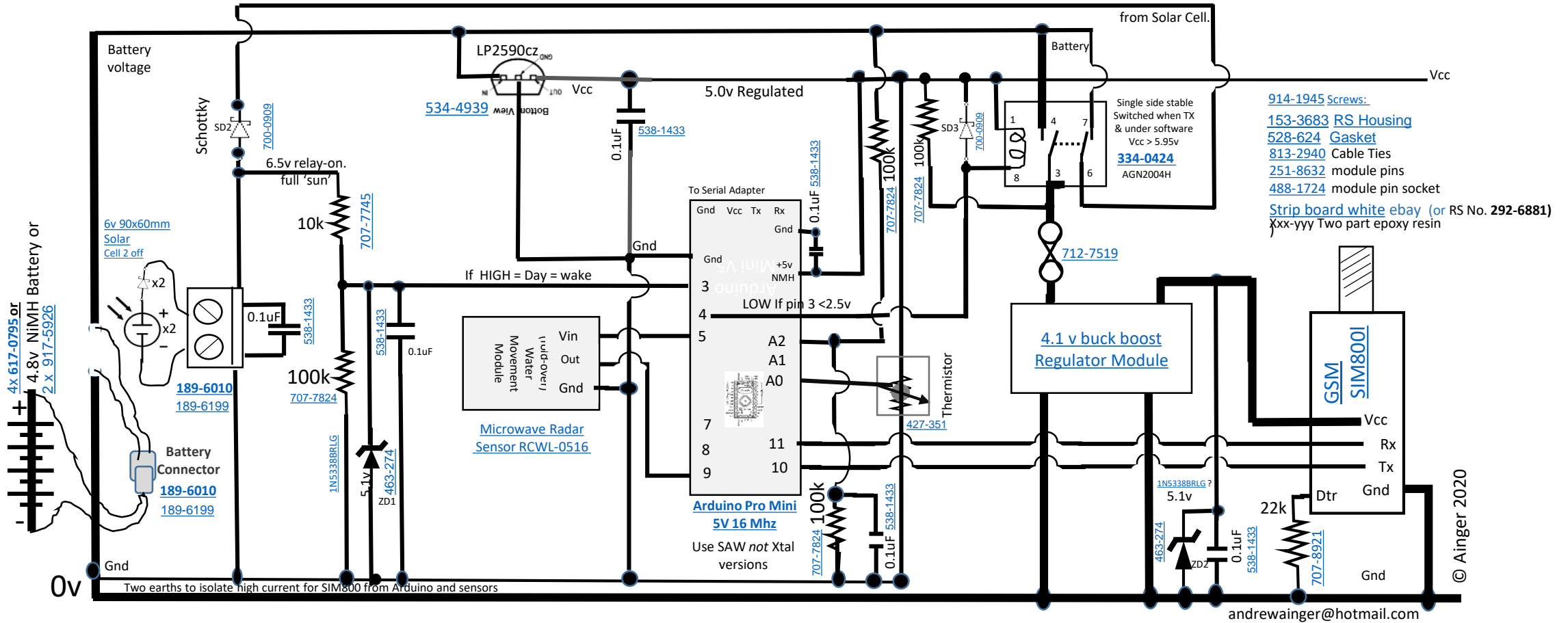


# CIRCUIT DIAGRAM of AWSOM

(A Well System for Ongoing Maintenance)  
v20201208-1



The part numbers in BLUE are searchable and are from RS-Components. Components descriptions are from ebay and are search-terms

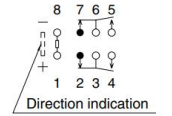
# AWSOM™ CIRCUIT DIAGRAM

(A Well System for Ongoing Maintenance)

The part numbers in **BLUE** are from RS-Components. Other blue components descriptions are from ebay and are search-terms

## Schematic (Top view)

Single side stable  
High sensitivity single side stable



(Deenergized condition)

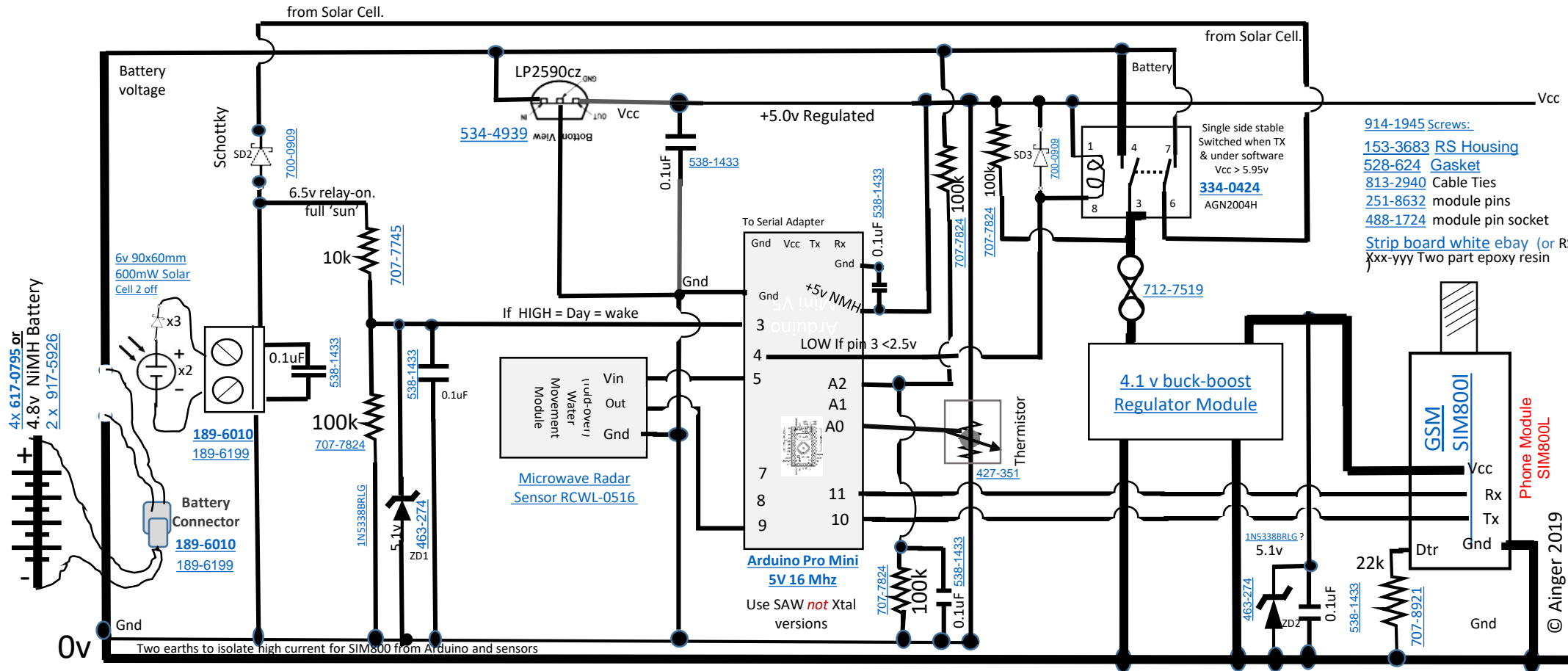
## LP Package 3-Pin TO-92 Bottom View



5v  
100ma  
regulator

**NB-1: All parts (except solar cells) to fit inside housing:**

v20201208-1



- 914-1945 Screws:
- 153-3683 RS Housing
- 528-624 Gasket
- 813-2940 Cable Ties
- 251-8632 module pins
- 488-1724 module pin socket
- Strip board white ebay (or RS No. 292-6881)
- xxx-yyy Two part epoxy resin

## Things to remember when setting up:

1. De-solder the Arduino Mino Vcc-ON LED (2mA x 24hrs)
2. Check if the Arduino is a Mino or a Nano [software](#) wise. (try loading with mini & nano to see which works)
3. Check the PORT to load the sketch from in the Arduino options
4. Check the type of BOOTLOADER (old) in the Arduino options too.
5. Make sure the Vcc on the Arduino is the same voltage as the USB port otherwise it won't load.
6. Check and adjust Arduino sketch Loop-Count is 30.0 seconds
7. Check credit on the SIM card!
8. Make sure the solar cell wired are screwed in tightly & makes a good connection
9. **Calibrate** the Voltage and temperature calculation or they could be out by 4c / 200mV respectively.
10. Have NO push connections as they get loose and cause havoc!

NB: Cable Ties [813-2940](#) for holding batteries on each side of the PCB on to the Vero/PCB:

andrewainger@hotmail.com

© Ainger 2019

(on Arduinos with **crystal** current **increases** to **5.6mA** not 3.6mA)

### Total power drain 96mAh/day.

This is made up of 100mA for 10mins for SMS's = **17mAh** (plus 1500mA start-up for 250mS - Ignored small wrt 24 hrs)  
 3.6mA sleep 26sec/30sec plus 18 mA 4secs/30 = 37mAh + 28mAh during 12hr day = **66mAh**  
 Total on battery during 12 hr Night is 0.75mA = **9mAh**  
 Plus self-discharge say over the 24hr period = **10mAh** (use 2.5Ah batt x 10%/month = 250mAh/ mth = 250/30=10mAh/day)  
 So, Total on battery during 24 hrs = 66mAh during the **day** + 17 mAh for SMS at **dusk** + 9mAh at **night** + plus 10mAh self-discharge **Total 102 mAh in 24hrs** (so 2.5Ah batt charged up to 2Ah will last 2000/102 = 19 days over two weeks)

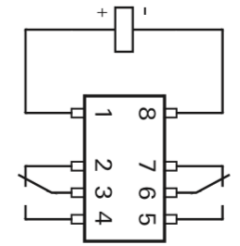
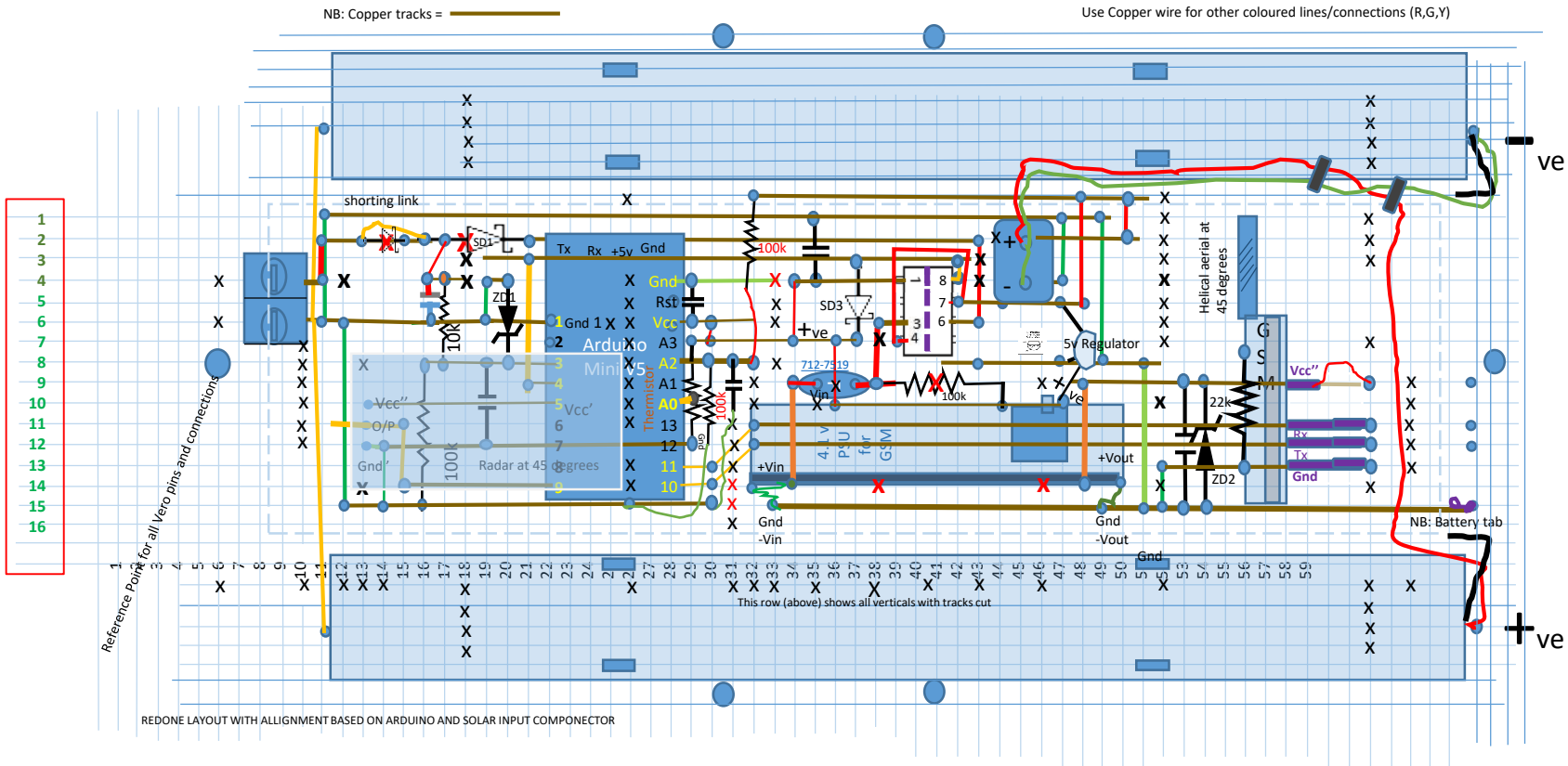
NB: The 5v regulator enables the 4.8v battery to charge up to more capacity. Just 300mV equates to increasing the max charge from 13% to over 60% of the battery's capacity. NB: The Zener's are acting as protective devices only.

### NB-2: Phone Module SIM800L takes 1.5 Amps for 250 milliseconds about

1.25 seconds after start up (hence fat-tracks)  
 Take care with the PCB and do not let this part of the cct impart this voltage dip to the Arduino or it will reset itself.

# Well Maintenance Unit

VERO BOARD Layout v20201208



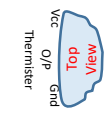
**Terminal assignment**  
 TOP view on relay  
 Monostable version  
 rest condition

NON-LATCH

LP Package  
 3-Pin TO-92  
 Bottom View

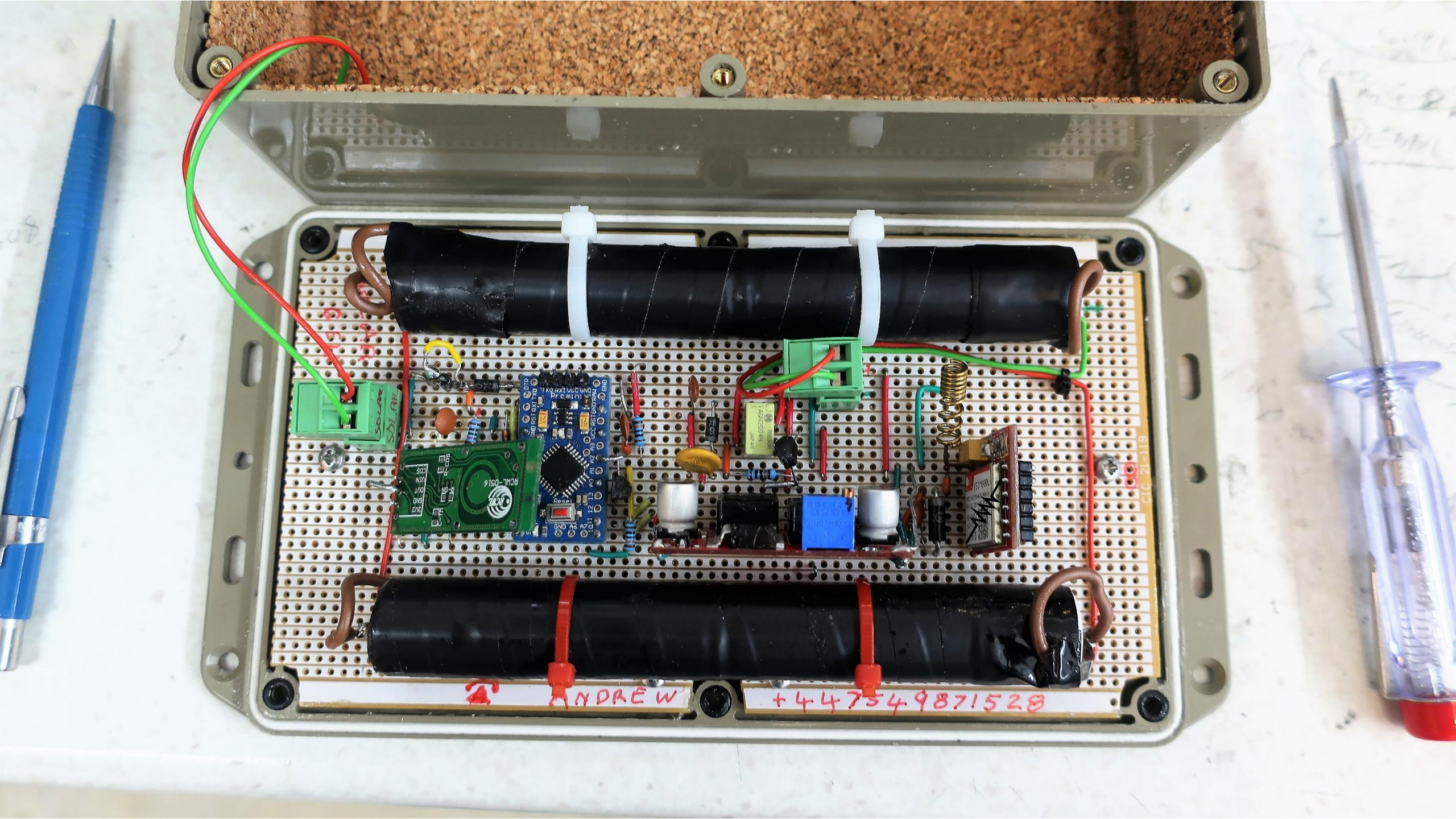


5v  
 100ma  
 regulator



PIN 1, +V<sub>G</sub>; PIN 2, V<sub>OUT</sub>; PIN 3, GND





ANDREW +447549871528

PCML-0916

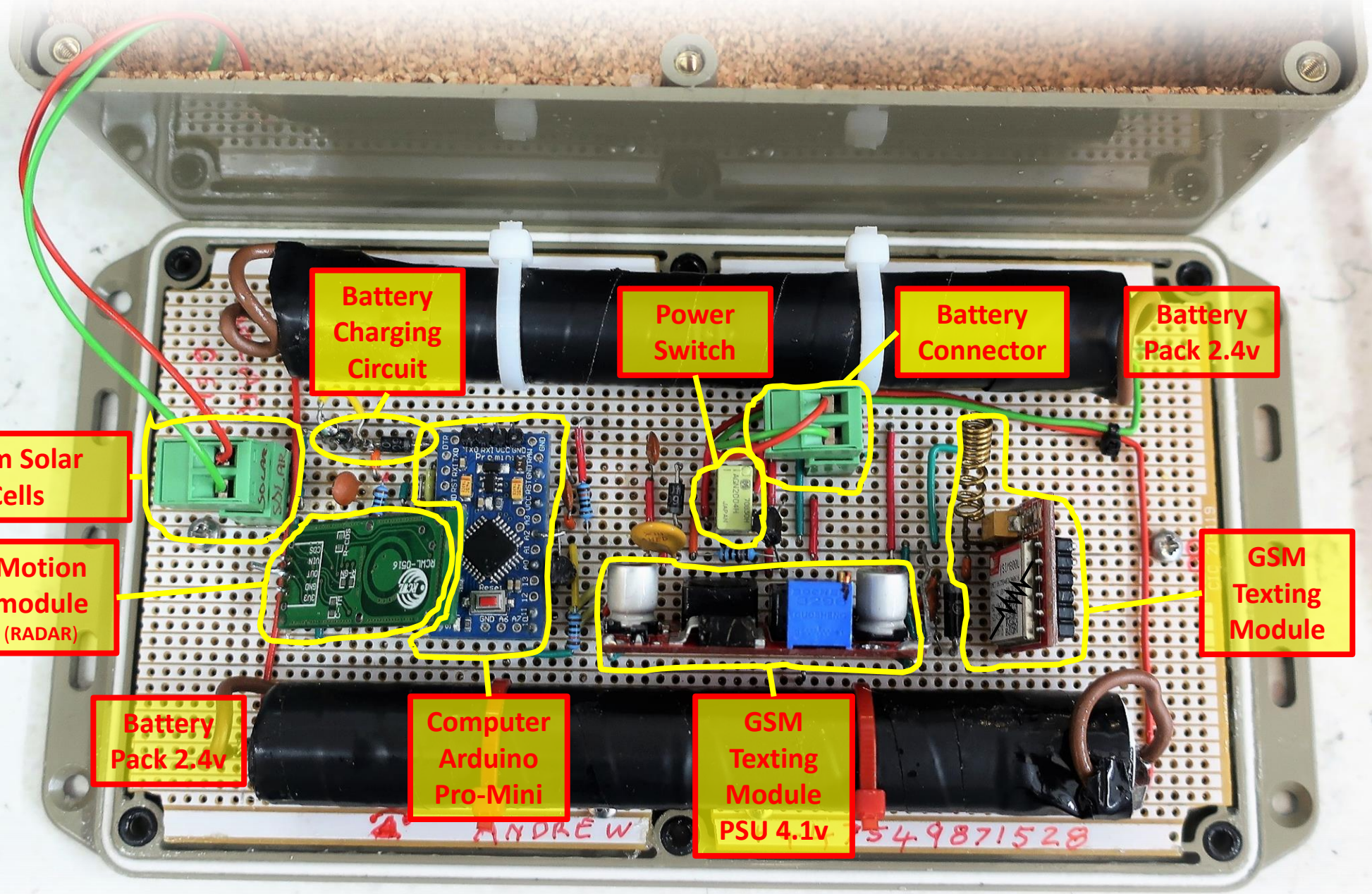
PIC16F887

1A02D004

SHARP

GLC 21-119





Battery Charging Circuit

Power Switch

Battery Connector

Battery Pack 2.4v

From Solar Cells

Motion module (RADAR)

Battery Pack 2.4v

Computer Arduino Pro-Mini

GSM Texting Module PSU 4.1v

GSM Texting Module

ANDREW

549871528





**Well Maintenance Unit**  
Engineering Ltd.  
www.wellmaintenanceengineering.co.uk  
Please report damage to Mr. G. Sandover  
Tafodhali rhesod uwiriddu wed.  
Version & Size Date Name & Comments  
#3000 2000 05/21/20 05/21/20



***A Well Monitoring  
Service for Ongoing  
Maintenance***

(AWSOM)



# GRAPHICAL TRENDS

WMS

## Graphical Trends

A2 & A3 Tnz, A1 & A5+ UK

Back

Help

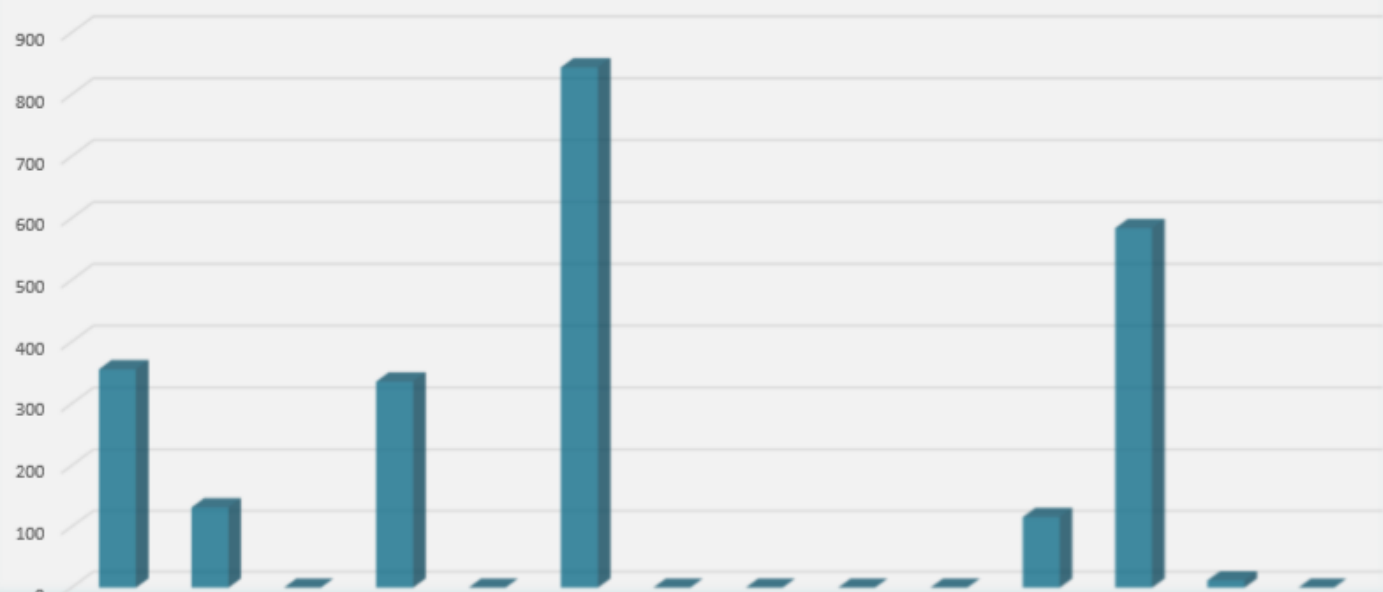
Derived Activity-LITRES

Well ID

A-03

Chart END-Date

20 January 2020



|          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 07/01/20 | 08/01/20 | 09/01/20 | 10/01/20 | 11/01/20 | 12/01/20 | 13/01/20 | 14/01/20 | 15/01/20 | 16/01/20 | 17/01/20 | 18/01/20 | 19/01/20 | 20/01/20 |
| 356      | 132      | 0        | 336      | 0        | 844      | 0        | 0        | 0        | 0        | 116      | 584      | 12       | 0        |

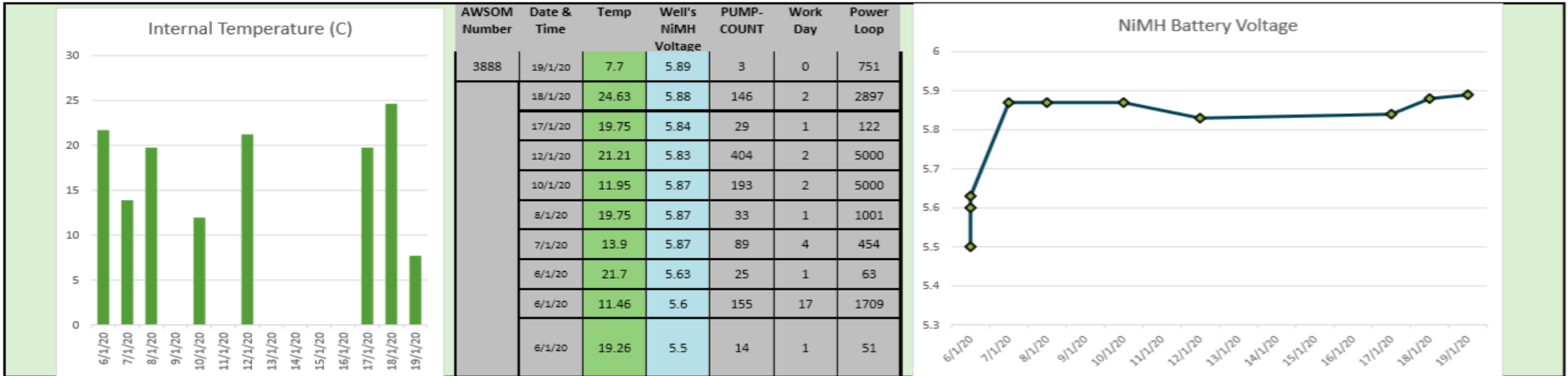
**Enter Recommendations** below, add the Date and then click **File & Save**. Date: 20/01/2020

Godfrey successfully installed Unit #3888 on well (A-03) in Biharamulo. First text at 16:52 on 7/8/2019. Last on 23/8/18.  
 'Godfrey to put in local SIM. UK tests contiuue prior to shipping Jan2020. (Andrew 20/01/2020)

*Note: Charts take 7 days to stabolise after a reset (Purple Cell) event. (NB: Use Shift+F5 to refresh web display)*



## GRAPHICAL TRENDS



### A-03 CALIBRATION STATION

Average time for the Person to fill a 20 ltr bucket.

| Number of People Using the Well/Day |            |
|-------------------------------------|------------|
| Men                                 | 12         |
| Women                               | 155        |
| Children                            | 122        |
| <b>Total</b>                        | <b>289</b> |

If in doubt, please leave these figures.

| Time the Person Uses the Well                  | Mins         | Secs |
|--|--------------|------|
| Time for a Man to pump 20 Litres               | 1            | 15   |
| Time for a Woman to pump 20 Litres             | 1            | 39   |
| Time for a Child to pump a bucket of 20 Litres | 1            | 20   |
| <b>Calibration factor (Ltr/Time-Count):-</b>   | <b>4.000</b> |      |

If in doubt, please leave the figures as they are - thanks.

Thursday, 2 Jan • 16:20



AWSOM#3888 MaxTmp = 13.41:  
Ni-Battery = 4.78 Volts (12%):  
PUMP-COUNT = 61:  
Work-day = 5:  
Powered-time = 961:

Friday, 3 Jan • 16:24



AWSOM#3888 MaxTmp = 15.36:  
Ni-Battery = 4.82 Volts (15%):  
PUMP-COUNT = 63:  
Work-day = 6:  
Powered-time = 971:

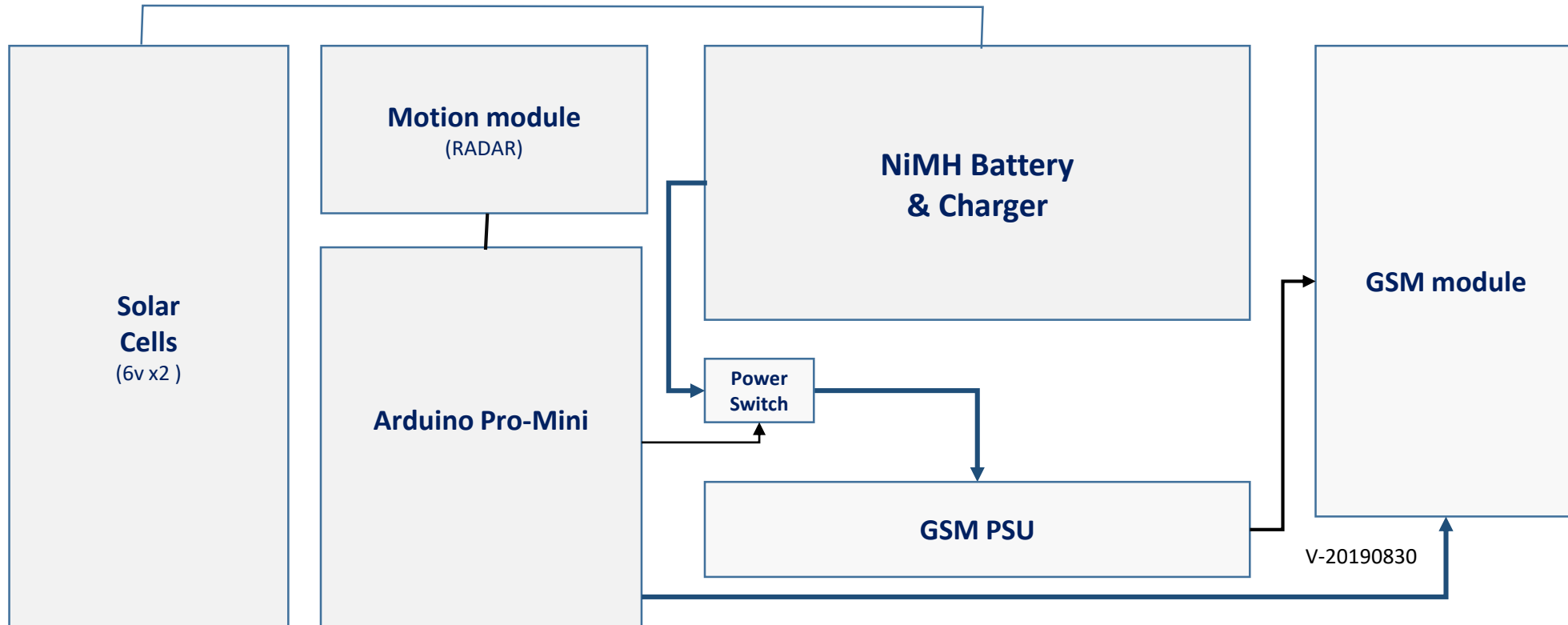
Saturday, 4 Jan • 23:55



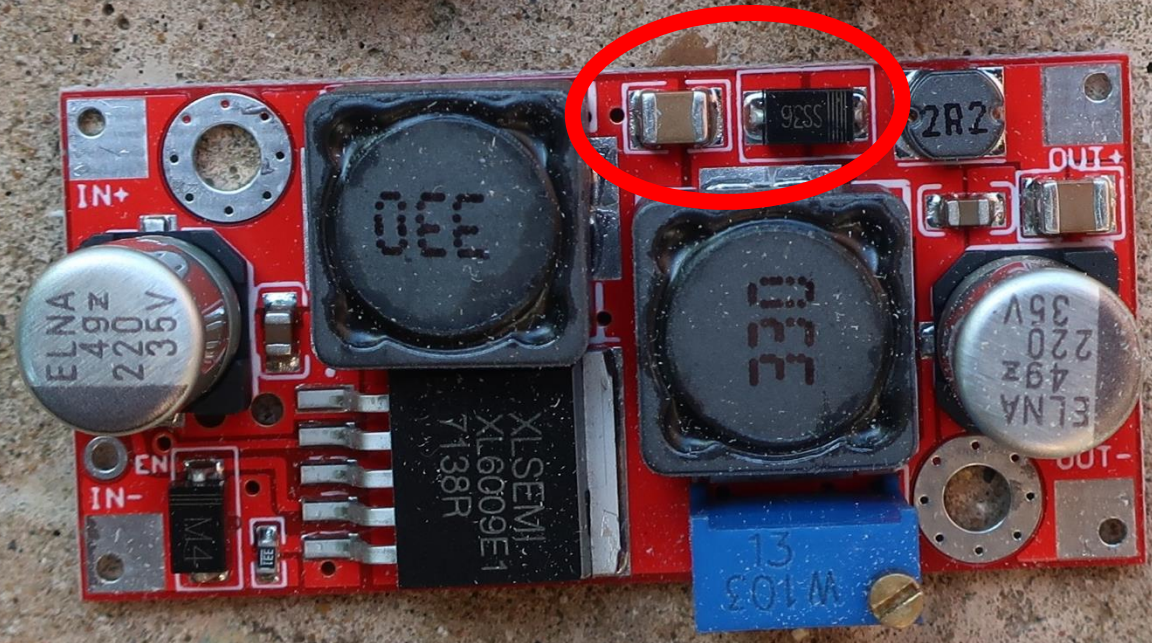
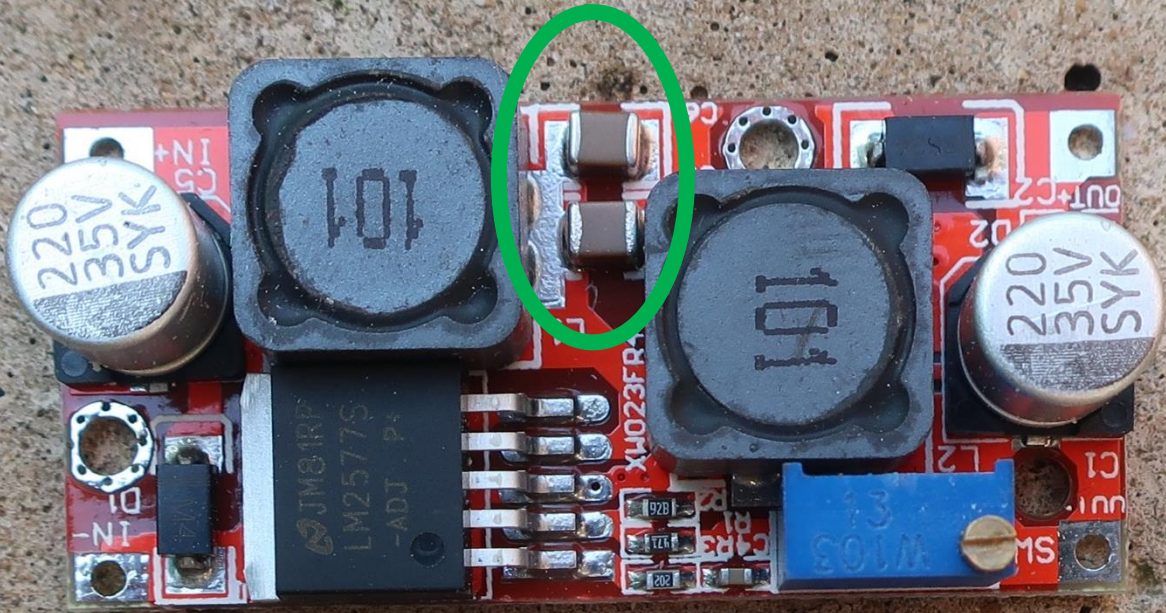
AWSOM#3888 MaxTmp = 23.65:  
Ni-Battery = 4.72 Volts (8%):  
PUMP-COUNT = 90:  
Work-day = 10:  
Powered-time = 67:  
[↓ See latest message](#)



# AWSOM™ BLOCK DIAGRAM









## A WELL SYSTEM for ONGOING MAINTENANCE (AWSOM)

### A 'USER' VIEW

#### GENERAL-USER

1. The AWSOM unit facilitates rapid Ambulance & Pro-Active maintenance of remote hand pumped water wells by the provision of appropriate and timely Well data to Head Office staff for consideration and remedial action.

#### EVERYDAY-USER

1. The AWSOM unit sends a Text of the current, normally cumulative, Well Activity-Counts in 30 second blocks every given number of Night(s) normally one. The Text data is entered Manually or Automatically into the AWSOM Spreadsheet for processing & analysis.

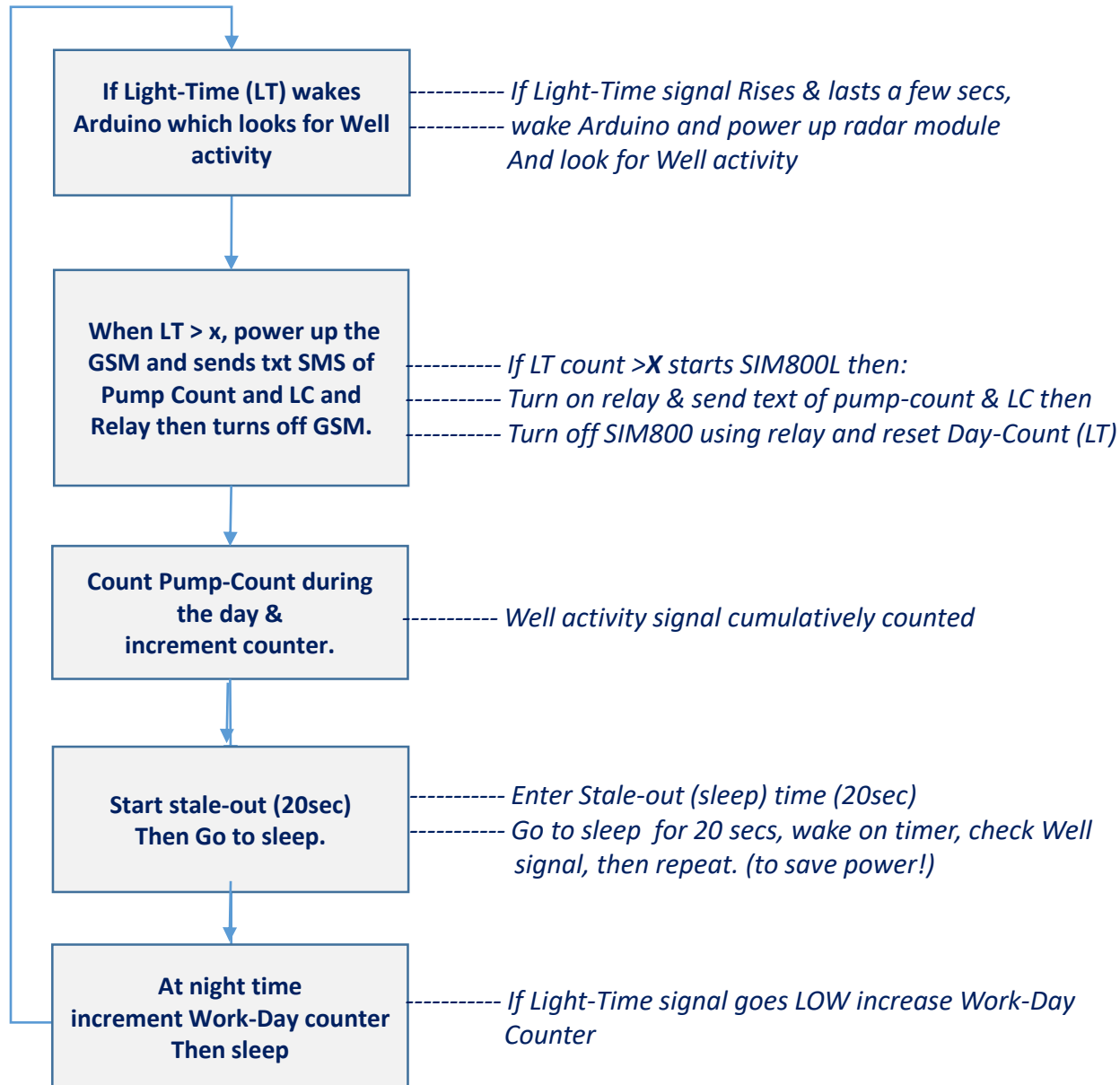
#### ENGINEERING-USER

1. After a set number of days, (at Night - normally one) the unit sends a Text which includes the:
  - Maximum **temperature** since the last Text,
  - The current **battery** voltage,
  - The cumulative current **PUMP-COUNT**, (in 30 second units )
  - The **Day-Count** (cumulative number of Texts since last system Reset)
  - The **Powered-Up-Time** in 30-sec units since previous Text

#### THE UNIT'S VIEW

1. **Counts** the number of times (in 30 second blocks) the Well is used and has sustained activity around it. (The Pump-Count)
2. The Unit **sends** a Text of the, normally cumulative, Pump-Count every given number of Dark-Times (Nights – normally one). Texts are sent after a full days charge just before the Unit goes to sleep at night.
3. If battery voltage drops below 4.60v then the Unit sleeps for a few hours waiting for the sun to **charge the batteries**. After this time and provided the battery is above 4.60v the Unit starts to count cumulatively the Well's activity again (Pump-Count).
4. When the Well Pump-Count is greater than 999998 (about every +18 months) the Unit will automatically **Reset** the Pump-Count ready to start-again all other counters continue.
5. **The Unit goes to sleep** when the sun goes in. This saves considerable amounts of power resulting a smaller Unit.
6. During the Day the Unit **sleeps between readings**. (In accordance with the Nyquist-Shannon Theorem.)
7. The **maximum temperature** between Texts is calculated and stored and sent in the Text message.
8. The Unit counts cumulatively the **number of Days** the Unit has been used since the last full Arduino Reset.
9. When sending texts the Unit **switches off** the water movement sensor.
10. The water movement radar sensor enters a power-saving routine and is switched off when not required.

# WELL MONITORING LOGICAL OUTLINE



## Logic Outline:

When the Solar cells produce voltage this wakes up the Arduino and turns on the radar sensor & Arduino sleeps.

When interrupt (movement) signal is detected it increments the Pump-Count. The unit then enters STALE\_OUT time and 'sleeps'/ delay for 20sec then repeats.

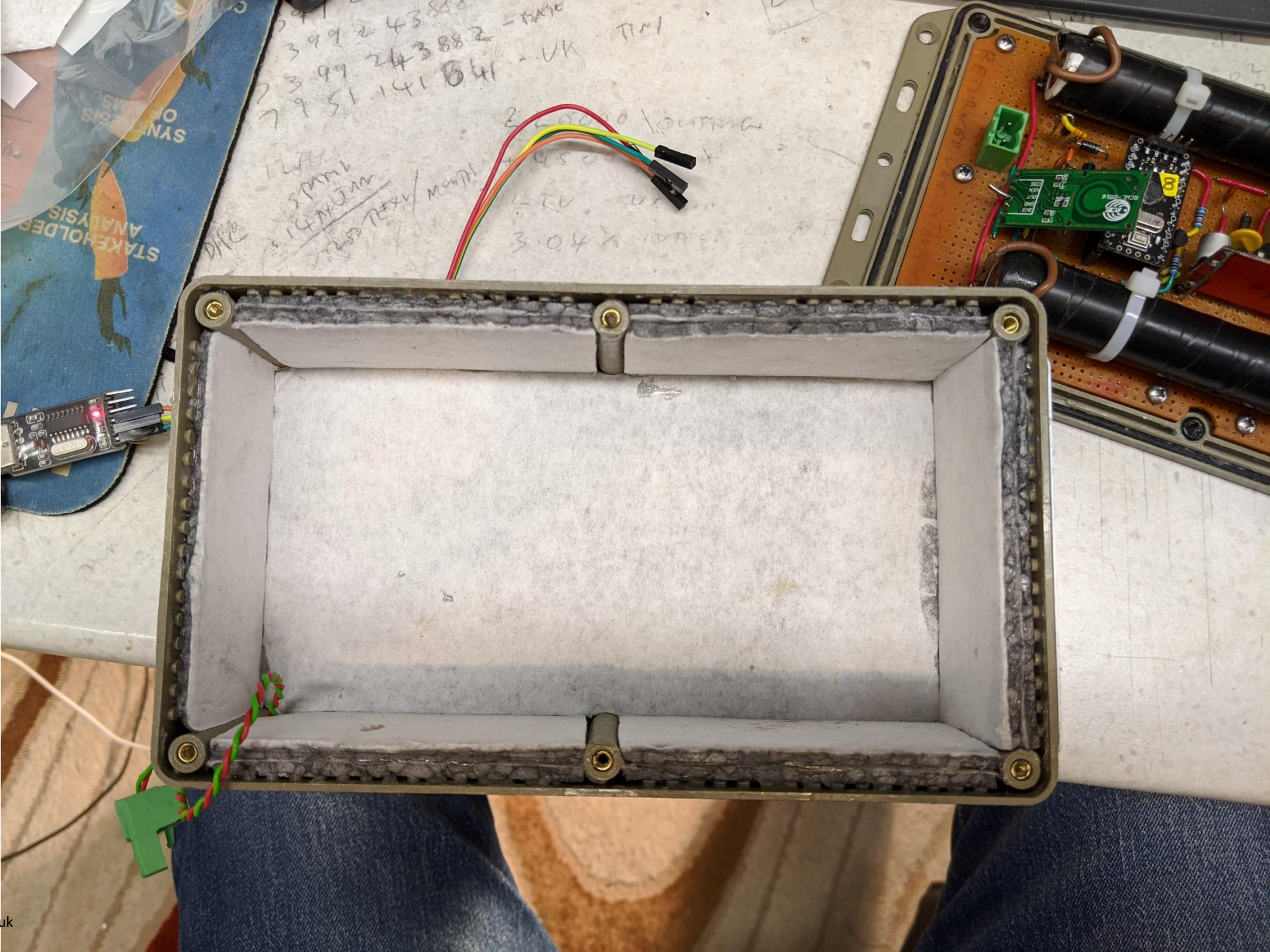
When the Light-Time Day-Count is >than **say 1** the GSM is powered up and both Pump-Count and Day-Count texts are sent.

At night the GSM is turned off by Relay and Arduino put to sleep waiting for the next sunrise.



## Things to remember when setting up:

1. De-solder the Arduino Mino Vcc-ON LED (2mA x 24hrs)
2. Check if the Arduino is a Mino or a Nano software wise. (try loading with both to see which works)
3. Check the PORT to load the sketch from in the Arduino options
4. Check the type of BOOTLOADER (old) in the Arduino options too.
5. Make sure the Vcc on the Arduino is the same voltage as the USB port otherwise it wont load.
6. Check and adjust Arduino sketch Loop-Count is 30.0 seconds
7. Check there is credit on the sim card!
8. Make sure the solar cell wired are screwed in tightly & makes a good connection
9. **Calibrate** the Voltage and temperature calculation or they could be out by 4c / 200mV respectively.
10. Have NO push connections as they get loose and cause havoc!



Handwritten notes on a piece of paper:

399 243 882 - MAX  
73 99 243 882 - UK  
79 51 141 841 - UK  
25000 / OUT  
4500  
LTV  
3.04 x

Handwritten notes on a blue mousepad:

STAKEHOLDER ANALYSIS  
SYNOPSIS



