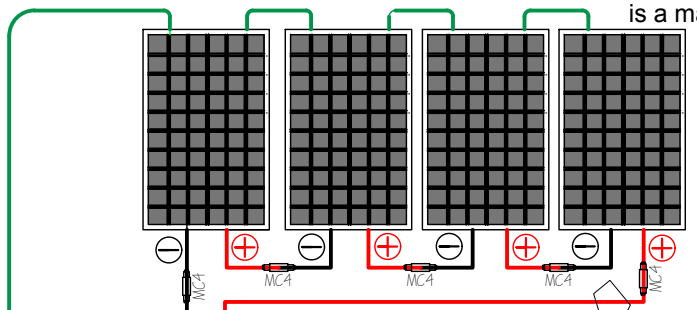
MINIMALIST PV---System Design #1 INTERRUPTED DC ONLY! SCALE: NTS	IOLA MAINTENANCE NORMAN SOLLIE 907-712-4659	SHEET: 1 OF: 2

DRAWN: 2021.11.14	DRAWN BY: N. SOLLIE	CHECKED BY DIYGrid: M. MOTSENBOCKER; I. AKASHI	REVISED: 2021.11.24

NOTE: In a system with only four panels generating no more than 10 amps, with no storage batteries as shown below, the diode and 15-amp fuses are not necessary, but ready to accommodate future expansion. Output of pictured Trina TSM-250 panels is a maximum 8.27 amps.



Sufficient solar panels in series (wire + to -) to add their rated Maximum Power Voltages (Vmax) up to a range of 120 to 140 VDC, pgs 69 & 109 Additional arrays may be wired in parallel to increase system production.

#12AWG solar panel wire typ. (rated up to 20 amps) p 71 Output of pictured Trina TSM-250 panels is a maximum 8.27 amps.

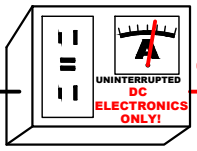
Ground solar panel frames together with min #8 AWG clamped to min 3' copper grounding rod driven into earth away from solar equipment. No sharp turns in the wiring (lightning pulses may go straight). This will be the only traditional ground in the system. pgs 72-73

20 amp disconnect breaker/ switch to allow working on the system without incoming panel voltage. p 72

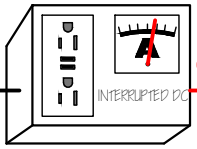
Diode

Uninterrupted DC direct from the solar panels. This to provide power to electronics only during poor production when the panels provide approx 80-105 vdc. [email from M. Motsenbocker 2021.11.15]

#12 AWG min

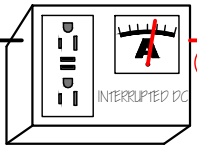


High Priority Jack Junior interrupted DC box w/ amp meter, 120 vdc receptacle, & USB plug-ins. [pgs 80-85] When incoming power goes above ~105 vdc, supplies interrupted DC power to receptacle and USB ports .



15 amp Overcurrent Protection Devices typ. (such as Midnite Solar Breaker MNEPV 150 vdc 15 Amps DC) to protect Jack Jrs. from high amps supplied through panels or later addition of batteries. [discussion w/ M. Motsenbocker and I. Akashi 2021.10.26]

#14 AWG min



Low Priority Jack Junior [Pgs 80-85] Available w/ incoming power of 120 vdc or higher.

INTERRUPTED DC
SCALE: NTS

NOTE: Not necessarily pictured per the U.S. National Electrical Code, "...exposed non-current carrying metal parts of module frames, equipment, and conductor enclosures shall be grounded."

MINIMALIST PV---System Design NOTES (SCALE: NTS)	IOLA MAINTENANCE NORMAN SOLLIE 907-712-4659	SHEET: 2 OF: 2

DRAWN:	DRAWN BY:	CHECKED BY DIYGrid:	REVISED:
2021.11.14	N. SOLLIE	M. MOTSENBOCKER; I. AKASHI	2021.11.24

NOTES:

THE ALASKA WINTER ADVANTAGE---

1) Although reduced hours of sunlight lower the potential energy to be harvested, solar panels in cold conditions run more efficiently when they do get sunlight, with increases in both voltage and wattage. For example, at 25℃ Trina TSM-250 panels have a Vmax of 30.3vdc w/ 8.27 amps and 250 watts. Add together the individual Vmax of 4 panels for the array voltage to get 121.2 vdc at 25℃. But there is a 0.4% increase in volts and watts for each ambient degree under 25℃. At 0℃ this results in 10% more volts, or 133.3vdc & 1,100 watts. [M. Motsenbocker email of 2021.11.10]

2) Panels oriented vertically self-clean; take advantage of the low winter light angle; and collect more reflected light off snow-covered ground.

Interrupted DC Power in Jack Junior Boxes---One advantage of AC power is that the current drop of 60 times a second protects mechanical switches and thermostats from sparking. The Jack Junior boxes do a better job than AC at protecting these components by interrupting the ~120vdc 250 times per second.

Low Voltage Shut-Off---Jack Junior boxes automatically shut-off power usage at low incoming voltage to protect batteries from being over discharged.

High Priority Jack Jr. [~105 vdc and up]---Interrupted DC power through High Priority Jack Jrs. is typically available during all solar production and through charged batteries at night. Among other things, this power may be used for induction plates, crock pots, & charging tool batteries. During low or nil production hours (when running off batteries), High Priority Jack Jrs. may be used for 200 or less watt items such as lighting. Voltages may be increased in cold winters to adjust for greater Vmax of panels.

Low Priority Jack Jr. [~120 vdc and up]---This receptacle automatically provides power when batteries are fully charged and solar production is high. This is "excess" solar array production that may be used to heat water (water heater elements will work fine with interrupted 120 vdc), air (electric resistance), or even to keep the batteries themselves warm (through self-regulating heat trace cable @ 7 watts/ft). Voltages may be increased in cold winters to adjust for greater Vmax of panels.

Inverter---In a pre-planned "Think Like a Plant Solar" household, AC power and inverters may not be needed, but microwaves, the compressor motors of even some energy efficient refrigerators, transformers, and some other electric motors must have AC power to run (and to not be ruined!).

Grounding---The AC side of PV electrical systems are grounded in accordance with local building codes, however *direct current* electrical systems do not require grounding where not required by code. When it comes to metal equipment in a dc system, the U.S. National Electrical Code states, "...exposed non-current carrying metal parts of module frames, equipment, and conductor enclosures shall be grounded." Solar panel frames should have lightning protection with a route provided to earth (ground).

DIODES---Current will only flow in the direction indicated through a diode. When the current flows forward, the diode acts like a bare wire and permits the current to go through. When current attempts to flow in the opposite direction, the diode acts as an open switch and blocks passage. Diodes are used here to prevent backfeed of current to solar arrays and batteries (if any).

Uninterrupted DC---Provides >80 vdc uninterrupted power to DC electronics during periods of low power generation.