Solar Panel Innovations

Real World Experience

- Jeff Cote

Different Charge Methods

- Ways to create power
  - Charger(s)
  - Alternator(s)
  - Solar
  - DC Genset
  - Wind

Imagine…

- Staying an extra day or two at anchor without more battery
- Offsetting the loads associated with the fridge
- Recharging the batteries without any noise, vibration, smoke
- For sailors: not worrying about motoring between anchorages to recharge batteries
- Running a genset less or NOT at all

Solar Innovations

- Flexible panels: similar wattage per area to rigid panels

Northwest Advantages

- During peak summer months: 15 + hours of sunlight a day
- Relatively sunny days during summer months
- Most boaters have extensive canvas covers (e.g. bimini, dodger) or hardtops

Flexible Panels: Endless Mounting Options

- Lightweight
- Mounted on:
  - cabin roof (no ventilation space needed)
  - canvas (bimini, dodger, cockpit enclosure)
- Zippers, grommets, Velcro, snaps, adhesive

Hard Top Installation

Prepping for Dodger Install

Wide Selection of Panel Size

Choice: Mono or Poly?

- Monocristalline cells
  - Highest efficiency
- Polycristalline cells
  - Best value

Solar Power Efficiency Defined

What do the different efficiencies mean?

- The efficiency of the panel is included in the wattage rating
  - a poly 100W panel will be larger than a mono 100W panel, but
  - both will produce the same energy
- The efficiency is a measure of how much of the sun's energy is captured by the panel
  - lower efficiencies mean a larger panel is required to capture the same energy

Solar Trawler

What Makes a Great Panel?

- Depends on construction:
  - Quality of encapsulation: EVA (Ethylene vinyl acetate)
    - Prevents yellowing <- similar effect to shading
  - Connections between cells: silver alloy
  - Redundant pathways between cells (32 times more connection)
  - Top ones are hand-made
  - High end cells
    - German made (Day4)
  - Sealed and waterproof junction box and MC-4
  - IP67
  - Visual and tactile inspection
  - Test individually (in-house) for 24 hr before shipping
    - Xenon Sun Lamp

Solar & Cushion

Expected Life

- Expected life: 20 years
  - Plastic life proven
- Warranties: 5 years

Aft of Center Cockpit

Panels Shade-Protected?

- Make sure solar panels include a bypass diode to prevent a shaded cell from de-powering the entire panel
- These diodes effectively split the panel into two independent power sources
- Without diodes in evening and night reverse current

Calculate Your Power Needs

- What is your daily power requirement?
  - Varies depending on the season, examples:
    - Lights are run earlier in winter
    - Heating in the shoulder and winter season
- Largest DC loads
  - Refrigeration is the largest draw: 50 – 125 Ah per day
  - Inverter: powering AC loads
  - DC loads from running diesel heater

Catamaran Installation

Typical Daily Battery Usage

Typical daily AHr budgets	Ah
Beneteau 33	85
Catalina 36	150
Suncruiser 38	225
Grand Banks 42	175
Ocean Alexander 48	375
Meridian 580	500

Surface Mount

Solar – How Many Watts?

- Solar panels can be sized to power
  - daily Ah demand
  - refrigeration Ah demand
  - effectively, extend your time at anchorage: e.g. 3 days instead of 2 days

Another Hardtop Installation

Sample - Quick Calculation

- Rule of thumb: 25% of wattage = daily Ah output
  - Watts X 25% or Watts / 4
  - E.g. A 100 Watt panel will produce 25 Ah
    - 100 X 20% = 25 Ah

- Optimistic: factor of 3 or 33 Ah
- Conservative: factor of 5 or 20 Ah

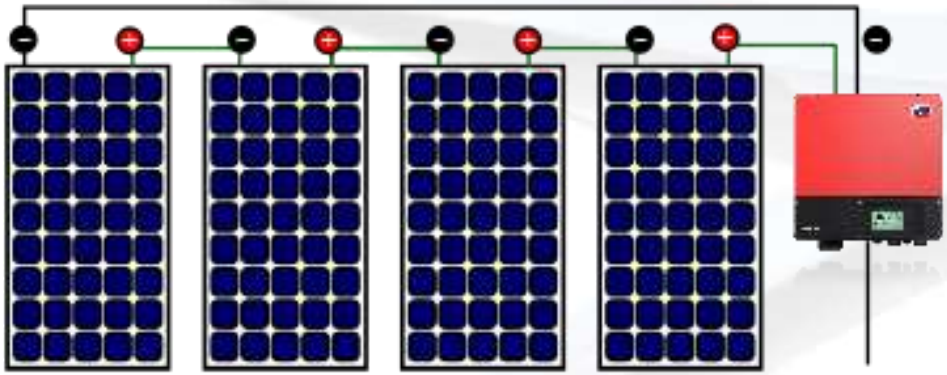
Solar Wiring

Solar MC4 Connectors Disassembled

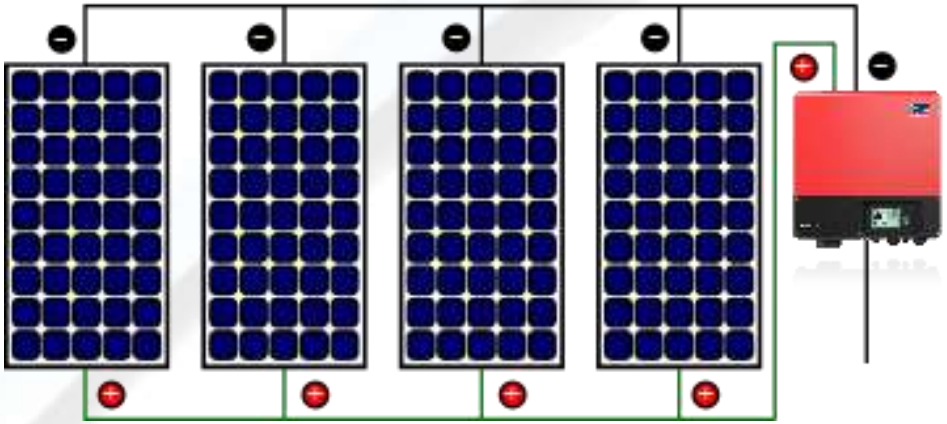
Solar MC4 Connectors

Solar Panel Series or Parallel

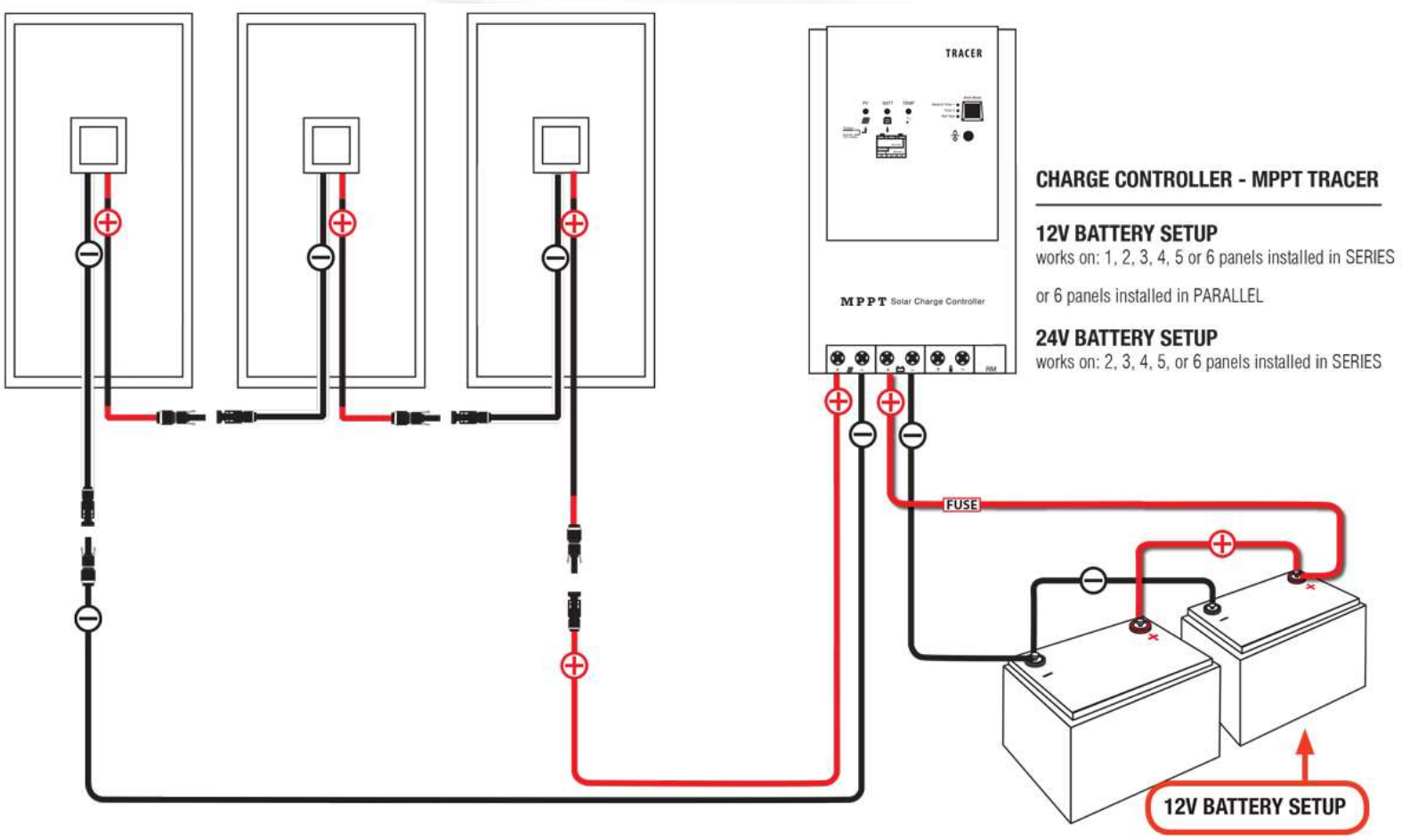
Wiring Solar Panels in a Series Circuit



Wiring Solar Panels in a Parallel Circuit



Solar System Wiring



MPPT Wiring

MPPT Selections

- Make selection based on
  - Battery Voltage
  - Maximum amperage
  - Maximum voltage
  - Battery chemistry

MPPT – 75/15


victron energy
blue solar charger
MPPT 75 | 15
IP43
Battery : 12/24V | 15A
PV : 75V max | 15A
20A
Green LED : on Power
: blinking BatteryLife
Yellow LED : blinking fast Bulk
: blinking slow Absorption
: on Float
BATT
PV
LOAD

Genasun – GV-10 LA

Adhesive Backed Panel

#1: Catalina 36

Context

- House Bank: 880 flooded
- Daily Ah: 90 Ah
- Goal: Ability to stay anchor indefinitely

Solution

- Array: 450 Watts
- Panels: 3 X 100 + 3 X 50
- Avg daily solar: 112.5 Ah
- Mount: With zippers on double-cover on bimini and dodger
- Dedicated MPPT per panel
- Outcome:
  - Sail when I want
  - Stay at anchor how long I want
  - No need to plug in while visiting other marinas

#1: Catalina 36

#1: Catalina 36

#2: SeaRay

Context

- House Bank: 440 flooded
- Daily Ah: 150 Ah
- Goal: Offset refrigeration & stay quiet with sailboat friends

Solution

- Array: 270 Watts
- Panels: 2 X 130 W
- Mount: With stick-on adhesive on hardtop
- Dedicated MPPT per panel
- Outcome:
  - Only need to run generator when running AC stovetop
  - Gunk hole in quiet anchorages longer without making noise

Hardtop Installation

#3: Beneteau 51

Context

- House Bank: 1200 Ah AGM
- Daily Ah: 125 – 250 Ah
- Goal: Meet daily power requirements during summer cruising

Solution

- Array: 425 Watts
- Panels: 3 X 100 W + 1 X 125 W
- Avg daily solar: 105 Ah
- Mount: With zippers on double-cover on dodger and bimini
- Dedicated MPPT per panel
- Outcome:
  - Removed troublesome genset
  - Stay at anchor indefinitely
  - No need to motorsail again

#3: Beneteau 51

#4: Grand Banks 36

Context

- House Bank: 440 Ah flooded
- Daily Ah: 100 Ah
- Goal: Meet daily power requirements

Solution

- Array: 375 Watts
- Panels: 3 X 125 W
- Avg daily solar: 90 Ah
- Mount: With zippers on double-cover on bimini
- Dedicated MPPT per panel
- Outcome:
  - No need to add generator
  - Stay at outstation without AC power indefinitely

#5: Ranger Tug 29

Context

- House Bank: 380 Ah flooded
- Daily Ah: 150 Ah
- Goal: Do as much as possible, EFOY does the rest

Solution

- Array: 340 Watts
- Panels: 2 X 170 W
- Avg daily solar: 85 Ah
- Mount: With zippers directly on bimini
- Dedicated MPPT per panel
- Outcome:
  - Doesn’t run Honda portable Gen
  - No alarming of inverter in the morning

#6: Mirage 33

Context

- House Bank: 220Ah
- Daily Ah: 60 - 70 Ah
- Goal: Stay at anchor an extra 1-2 days

Solution

- Array: 170 Watts
- Panels: 1 X 170 W
- Avg daily solar: 42 Ah
- Mount: With zippers on bimini
- Dedicated MPPT per panel

#6: Mirage 33

Setup: Hardtop

Setup: Deck

Setup: Aft Bimini

Details Matter

MPPT Tips

- Preferred: one MPPT controller per panel
- Bring 10 gauge wire from panel to MPPT
- Choose MPPT for the right battery type:
  - Flooded, AGM, Gel, etc…
- From MPPT to battery aggregate panels output to larger gauge wire
- Fuse each panel and each individual load
  - Properly label all fuses and wire runs

Solar Monitor

- Show charging amps
- Show daily charge rate

Closing Thoughts

- Recharging the batteries without any noise, vibration, smoke
- Costs are all front-loaded
  - No maintenance costs - put it in and forget it
- Secondary source for charging while at dock

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