

# **Salt Lake County ARES**

Topic: Solar Charging

Written and Presented by:

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# Solar Charging

- Objective
- Solar Energy and Solar Zones
- Different types of Solar Cells
- Components of a Charging System
- Design Considerations
- System Setup
- System Cost and Capabilities

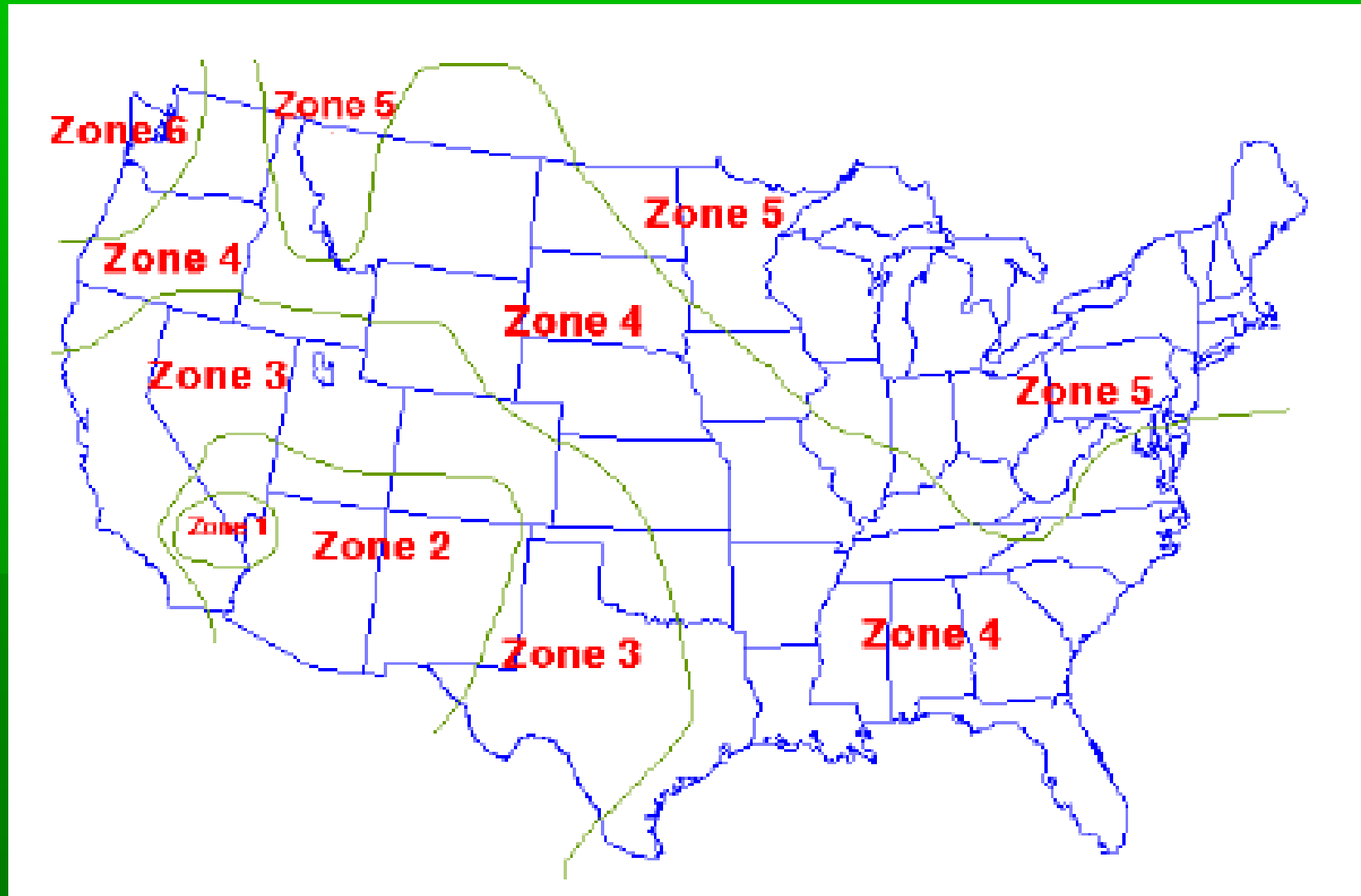
# Solar Energy

- Solar panels require no fuel other than sunlight. They produce no emissions, no fumes and have no moving parts. Other than an occasional wipe down to remove dust, they are virtually maintenance-free.
- Solar panels are used with batteries to store electrical energy produced during the day for use at night or when the sun is shaded by clouds. This combination of solar panels and batteries allows 24-hour operation with only occasional help from a generator when solar conditions are less than optimal.
- Solar battery charging generates no hum at all.

# Solar Zones

- Zone 1 = 6 Hours
- Zone 2 = 5.5 Hours
- Zone 3 = 5 Hours (Salt Lake Metro)
- Zone 4 = 4.5 Hours
- Zone 5 = 4 Hours
- Zone 6 = 3.5 Hours

# Solar Zone Map



# Solar Cell Types:

- *Single or Monocrystalline Cell* – This cell was the most popular and has been produced for the longest period of time. It consists of a single grown silicon crystal that is sliced into thin wafers, processed chemically, and finally covered with electrodes to collect the electric charge. They are typically blue or black and have shiny appearance. Efficiencies of 18% - 25% are commercially available.

# Solar Cell Types:

- *Polycrystalline Cell* – This cell type is now the most popular. It is made by slicing wafers from cast square silicon ingots. This cheaper grade of silicon results in a cell with less efficiency but cheaper in cost. These cells appear frosted. Typical efficiencies are 12% - 13%.

# Solar Cell Types:

- *Ribbon Cell* – This cell is formed by drawing flat thin films from molten silicon and results in a polycrystalline structure that is cheaper to produce since no bulk wafer cutting is required. Efficiencies are typically 13% - 14%.



# Solar Cell Types:

- *Amorphous or Thin-Film Cell* – These cells are usually created by applying doped silicon or other photo-voltaic material to the back of a plate of glass or a flexible insulator. Efficiencies of 6% to 10% are commercially available.

# System Design

- Panel Sizing:
- Assume an average power consumption of 96 watts (8 amps at 12V). In 24 hours a total of 192AH or 2304 Watt-Hours. The solar panel's required must provide  $2304/5$  for zone 3 of insolation or 460 watts or 38.4A per hour.
- Battery Storage Requirement:
  - The storage battery pack is recommended to deliver station power for a minimum of 8 hours.

# Radio Power Usage

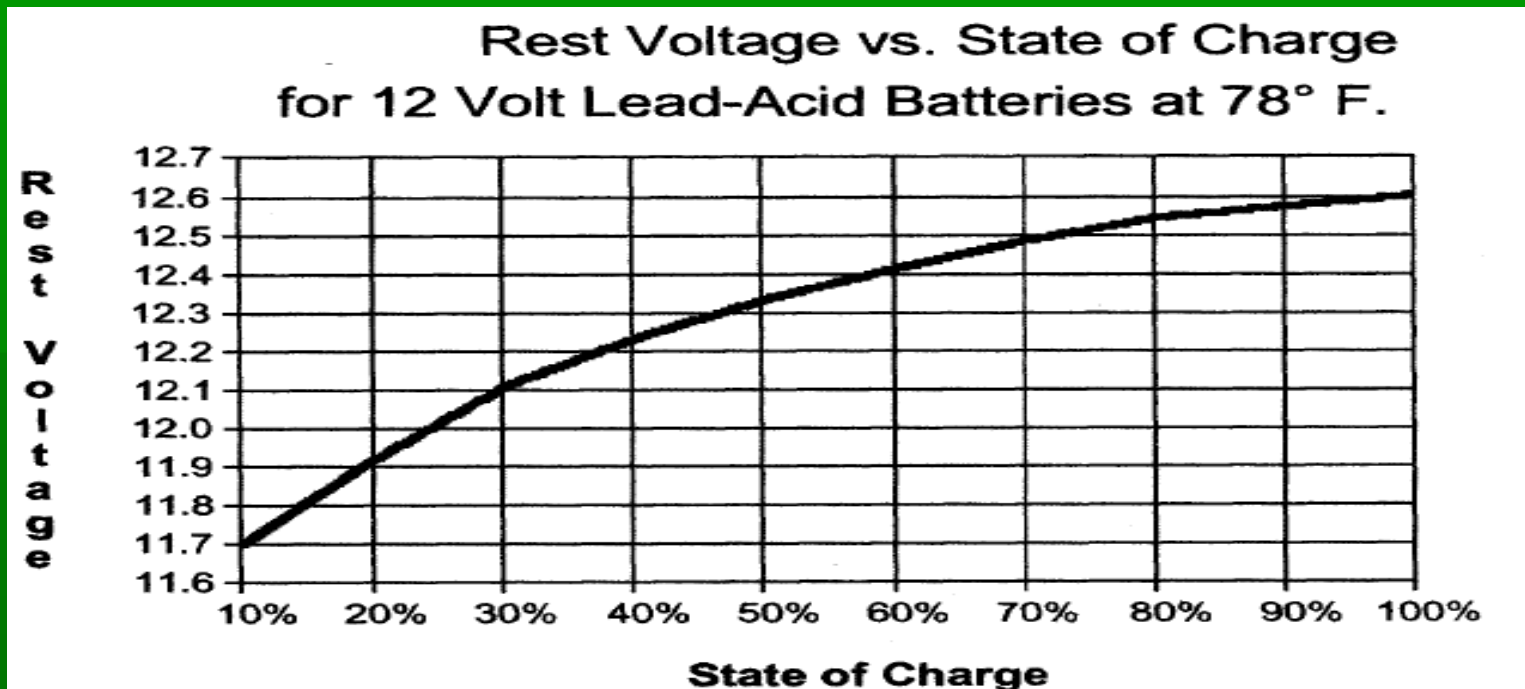
Radio's	Receive		Transmit			Power in Amperes @25%			Receive Amps 24 HR	Total 24 Power Amperes		
	FM	DV <small>100%</small>	High	Med	Low	High	Med	Low		High	Med	Low
IC 80AD	0.17	0.22	2.1	1.5	0.4	12.6	9	2.4	5.16	17.76	14.16	7.56
THF6	0.17		2	0.8	0.5	12	4.8	3	4.08	16.08	8.88	7.08
IC 2720	0.41		8.32	5.53	4.34	49.9	33.18	26	9.84	59.76	43.02	35.88
1D 800H	0.46		8.62	4.71	2.92	51.7	28.26	17.5	11.04	62.76	39.3	28.56
FT-897	0.68		11.5			69			16.32	85.32		

# Calculated load Continued.

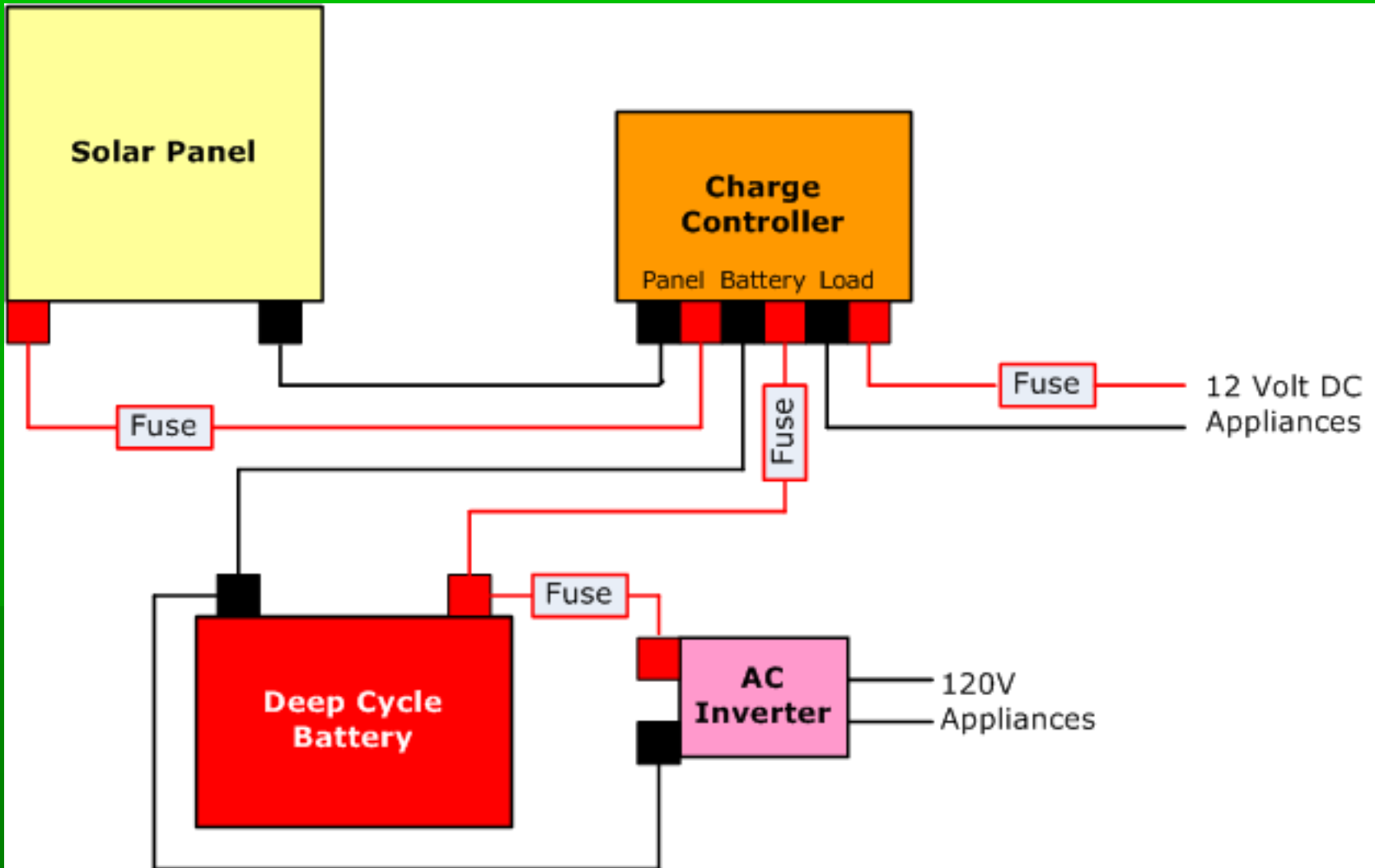
Radio's	Total 24 Power Amperes			Zone 3	TAH	Panel Size				
	High	Med	Low			100	200	300	400	
					PA	8.3	17	25	33	Amperes
					PA/5H	42	83	125	167	
IC 80AD	17.76	14.16	7.56	5						
THF6	16.08	8.88	7.08	5						
IC 2720	59.76	43.02	35.88	5						
1D 800H	62.76	39.3	28.56	5						
FT-897	85.32			5						

# Deep Discharge Batteries

- Choosing batteries for solar power offgrid or a battery backup system..avi



# Solar Charger Components



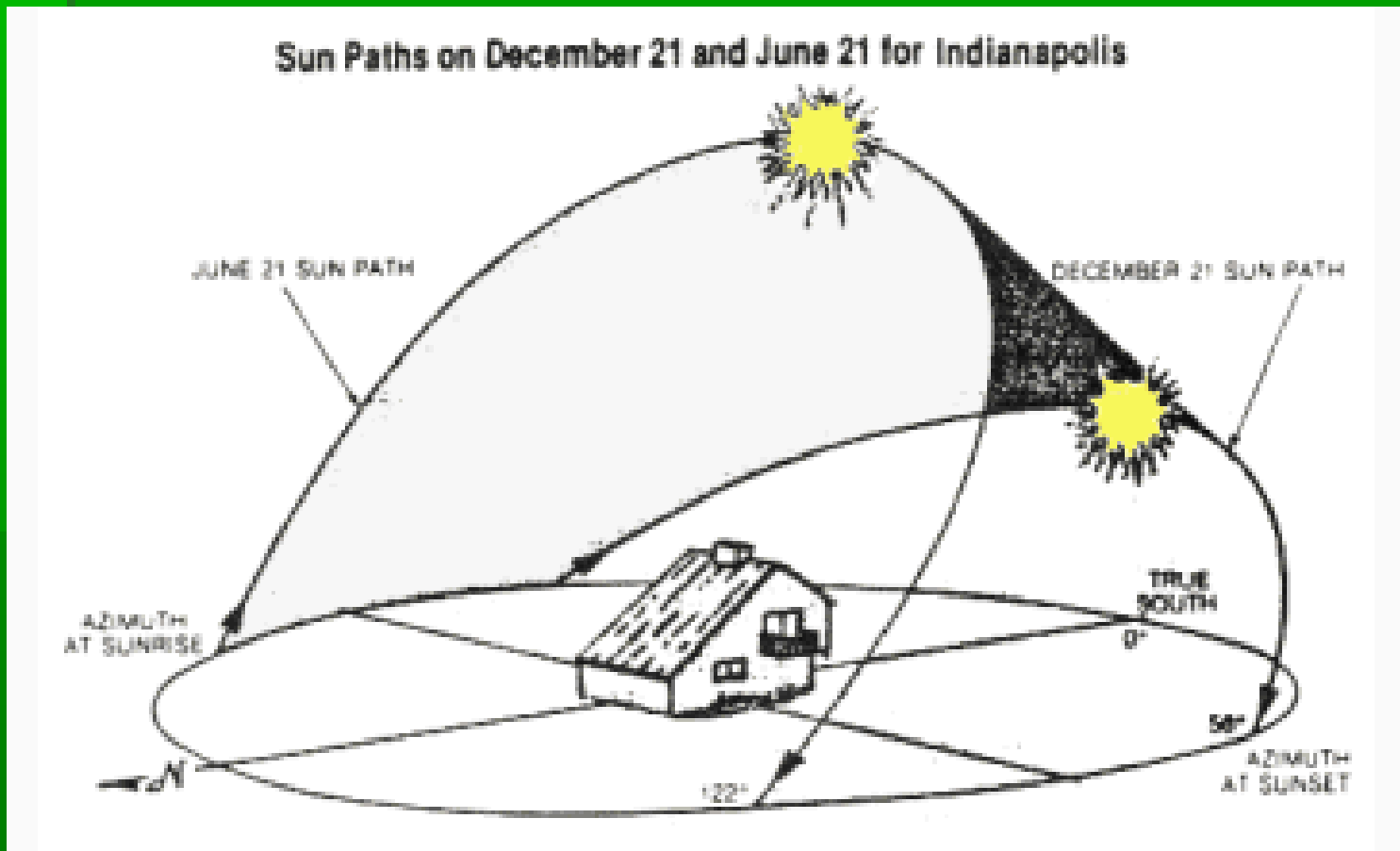


# Solar Panel Location

- The Solar panel should be located such that no shade will fall on it during its maximum insolation period. Further, the elevation and azimuth must be adjusted to maximum solar ray angle.
  - Winter = Latitude plus  $15^{\circ}$
  - Latitude in Spring/Fall
  - Summer = Latitude minus  $15^{\circ}$



# Solar Panel Altitude and Azimuth

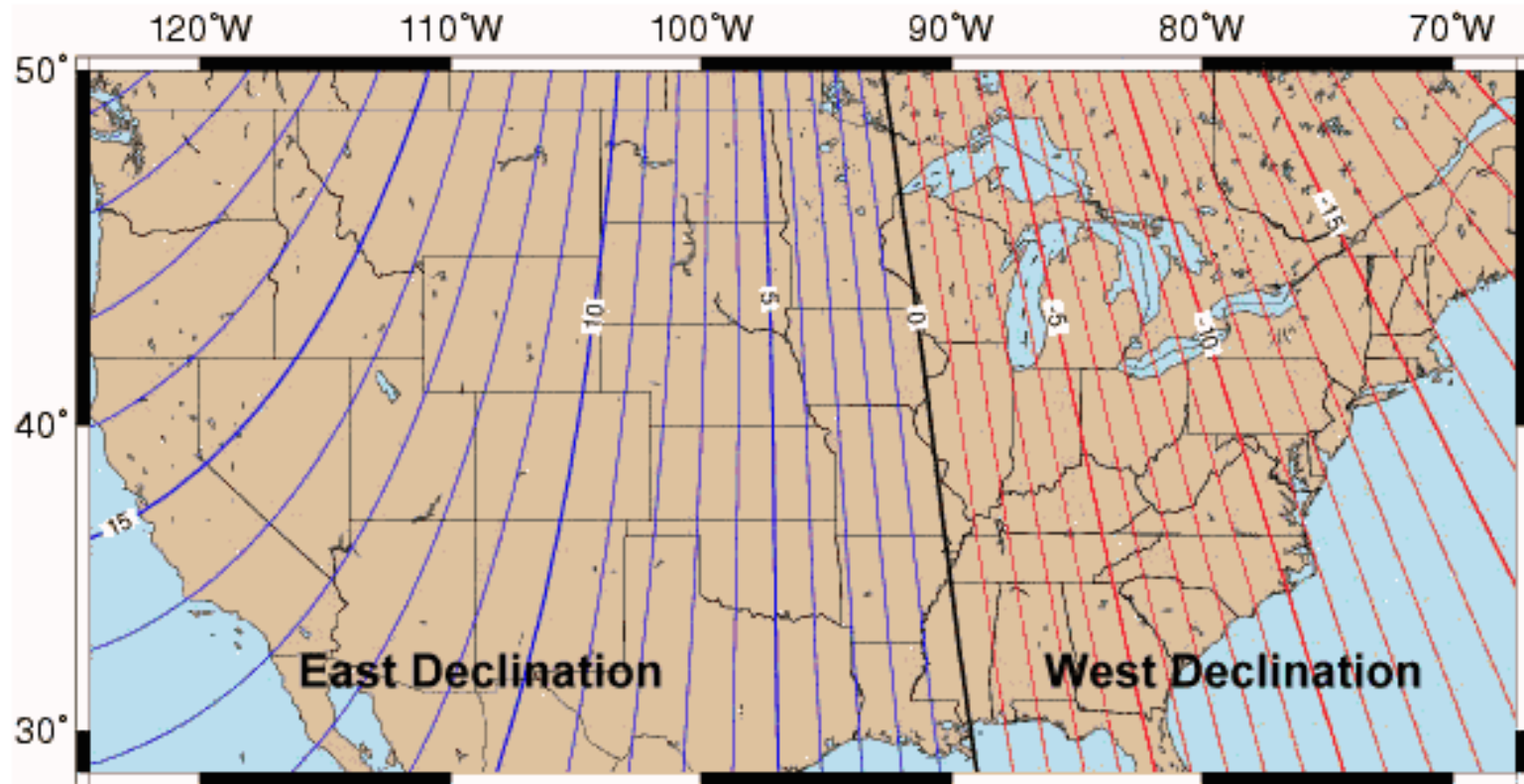


# Solar Panel Altitude and Azimuth 192.5°

- Salt Lake Metro Latitude = 40° Monthly Altitude settings

JAN	50
FEB	45
MAR	40
APR	35
MAY	30
JUN	25
JUL	30
AUG	35
SEP	40
OCT	45
NOV	50
DEC	55

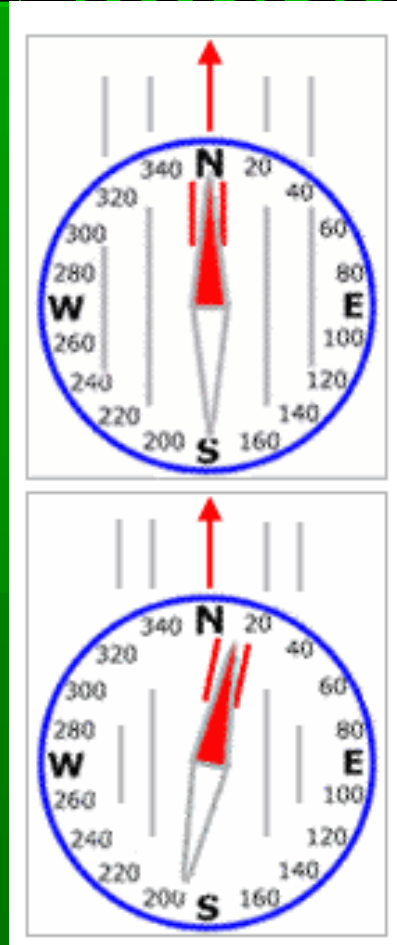
# Finding True South



# Finding True South

Declination SLC/UT is:

**12.5° East Azimuth = 192.5°**



# System Costs:

- You can plan on paying from \$100 to \$250 for a 100W panel. Cost depend on manufacture and grade of panel.
- In our example: (3) 100W panels were needed.
  - Panel Costs: \$600 - \$1000
  - Battery Cost: \$150-300
  - Charge Controller and Power Monitor \$45-75

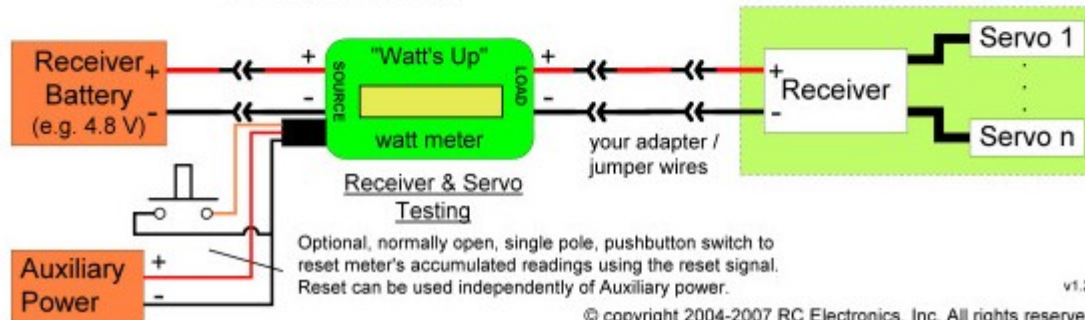
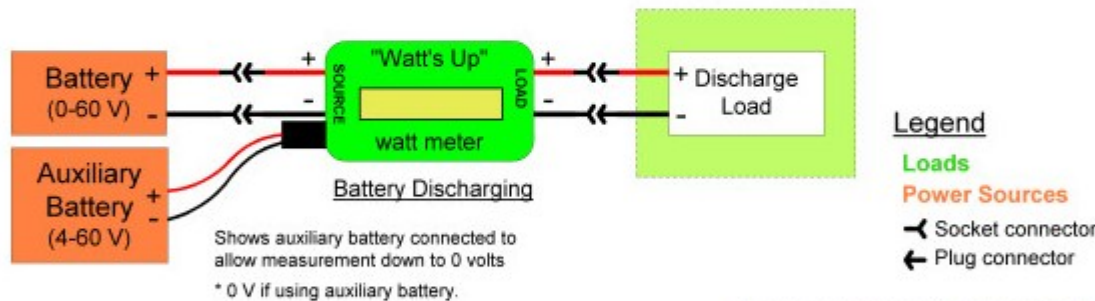
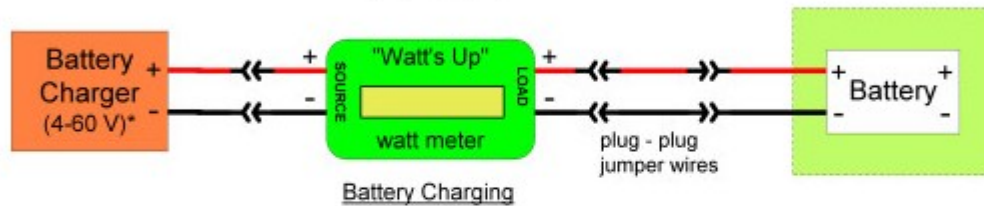
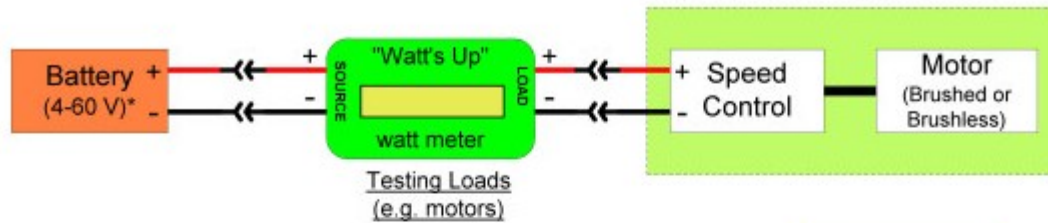
# Functioning System



# Salt Lake Country ARES

- Questions:
- Solar Video: Yaesu  
FT-817 Solar Powered Go-Pack - Part 1.avi
- [ad7lp1@gmail.com](mailto:ad7lp1@gmail.com)
- Ramsond 50 Watt Solar Panel 50w W Monocrystalline Photovoltaic PV Solar Panel Module 1...
- Sold by: Ramsond Corporation
- Condition: new
- Quantity: 1
- \$119.99 each

Diagrams show electrical energy flowing from left to right



v1.2

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