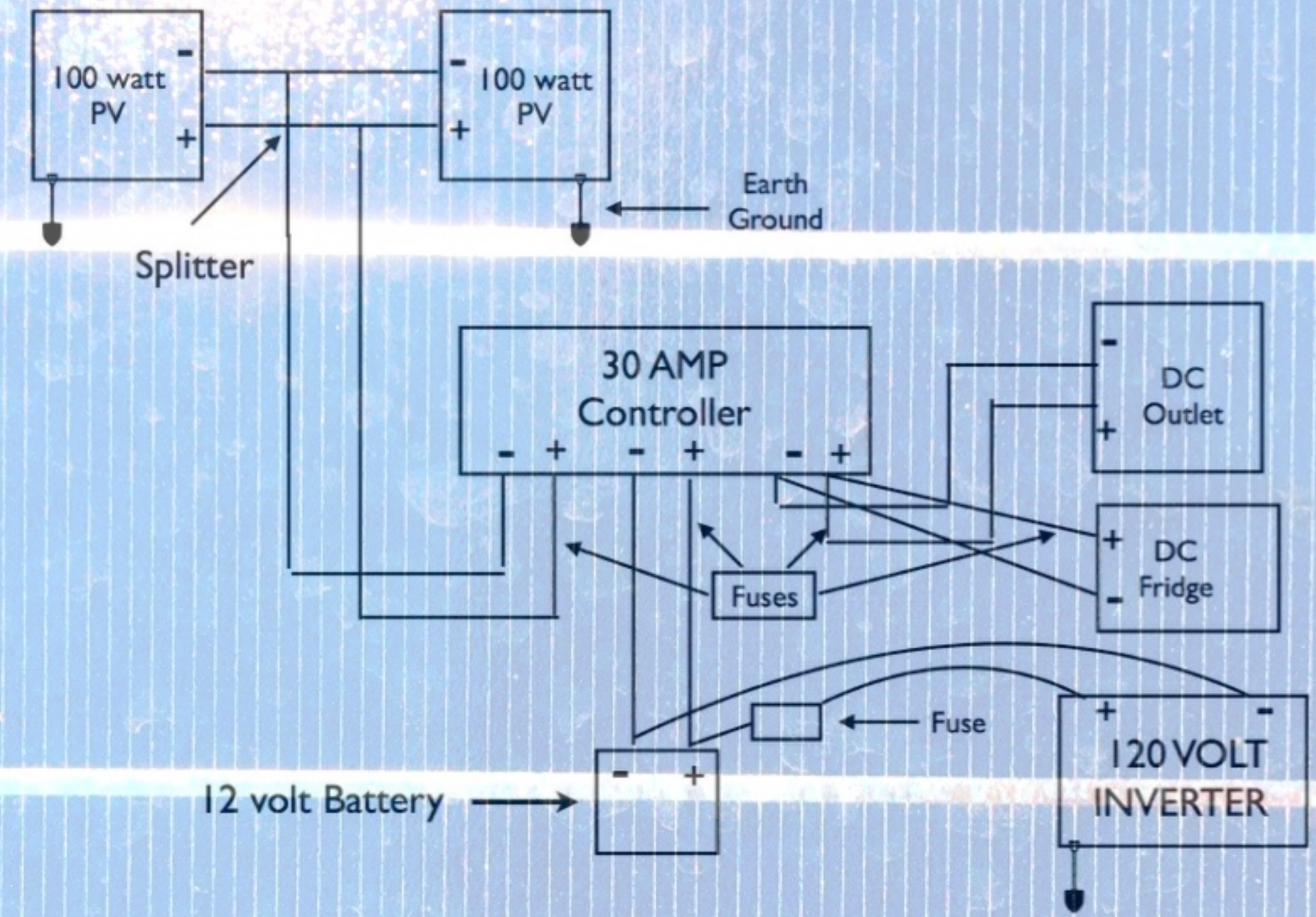
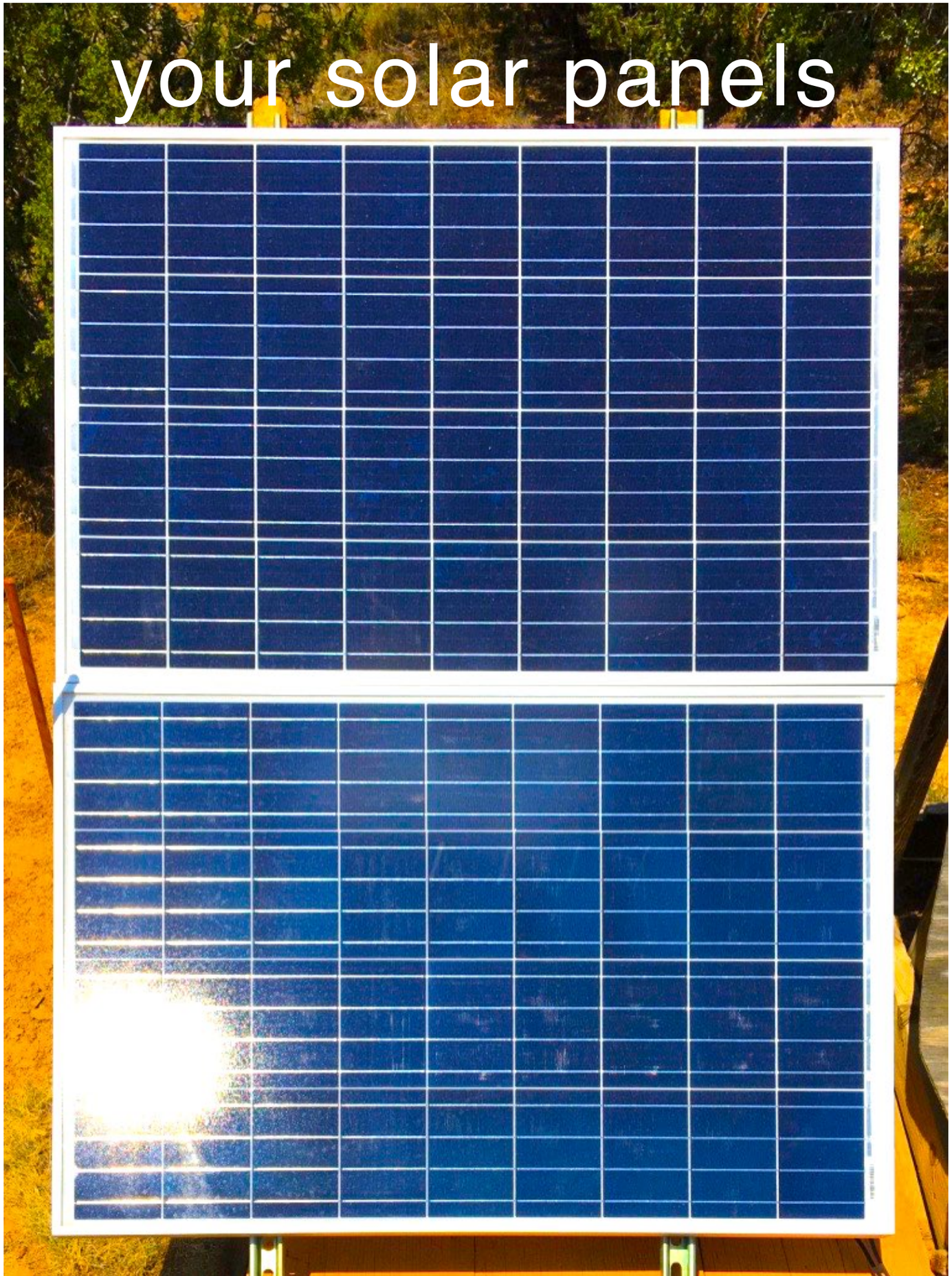
components of an off-grid photovoltaic system

for Solar Team 4

your system

Gallup Solar's 12Volt Hogan System




your solar panels

the I-V curve of your solar panels

The information on the label
on the back of your solar panel
tells you everything
about its capacity to create the electricity
that you are learning to manage
and use.

I-V (Current/I - Volts/V) curves are drawn
from that information
and present a graphic representation
of the operation of a solar panel
summarizing the relationship
between current and voltage.

your solar panels

This label on the back of your panels has all the information you need to draw an I-V curve.

windynation

www.windynation.com clean | power to the people

100W Polycrystalline Photovoltaic Solar Panel

Part #:	SOL-100P-01
Maximum Power (Pmax):	100 Watts
Open Circuit Voltage (Voc):	21.90 Volts
Short Circuit Current (Isc):	6.13 Amps
Max Power Voltage (Vpm):	18.00 Volts
Max Power Current (Imp):	5.56 Amps
Max System Voltage:	1000 VDC (600 VDC UL) *
Dimensions:	40.1" x 26.4" x 1.4" [1020mm x 670mm x 35mm]
Weight:	19.6 lbs [8.9kg]
Max Series Fuse Rating:	10 Amps
Nom Operating Cell Temp:	45 C [+/-2]

C SA US 264782 CE TUV NORD RoHS MADE IN CANADA

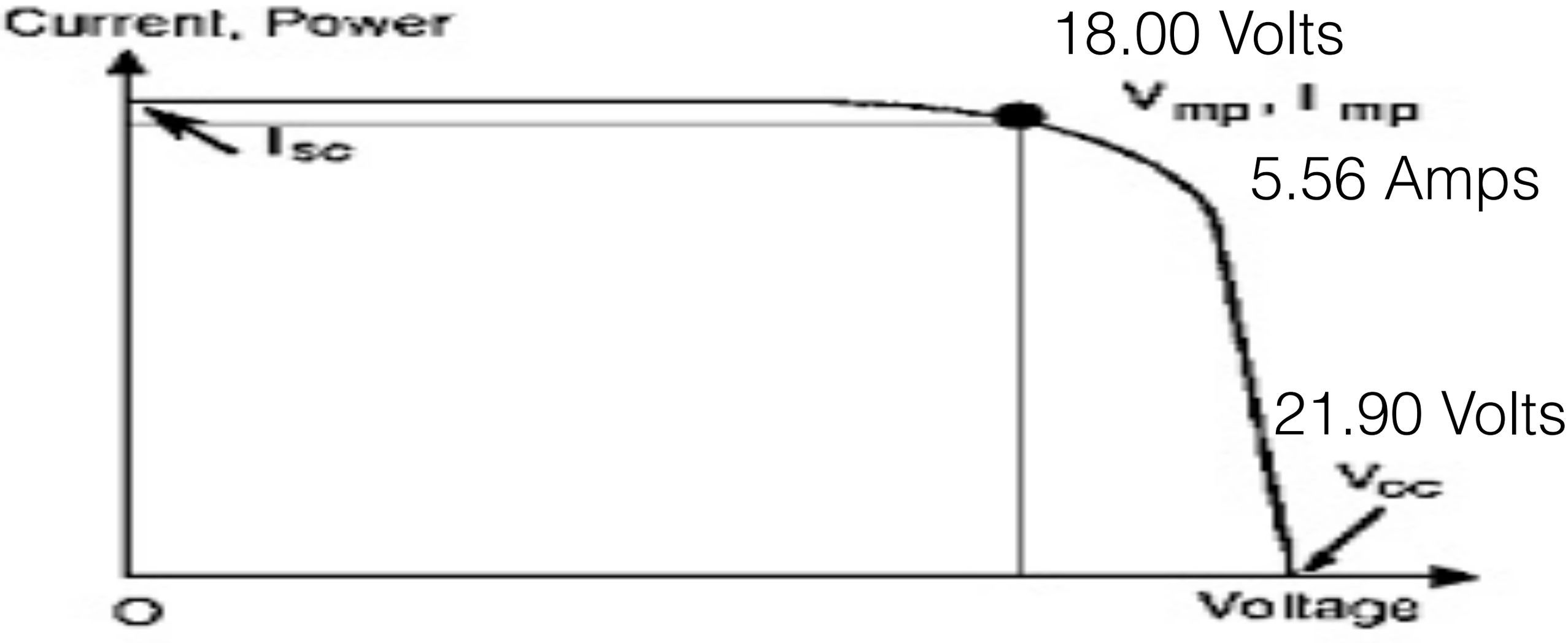
* 1000 volts direct current is the biggest system within which these panels can be used

the I-V curve of your solar panels

Maximum Power (Pmax):	100 Watts
Open Circuit Voltage (Voc):	21.90 Volts
Short Circuit Current (Isc):	6.13 Amps

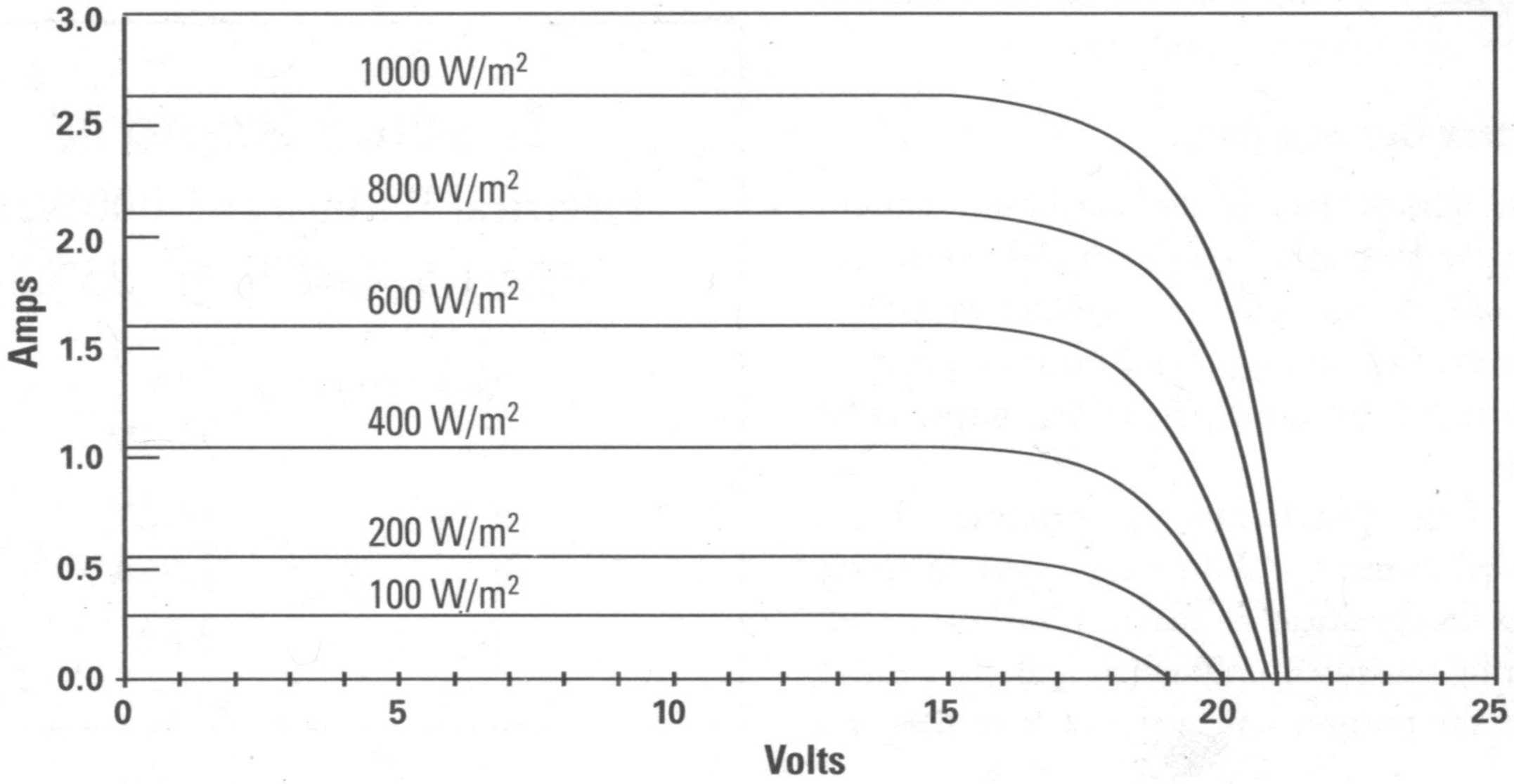
Max Power Voltage (Vpm):	18.00 Volts
Max Power Current (Imp):	5.56 Amps
Max System Voltage:	1000 VDC

6.13 Amps



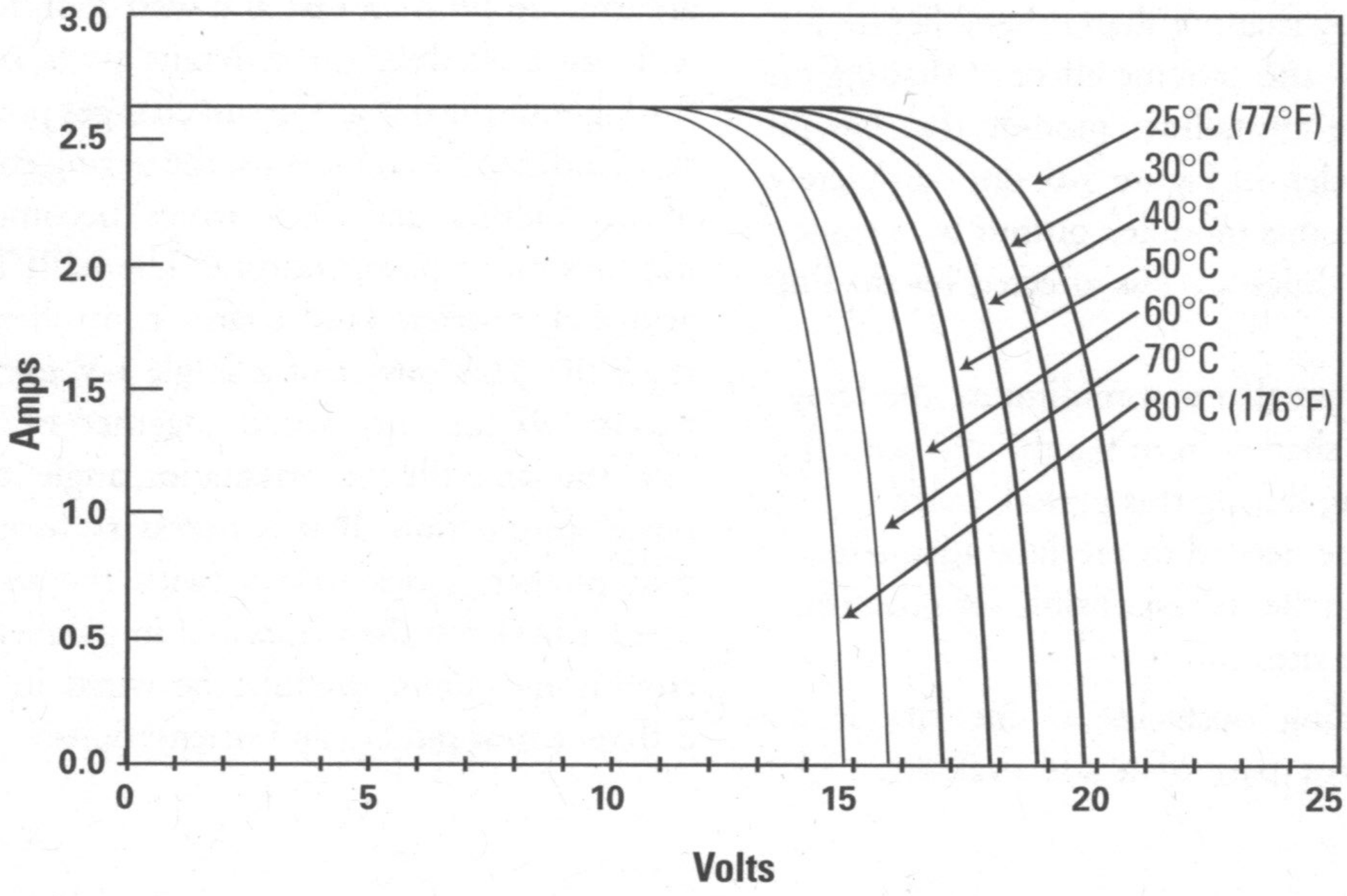
18.00 Volts x 5.56 Amps = 100.08 Watts, sound familiar?

I-V curve irradiance



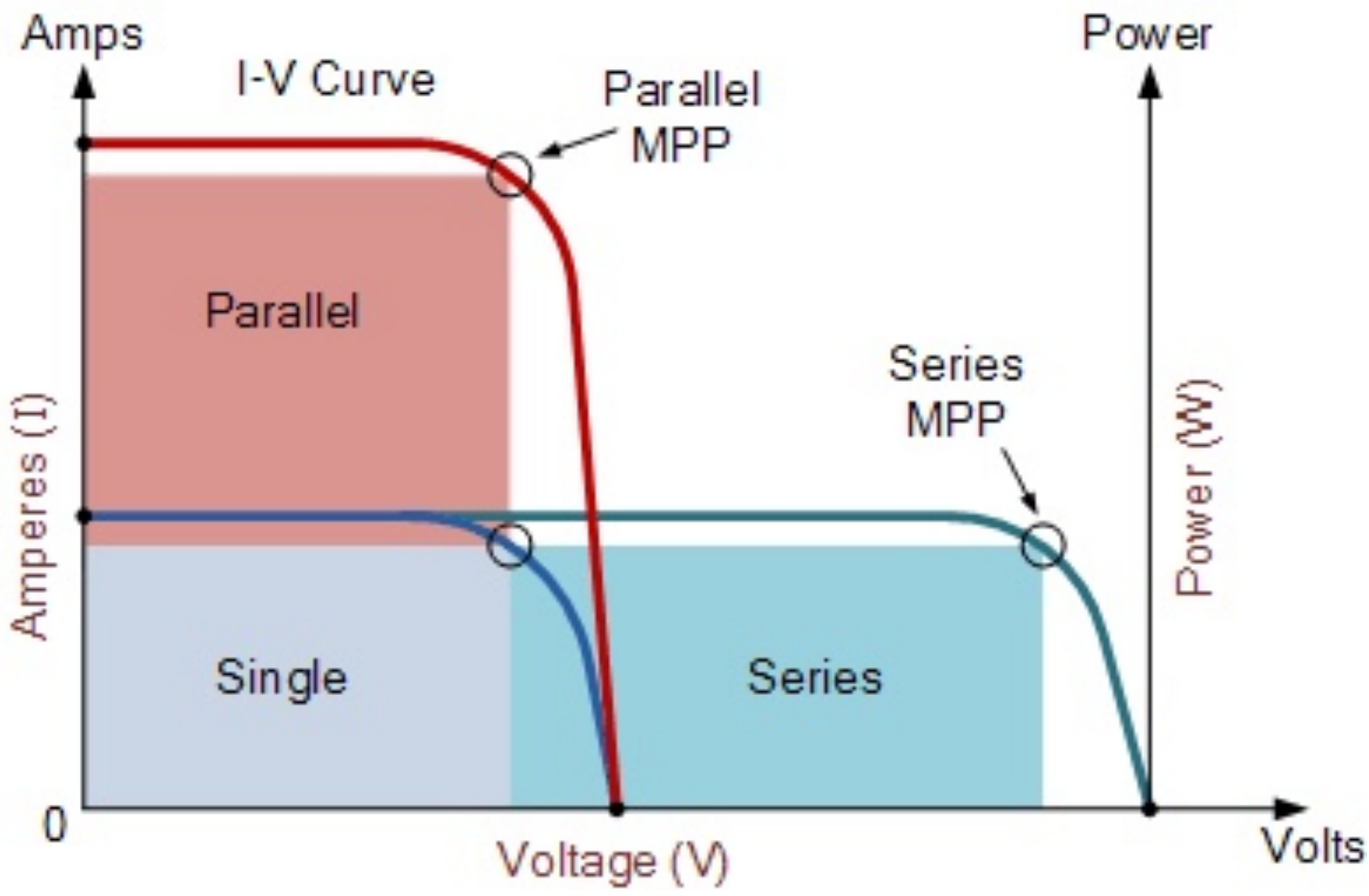
The more sunlight falling on a panel, watts per sq. meter, the more amperage

I-V curve temperature



The colder the more voltage

your solar panels / the I-V curve



You can choose whether
to put your two 100 Watt panels together or single,
in parallel for more amps
or in series for more voltage….

your solar panels

MC4 compatible splitters
make it possible
to easily connect
your panels
in parallel.

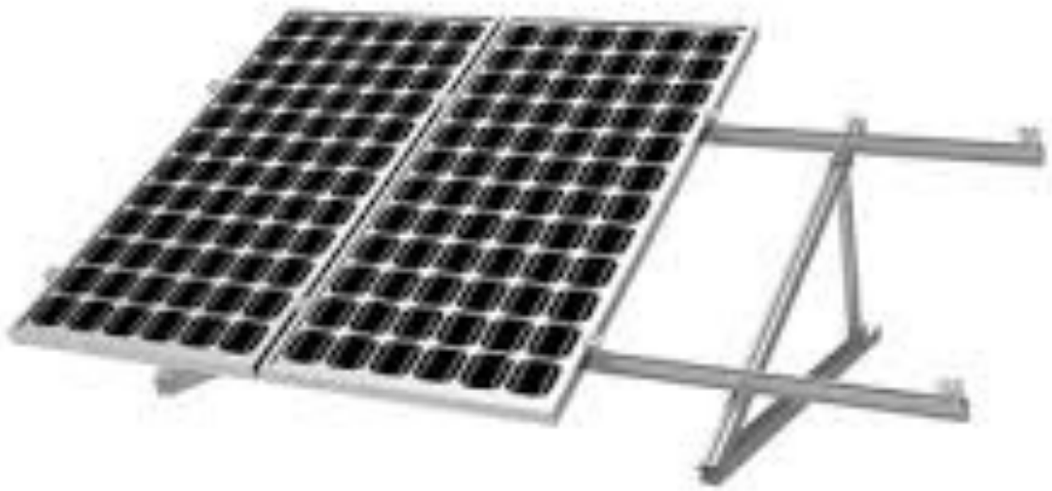
Two negative MC4s
connectors connect to
one splitter and two
positive MC4s connect to
the other.

wiring in parallel

Two positives
going to
one splitter.

Two
negatives
going to
the other.

solar panel mounts (up to you)



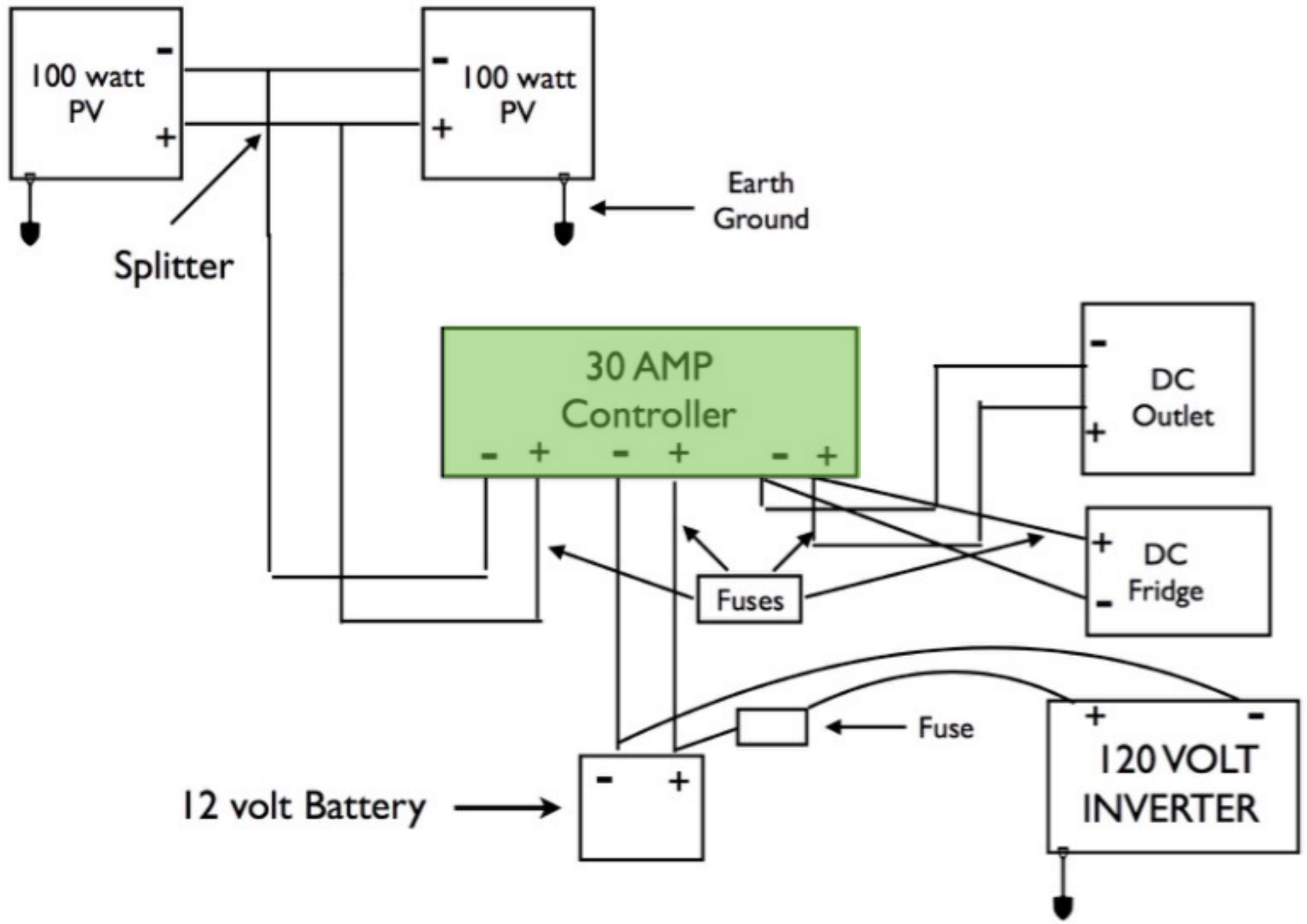
solar panel mounts up to you

But we do give you two 5’ Super Struts and fasteners with which to mount your panels.

This old lady used wheelbarrow parts get the right angle.

Notice drawn arrow needed when tightening upside down.

your solar controller



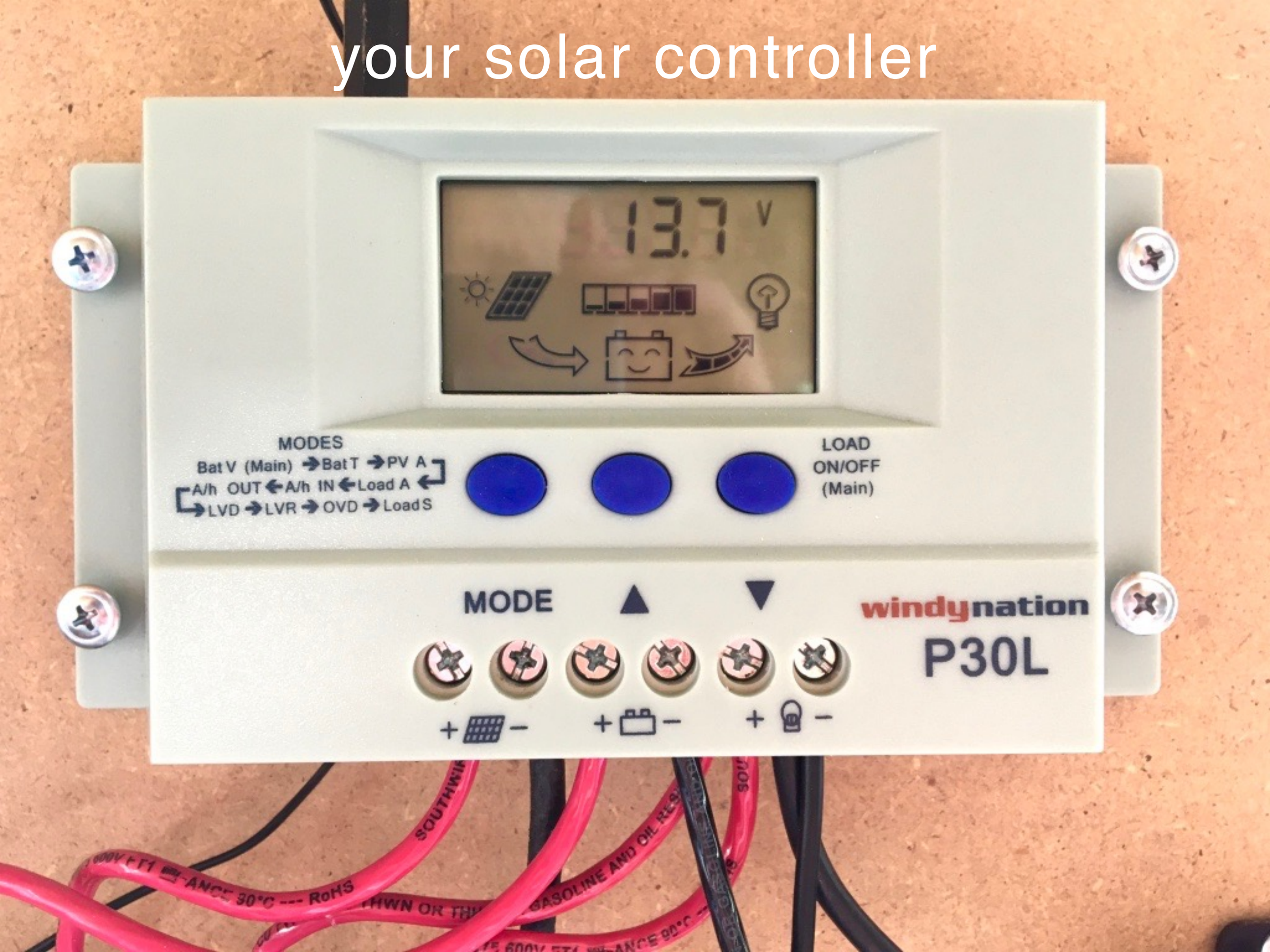
your solar controller

The purpose of a solar charge controller
is to keep your deep cycle batteries
properly fed and safe for the long term.

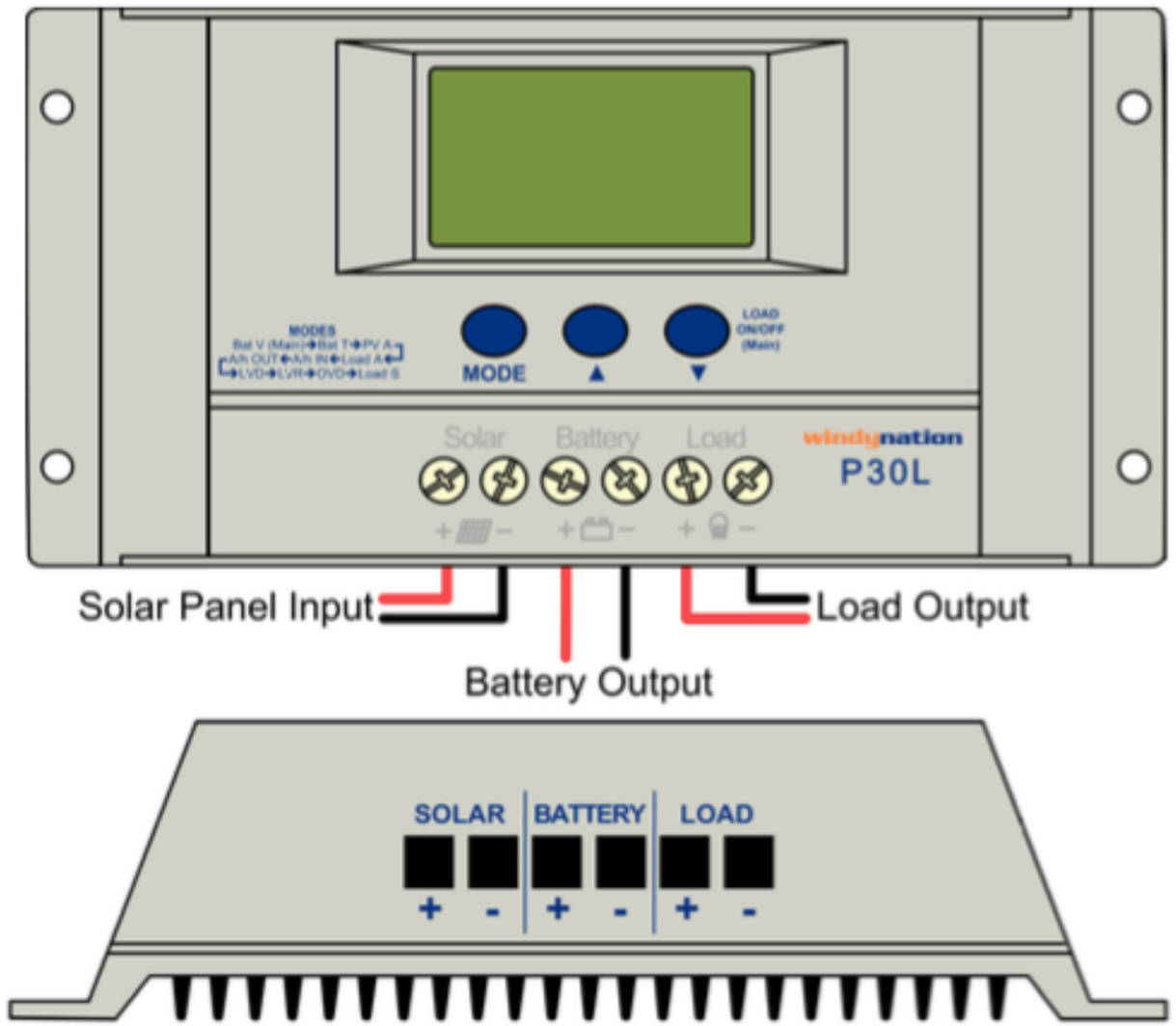
The basic functions of a controller
are quite simple.

Charge controllers block reverse current
and prevent battery overcharge.
Your controller also prevents
battery over discharge,
protects from electrical overload,
and displays battery status
and the flow of power.

your solar controller



wiring up your solar controller



1. Connect the Battery

2. Connect the Solar Panels

3. Connect the DC Load

4. Connect the Battery Temperature Sensor…

an optional feature that will be explained when you wire up your systems

your solar controller

MODES
Bat V (Main) → Bat T → PV A
A/h OUT ← A/h IN ← Load A
LVD → LVR → OVD → Load S

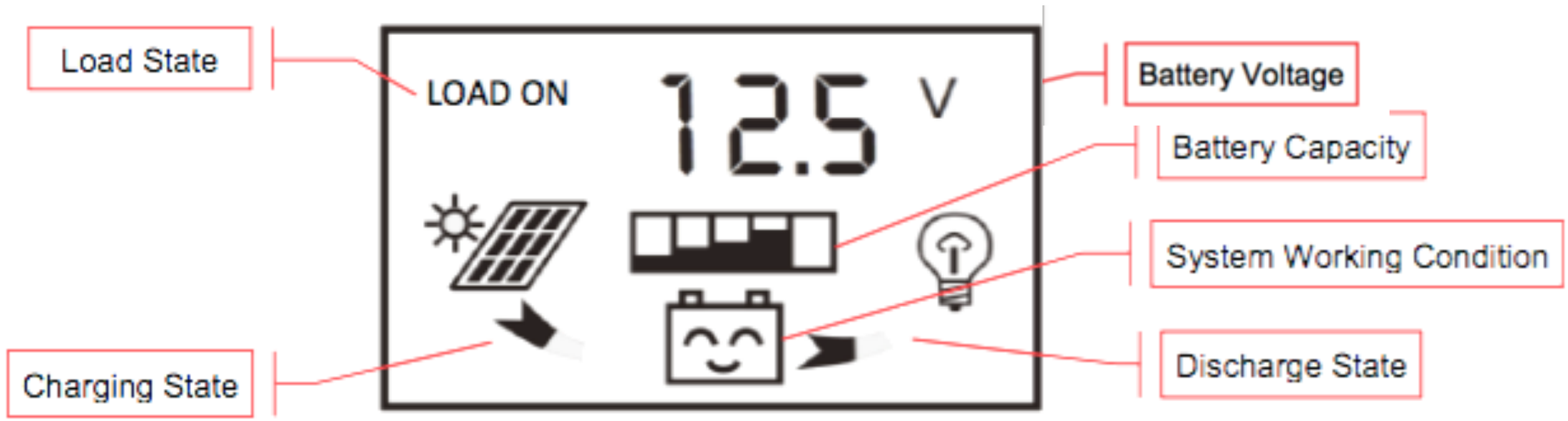
LOAD
ON/OFF
(Main)

MODE

windynation
P30L

SOLAR
BATTERY
LOAD

your solar controller's liquid crystal display (LCD)

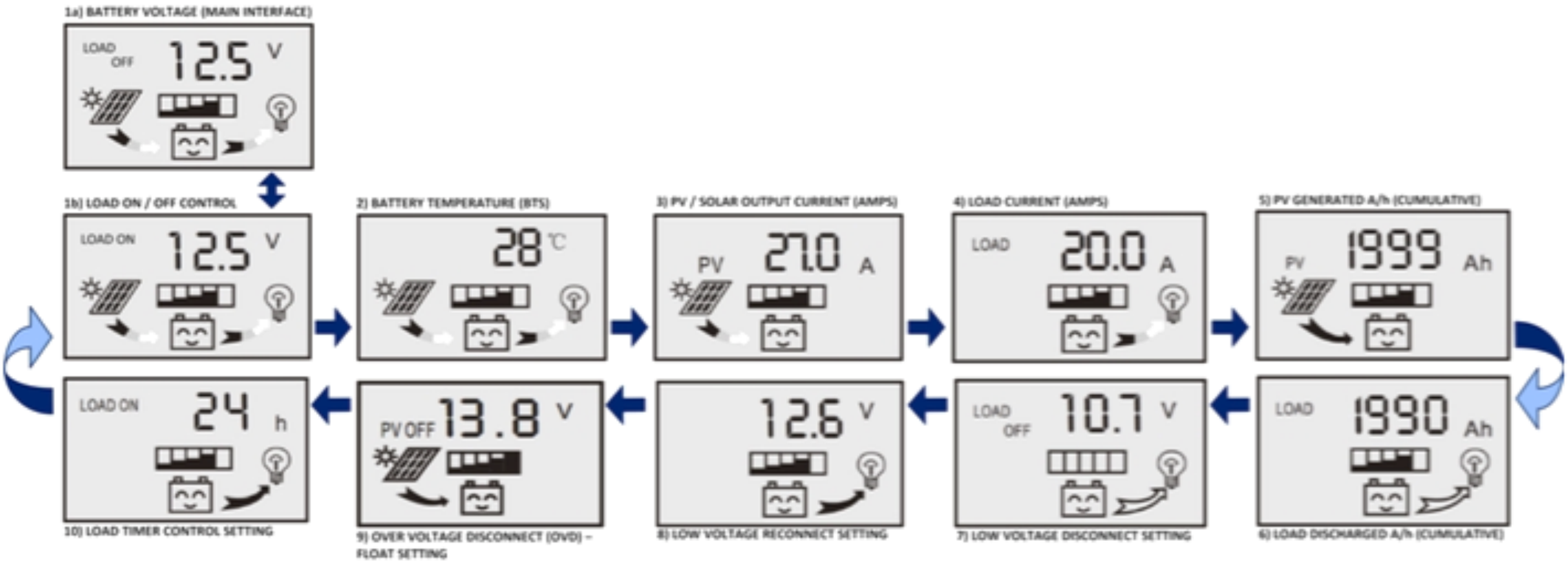


The Main Interface displays
the current state of the Load,
PV charging, Load discharging, battery capacity,
and overall system working condition.

LCD symbols

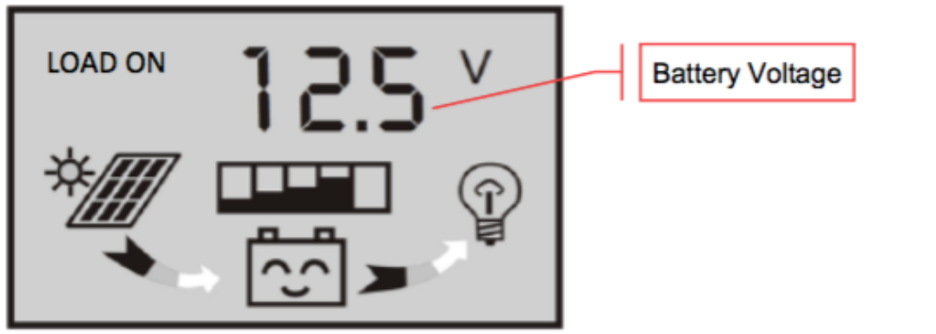
LCD Symbol	Description
	Stop power supply to LOADs
	Supply power to LOADs, No current drawn from Load
	Supply power to LOADs, Load is drawing current
	Load Icon
	Solar Panel Icon
	Battery Icon
	Load Light Control Icon
	Load Timing Control Icon
	Stop Charge to Battery
	Full Charging to Battery
	Float Charging to Battery
	Normal Working Condition
	Error/Abnormal Working Condition
	Battery Capacity

your solar controller's liquid crystal display (LCD)

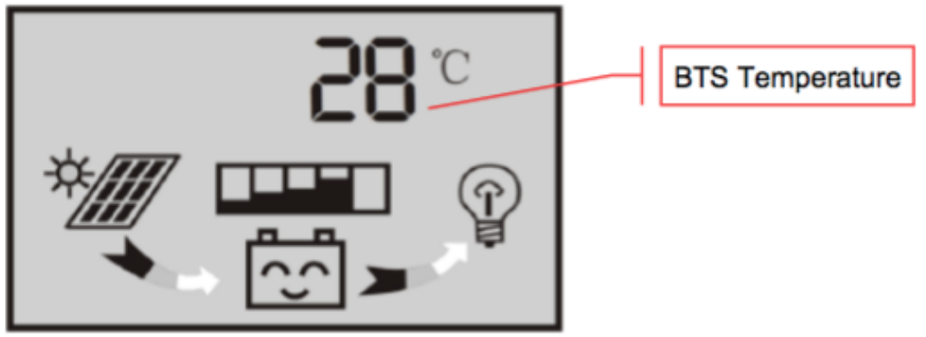


And there are 9 more
different graphical interfaces.
Each interface contains different information.

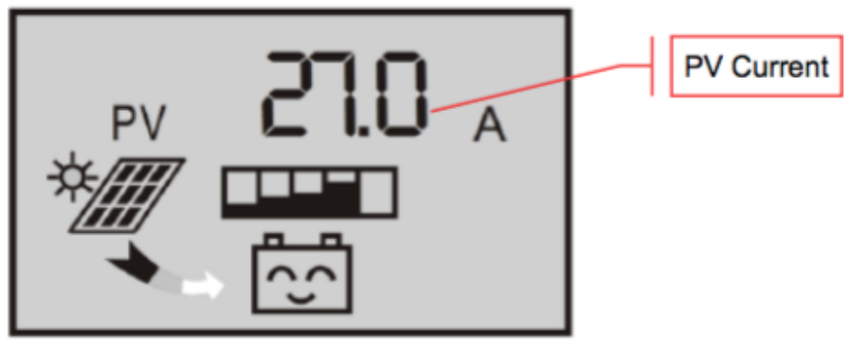
Main screen



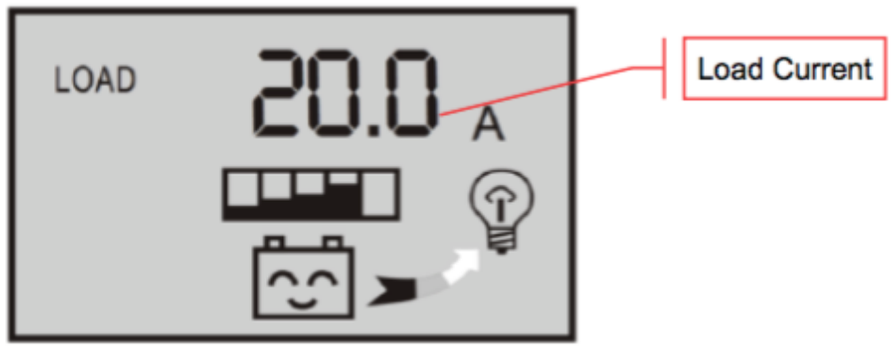
Battery temperature



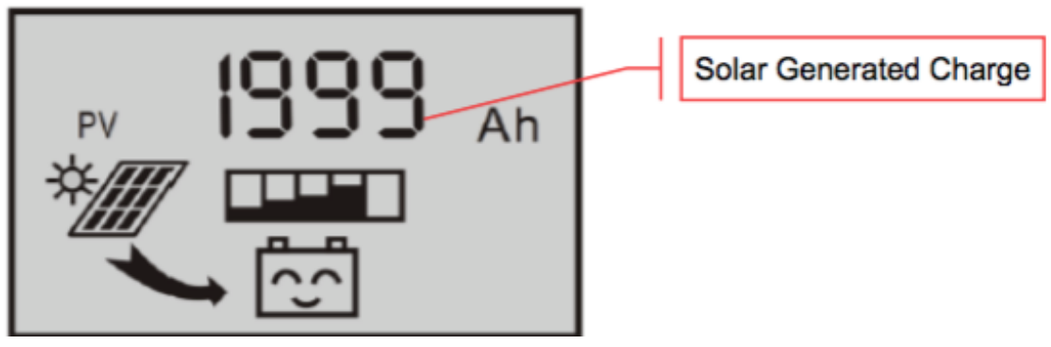
PV Amps



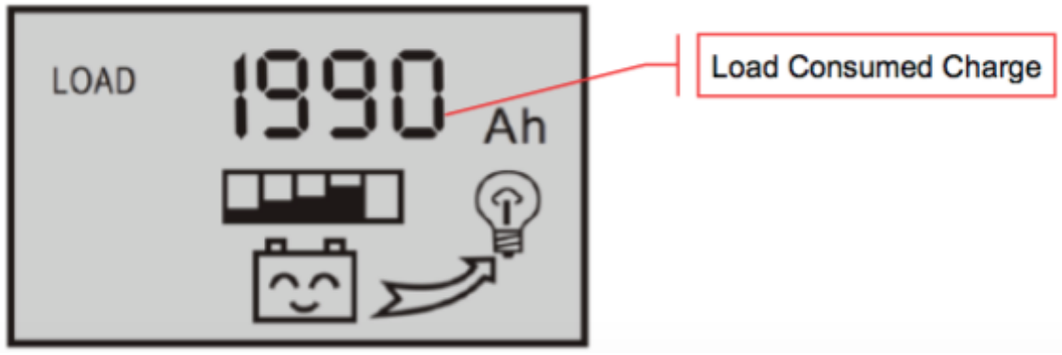
Load Amps



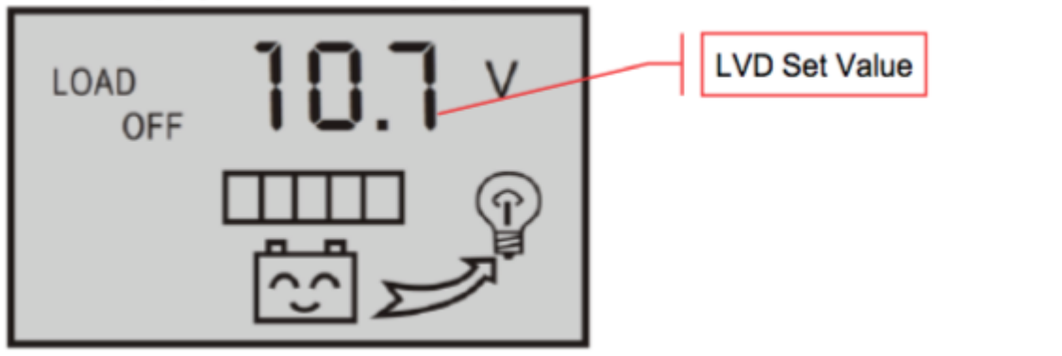
Total Amp/Hours produced can be reset



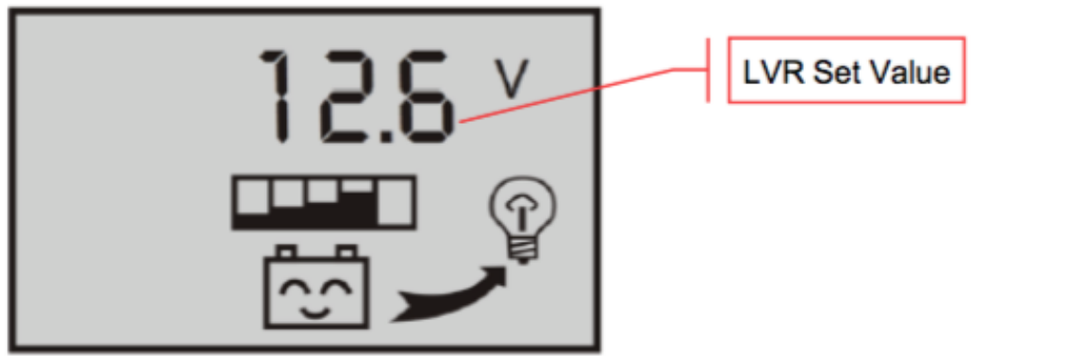
Total Amp/Hours used can be reset



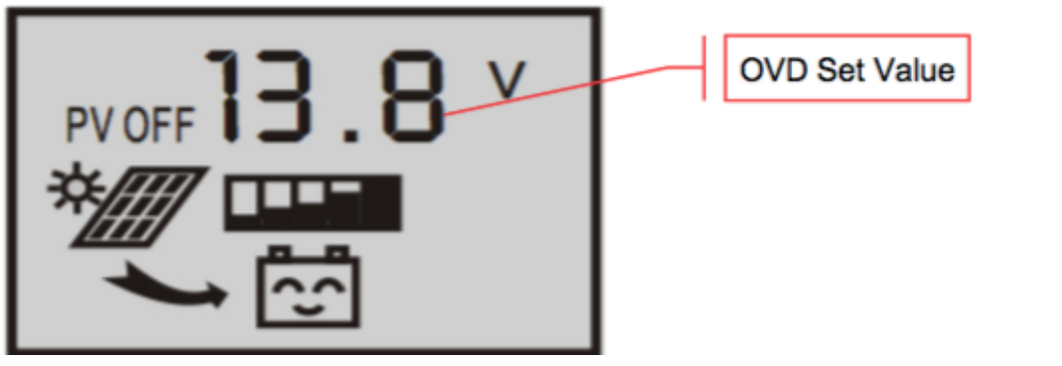
Low Voltage disconnect setting



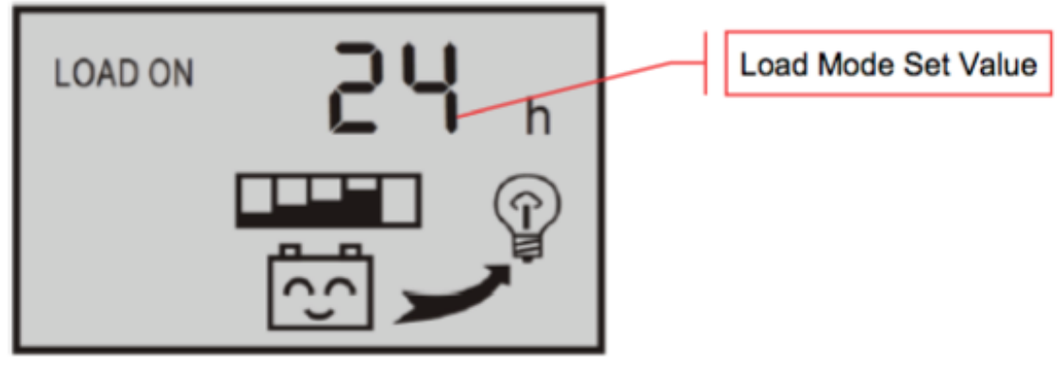
Reconnect when Voltage gets back up



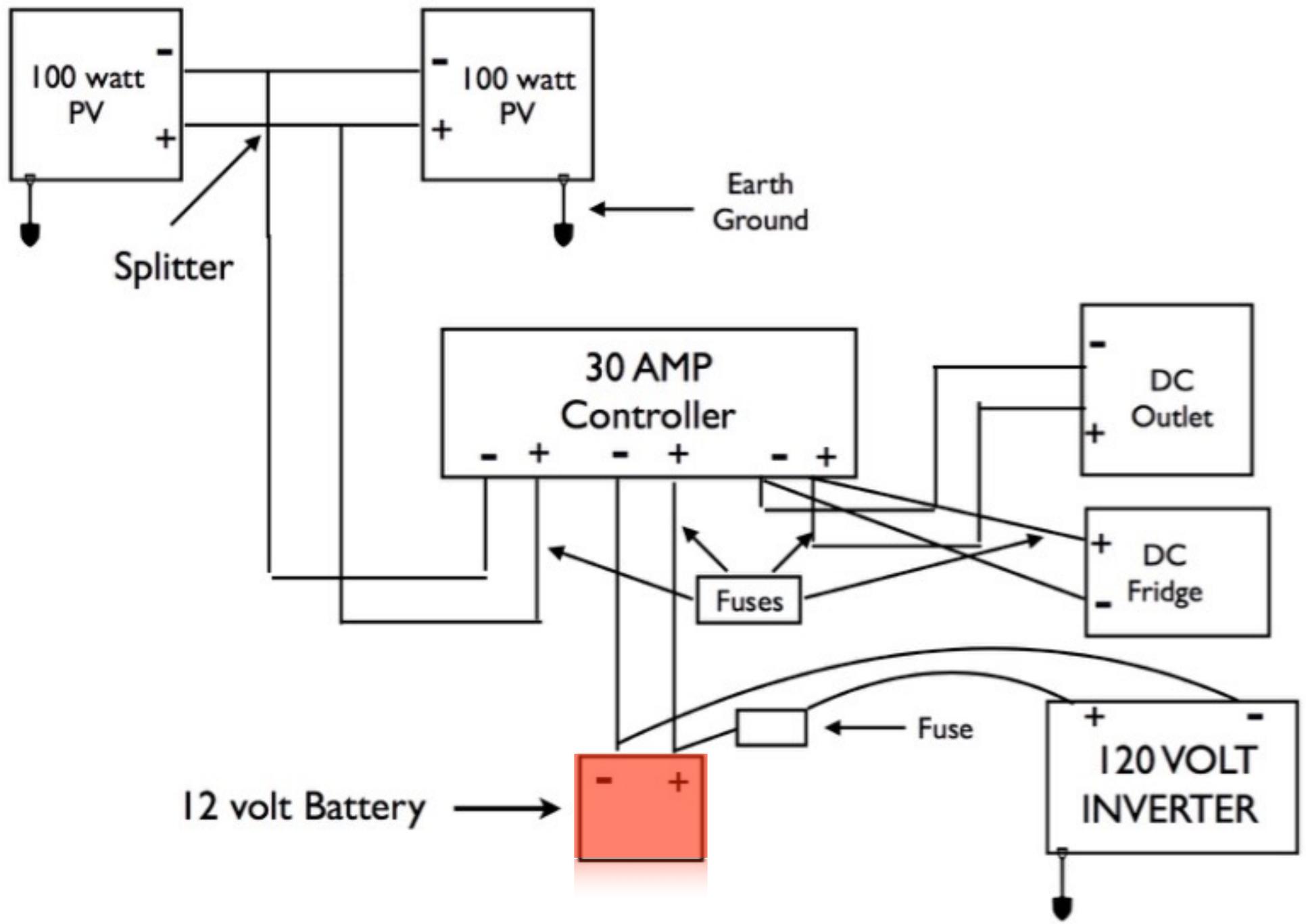
Over Voltage disconnect



Load timing setting



your battery



your battery

12 Volt Battery
110 Amp/ Hour
Absorbent Glass Mat (AGM)*

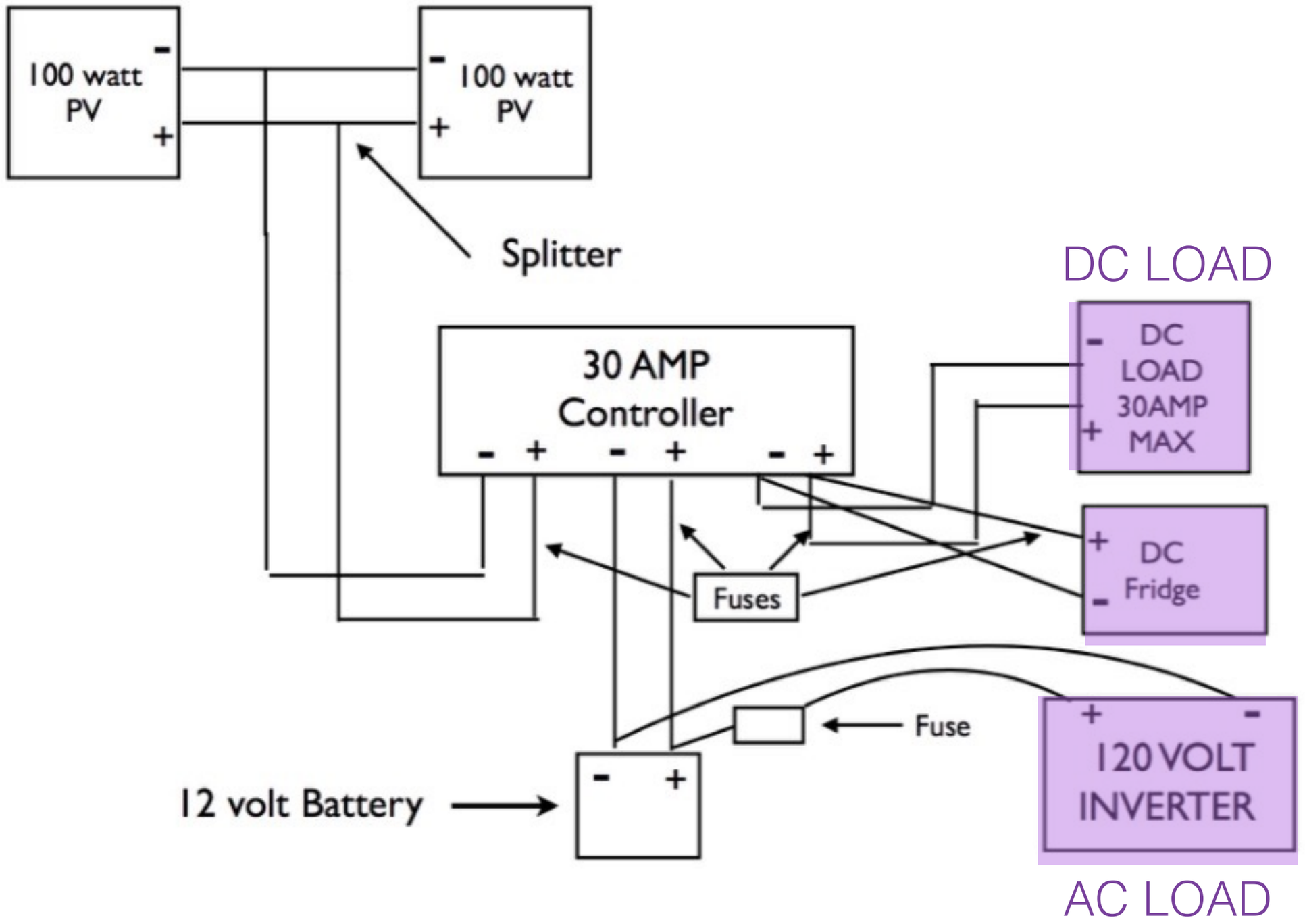
*AGM has very low internal resistance,
is capable to deliver high currents on demand
and offers a relatively long service life,
even when deep cycled.
The sulfuric acid is absorbed by a very fine fiberglass mat,
making the battery spill-proof.
AGM is maintenance free, provides good electrical reliability
and is lighter than the flooded lead acid (FLA) type.

AGM BATTERY STATE OF CHARGE	
Level	Voltage
100%	13.00V
90%	12.75V
80%	12.50V
70%	12.30V
60%	12.15V
50%	12.05V
40%	11.95V
30%	11.81V
20%	11.66V
10%	11.51V
0%	10.50V

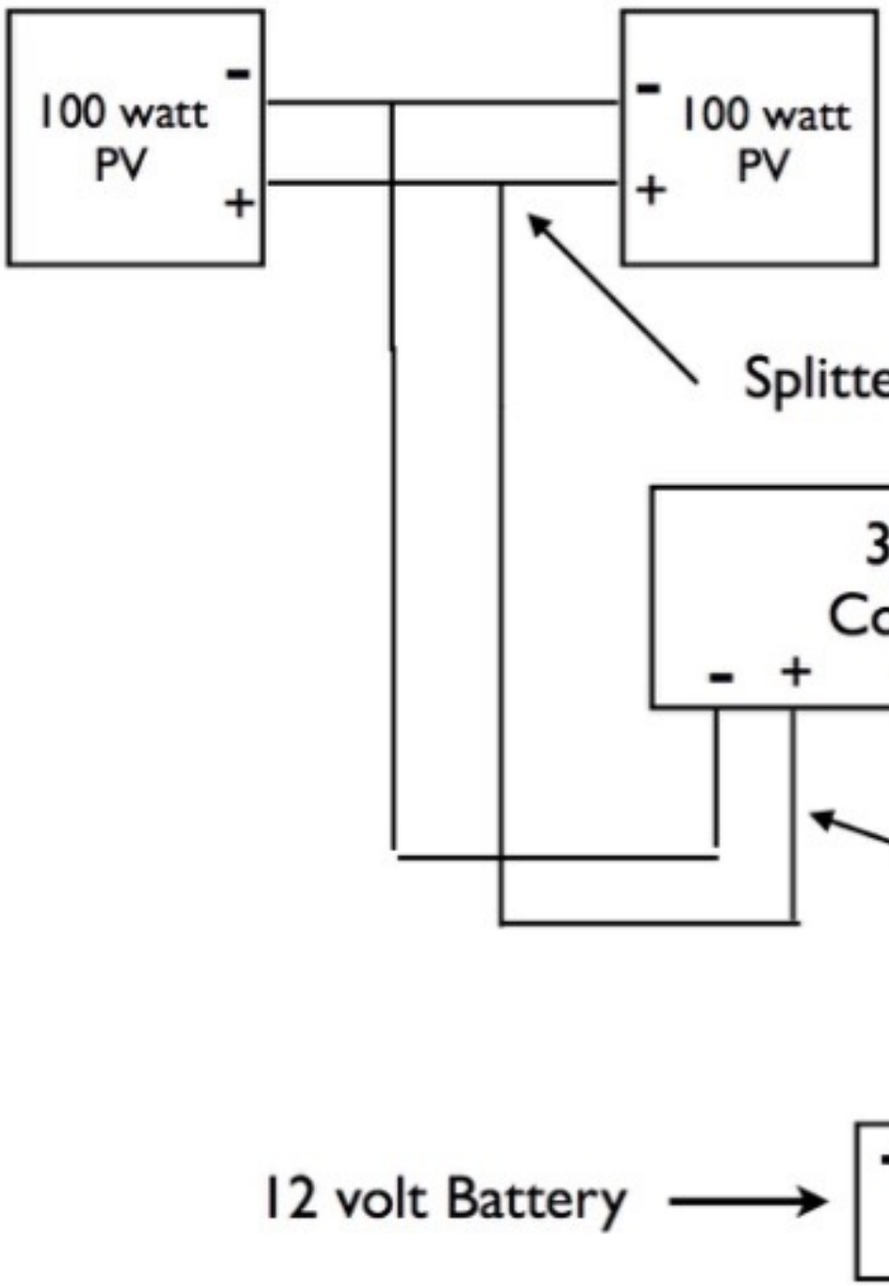
your battery

Voltage reading on your controller indicates how much charge your battery has.

Your solar system has DC and AC



Direct Current DC circuits



DC LOAD

your solar inverter

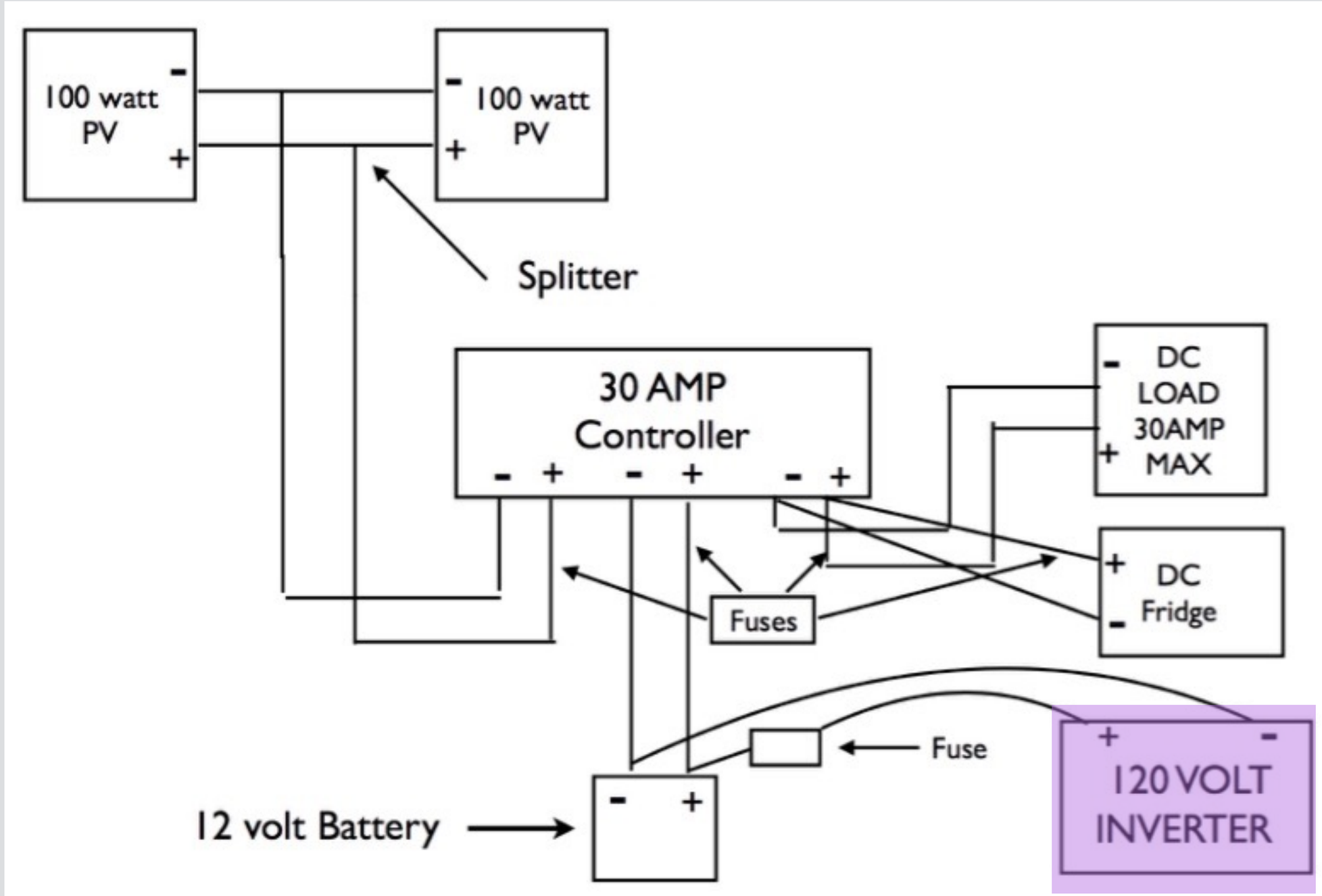
Your solar panels produce DC.

You need an inverter to make DC into AC.

An Inverter
converts DC power
from your12V DC battery
into 120V AC power
that is commonly used
in a wide variety of
household AC items
such as computers
mobile phone chargers
radio, TV, etc

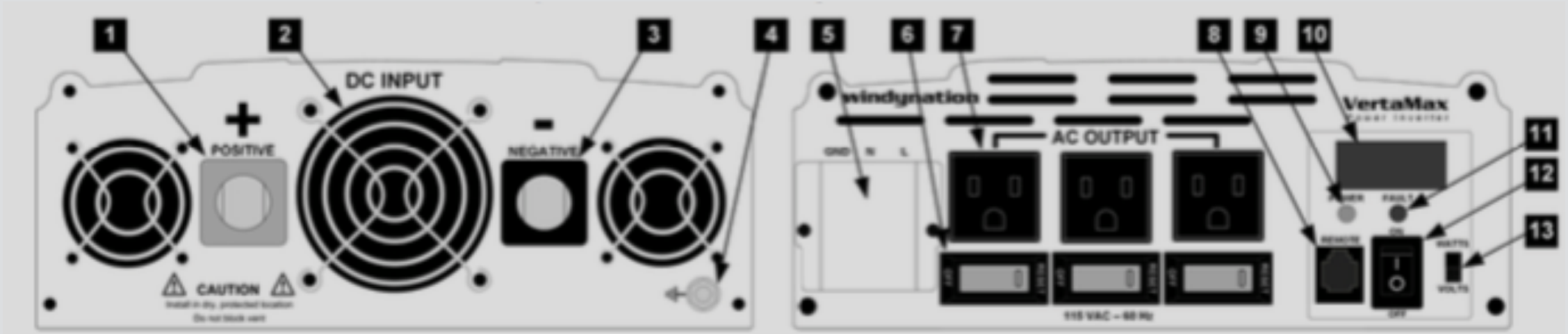
Direct Current
to
Alternating Current

Alternating Current AC



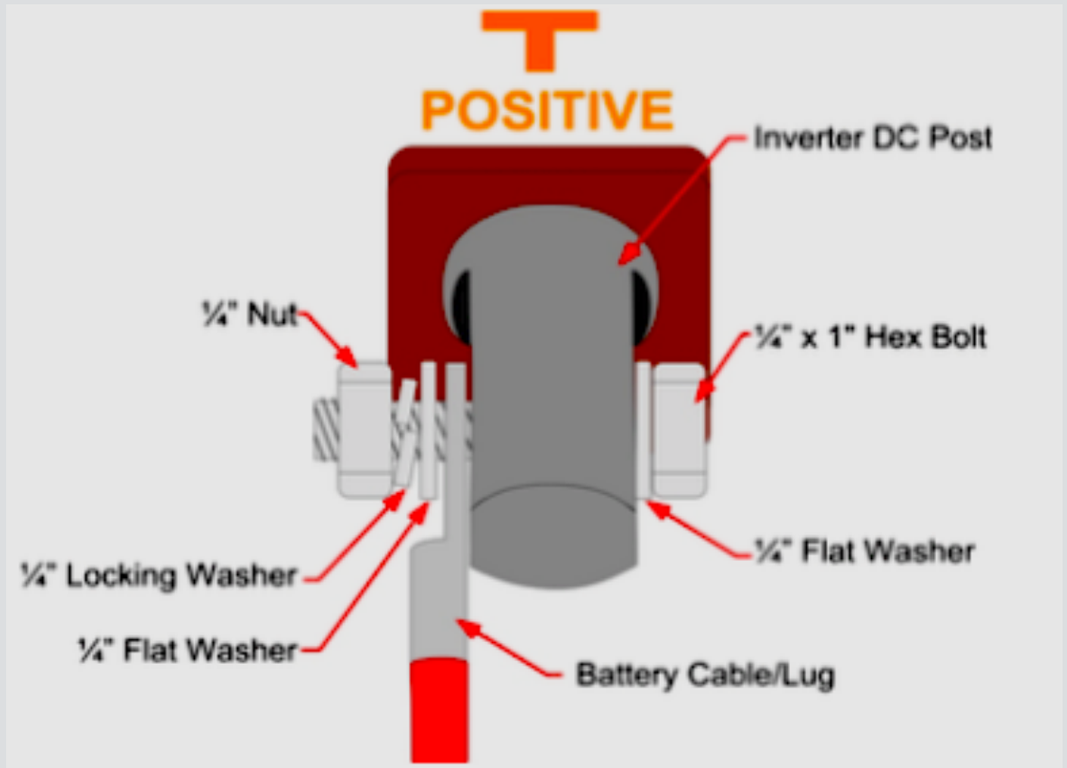
AC LOAD

your solar inverter



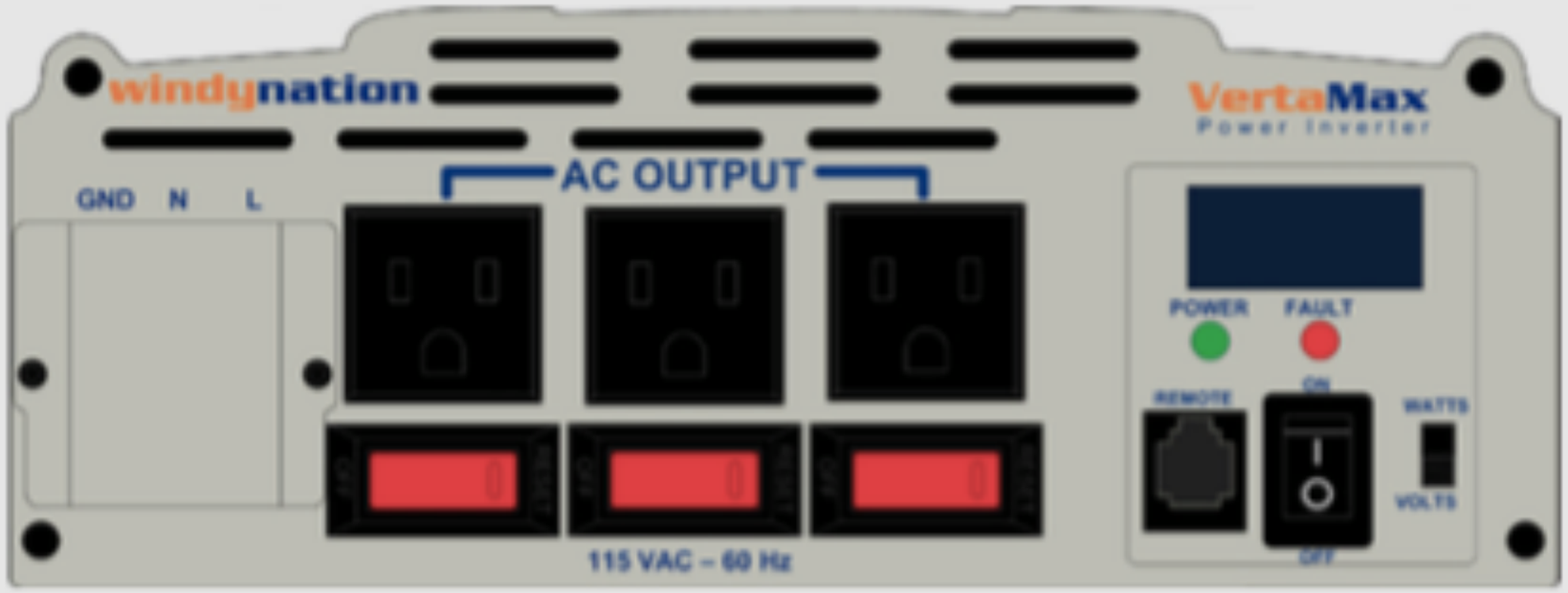
1. DC Positive (+) Input
2. Cooling Fan[1]
3. DC Negative (-) Input
4. Grounding Terminal
5. Permanent AC Connection[2]
6. Circuit Breaker Protector [x3]
7. AC Outlets [x3]
8. Remote Switch Port[3]
9. Power LED
10. Digital Display Meter
11. Fault LED
12. ON/OFF Switch
13. Digital Display Select Switch

your inverter input



The VertaMax has two DC terminals, one positive and one negative.Red is Positive [+] and black is Negative [-] and has the same polarity as the battery. When connected, positive must connect to positive (red to red), negative connect to negative (black to black)

your solar inverter output

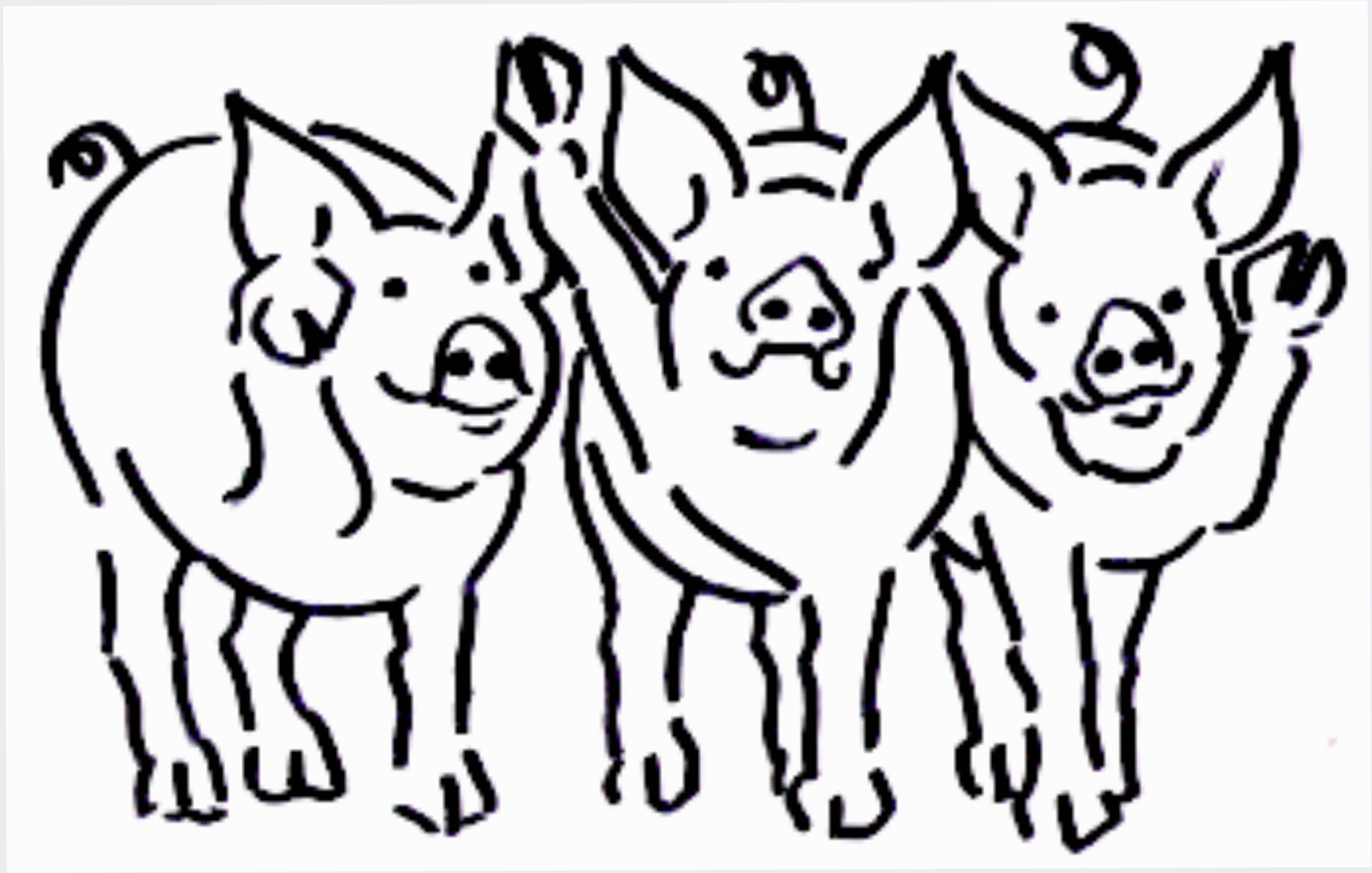


Ensure the VertaMax is properly installed and connected
and ensure the DC Power Source is ON (if switched).

From the AC Output end of the inverter,
switch the rocker power switch to the ON position.
The green power indicator will light and the VertaMax will now deliver
AC power to the outlet(s) on the AC Output end of the inverter.

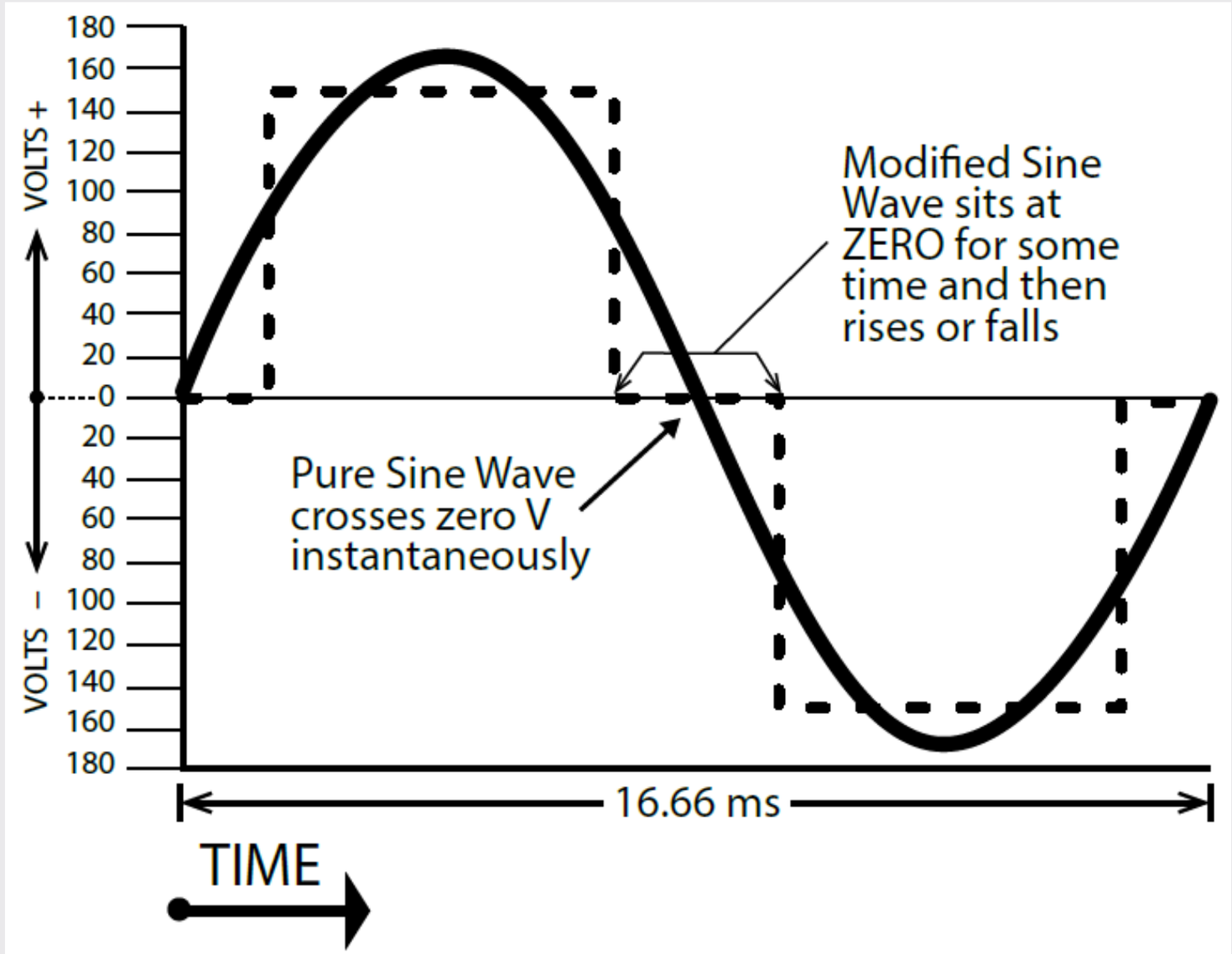
Plug the AC product(s) you wish to operate into the AC outlet(s)
and switch them on, one at a time.

your solar inverter is a
pure swine wave inverter



Sorry, I meant a pure sine wave inverter

Pure sine wave inverters use sophisticated technology to protect sensitive electronics such as televisions, laptops, digital microwaves, refrigerators, and inductive type loads.



there is lots more about your solar inverter in your manual

SAFETY WARNINGS

The VertaMax produces the same potentially lethal AC power as normal household outlets.
Treat it with the same precautions as a normal 115 VAC outlet.

Do not operate the VertaMax near flammable fumes or gases, such as in the cabin of a gasoline powerboat, or near propane tanks.

Never work or service the AC wiring without disconnecting the DC Input connections.

Do not connect or disconnect batteries while the Inverter is operating from the battery supply. Dangerous arcing may result.

Although the inverter has over-voltage protection, the input voltage should never exceed 15V.
Input voltages of 16VDC or more will permanently damage the inverter.

Due to high voltages inside the inverter, the inverter should never be opened when in use.

Fuses protect your solar system

A fuse is an electrical safety device that operates to provide over-current protection of an electrical circuit.
Its essential component is a metal wire or strip that melts when too much current flows through it, thereby stopping or interrupting the current.

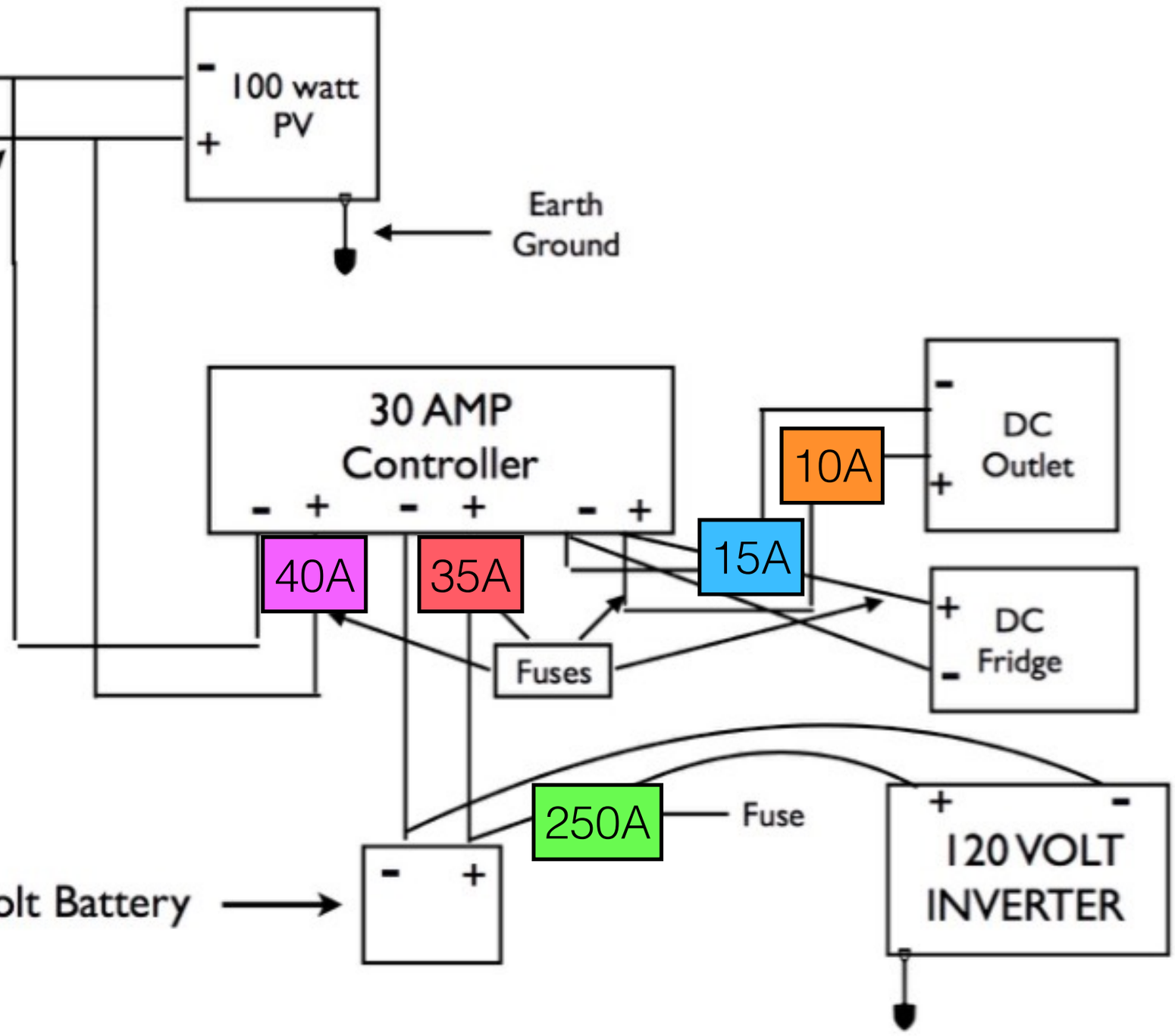
Fused Circuits

Circuits

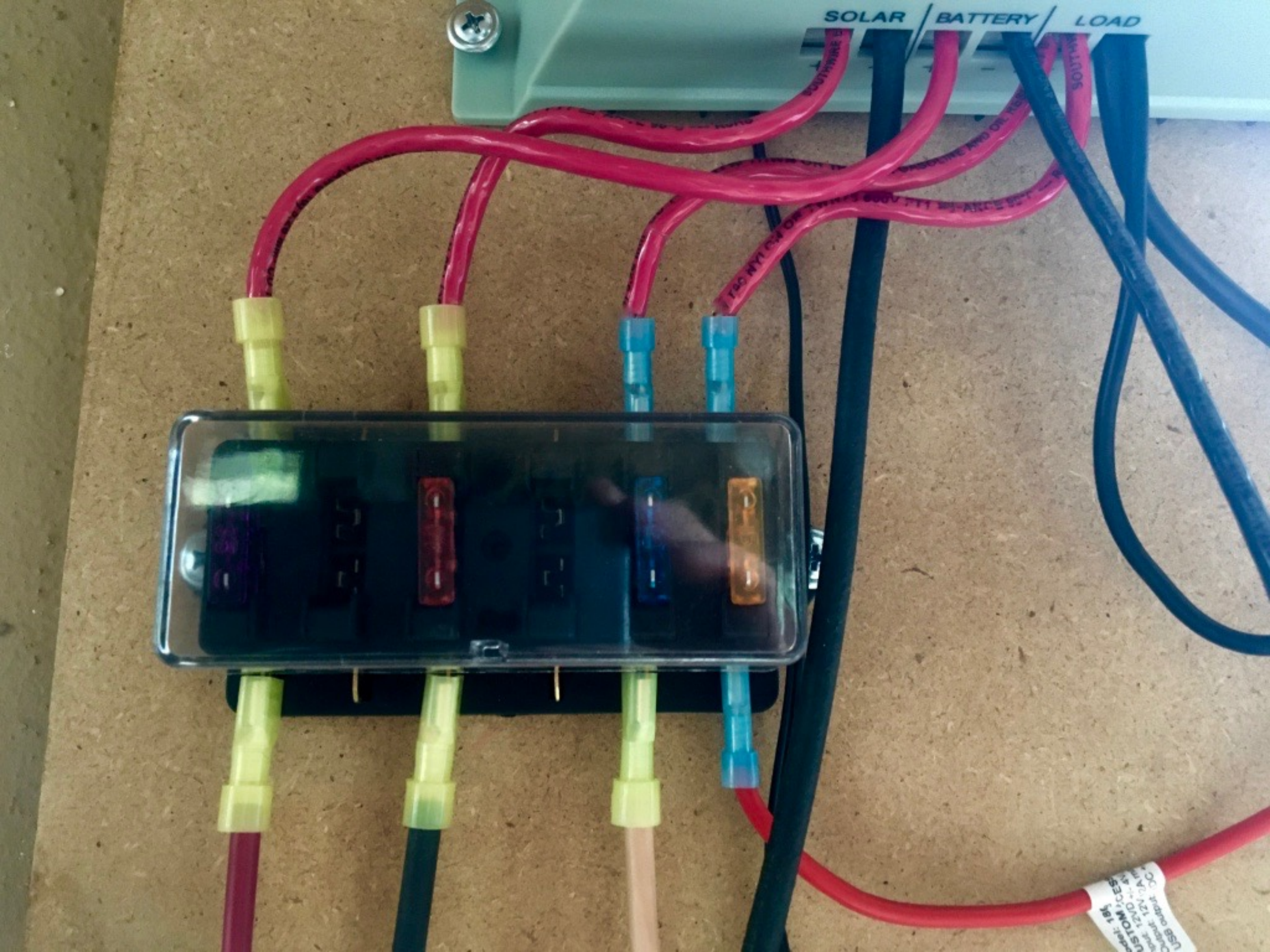
that are fused

1. Solar Panels 40 amp
2. Battery 35 amp
3. DC circuit 15 amp
4. 2nd DC circuit 5 amp

Inverter 150 amp



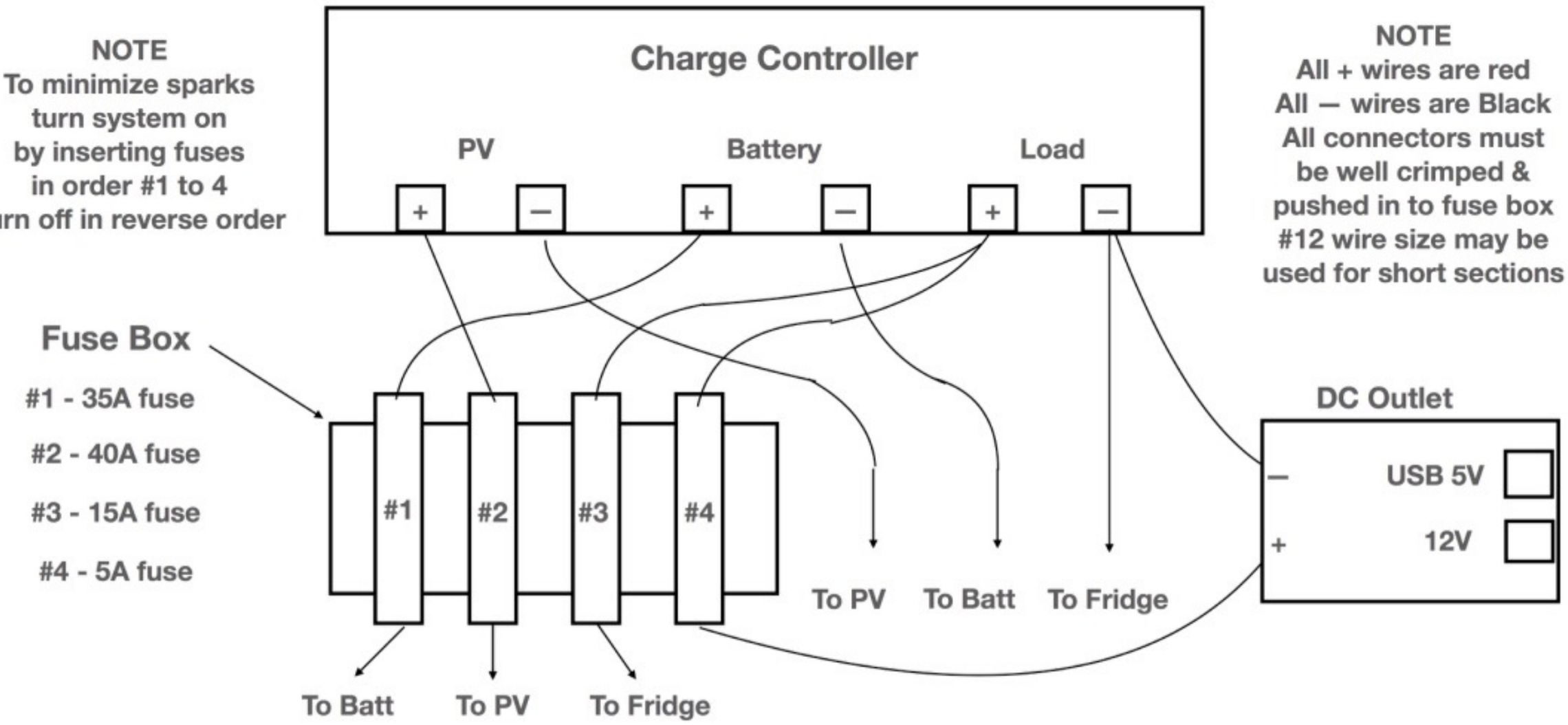
Order using fuses to turn on: 1, 2, 3, 4 To turn off: 4,3, 2, 1


SOLAR
BATTERY
LOAD


40
35

Gallup Solar 12 Volt Hogan
Fuse Wiring Detail

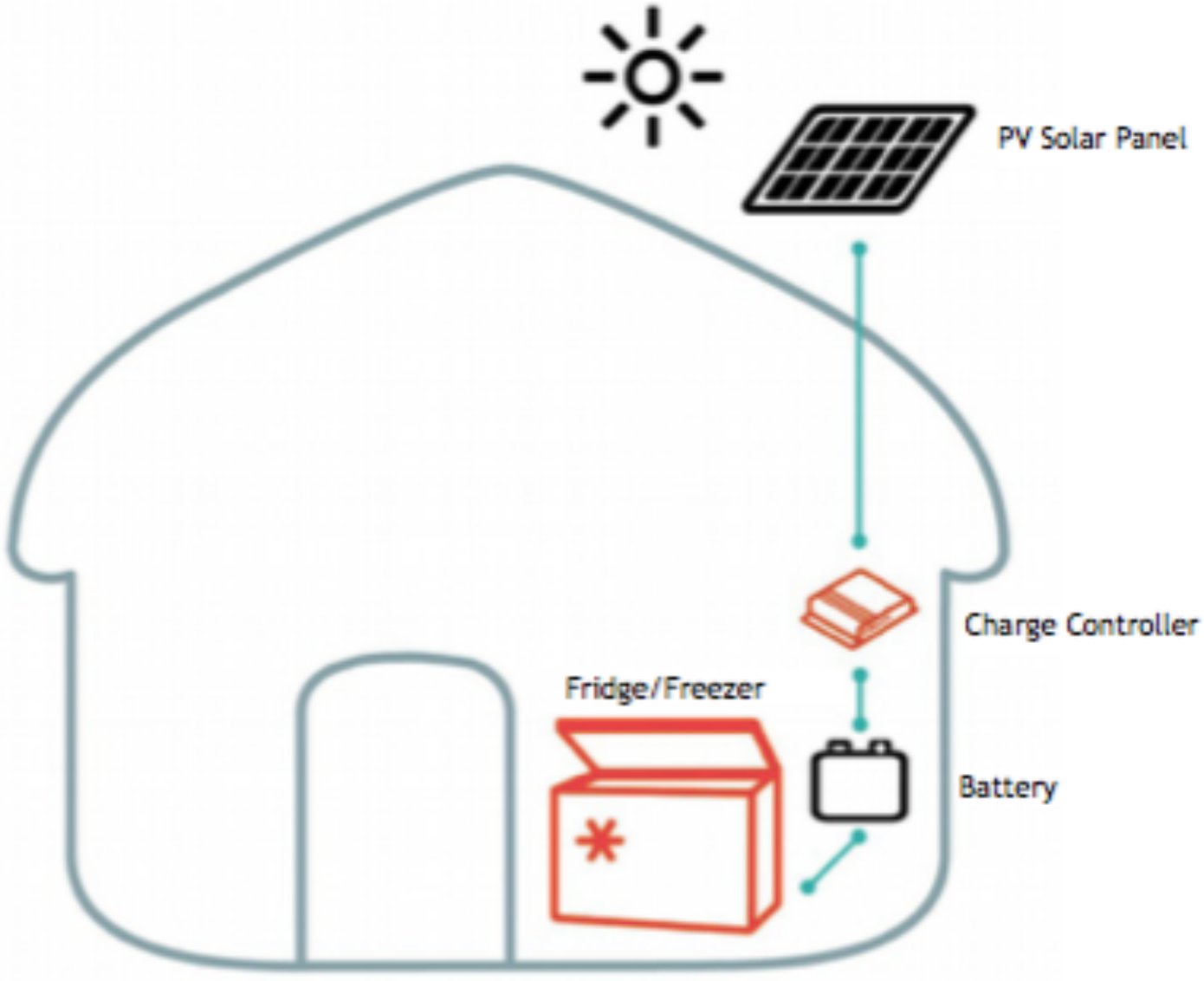
NOTE
To minimize sparks
turn system on
by inserting fuses
in order #1 to 4
Turn off in reverse order



NOTE
All + wires are red
All — wires are Black
All connectors must
be well crimped &
pushed in to fuse box
#12 wire size may be
used for short sections

your solar refrigerator

your refrigerator

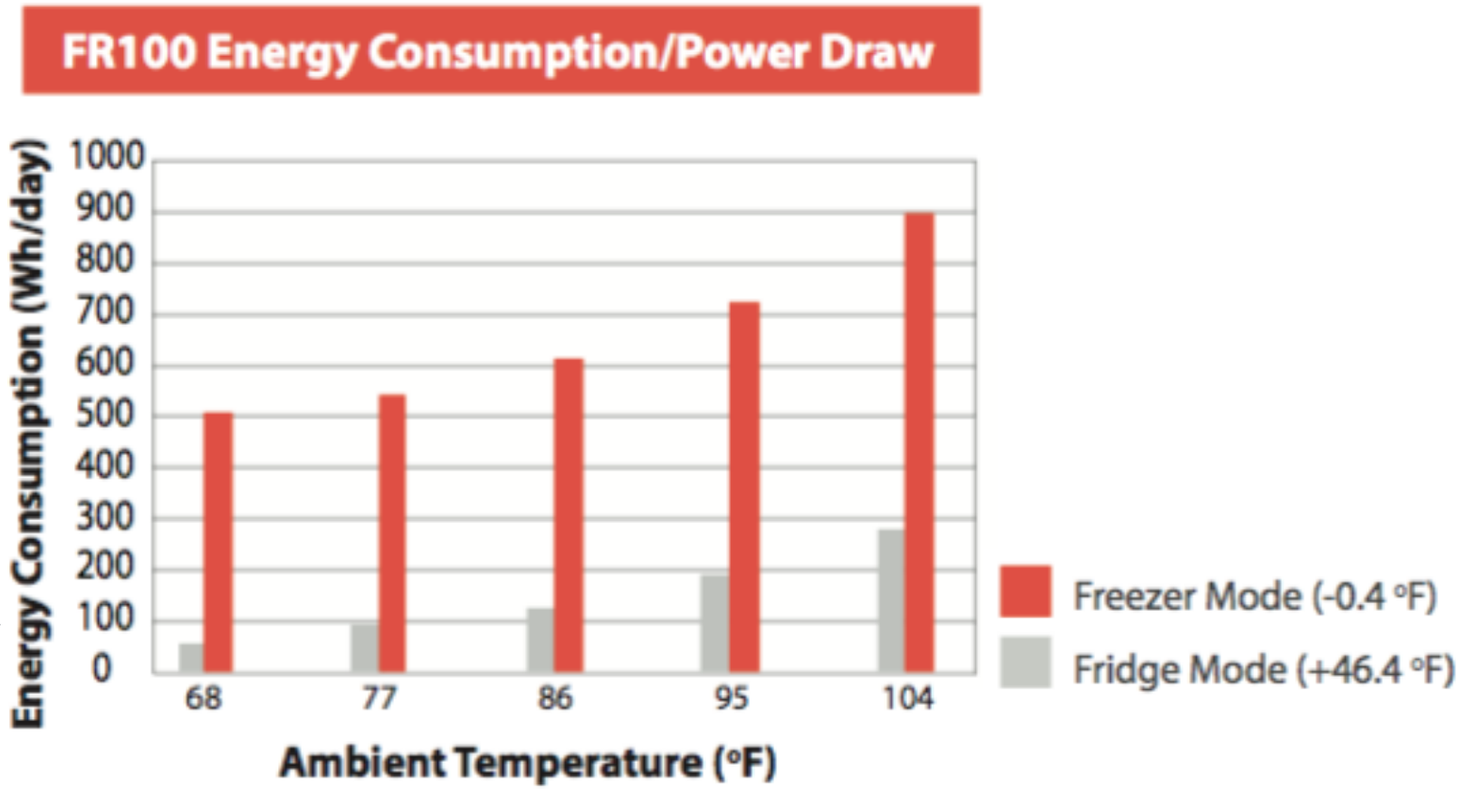


Technical Data

Type		FR100
System Voltage		12 / 24 V auto recognition
Temperature Range		-18* to +8 °C / -0.4* to +46.4 °F
PV Panel Size		70 W
Energy Consumption at +21 °C / +70 °F	in our area	108 Wh / day (fridge**), 553 Wh / day (deep-freezer**)
Energy Consumption at +32 °C / +90 °F	in hotter places	181 Wh / day (fridge**), 659 Wh / day (deep-freezer**)
Content (Net Capacity)		104 L
Refrigerant		R600a
Ambient Temperature		+10 to +43 °C / +50 to +104 °F
Door Type		Top opening
Cabinet Dimensions (WxHxD)		685 x 850 x 590 mm / 27 x 33.5 x 23.2 in
Inner Dimensions (WxHxD)		505 x 640 x 375 mm / 19.9 x 25.2 x 14.8 in
Battery Compartment Dimensions (WxHxD)		n/a
Weight		29 kg / 64 lbs
Warranty		2 years

* Up to +38 °C / +100 °F ambient temperature.
** Measured at +8 °C / +46.4 °F (fridge) and -18 °C / -0.4 °F (deep-freezer) temperatures.

in our area
the *phocos*
refrigerator uses
about 108wh
per day
in fridge mode



❷ Using your estimated power draw value, find the recommended solar array from the chart below (assuming a solar irradiation of >3 kWh/m²/day)*

Power Draw (Wh/Day)	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900
Recommended Solar Array (Wp)	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450

❸ Determine the recommended battery capacity for your system using the solar array value suggested above*

Solar Array (Wp)	50	75	100	125	150	175	200	225	250	275	300	325
Battery Capacity (Ah)	50	100	150	150	200	250	300	350	400	450	550	600

your refrigerator

Maximum Efficiency

- Direct DC operation eliminates wasted inverter energy
- Chest-style design and extra-thick insulation keeps the cold in and reduces compressor run time

Flexible

- Can be powered with a 12 or 24 V battery (auto detection)
- Wide temperature thermostat allows every unit to run as a refrigerator or freezer (temperature setting is defined by user)

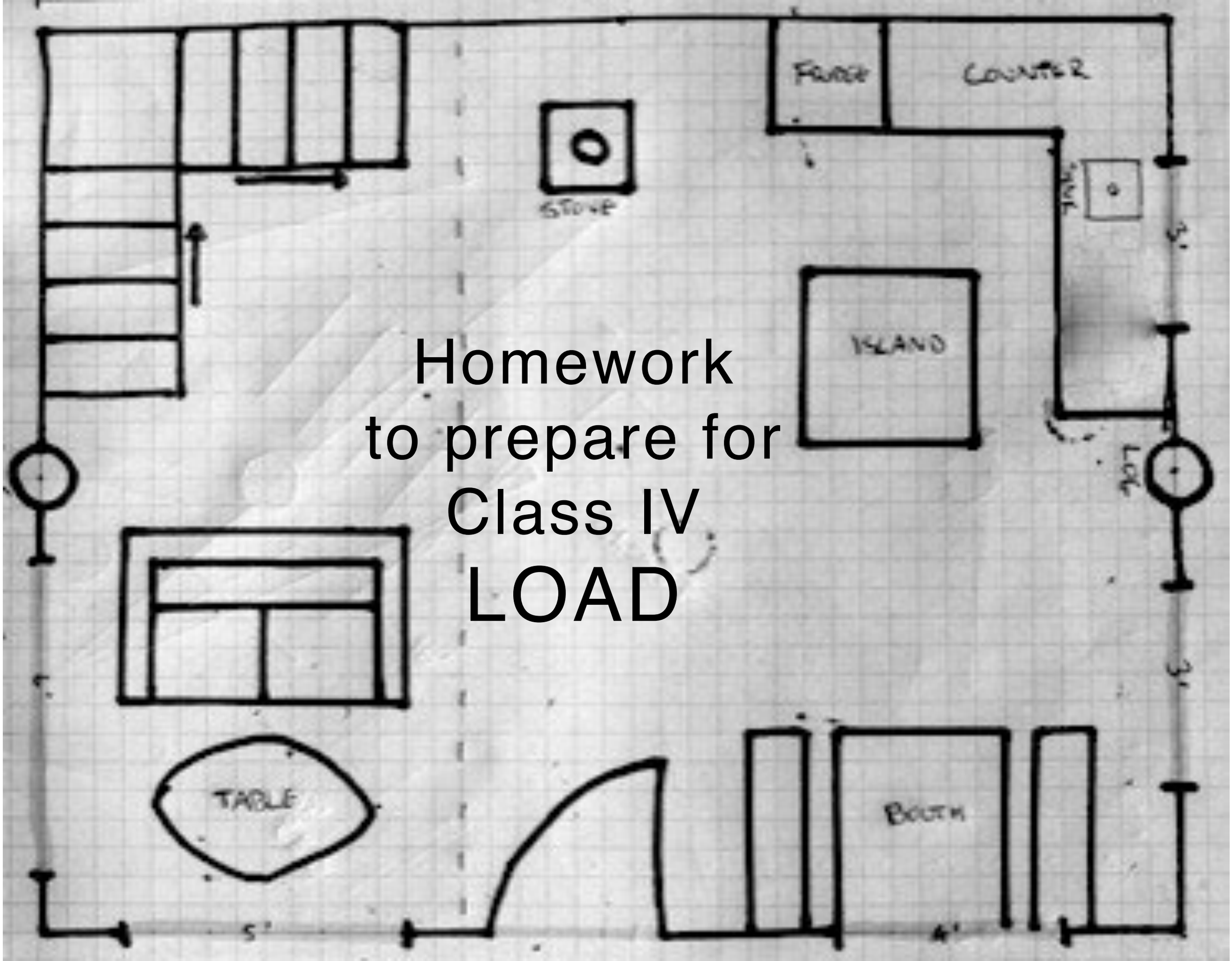
Low-Maintenance

- Maintenance free, brushless DC compressor
- Low-frost system reduces formation of condensation and ice
- Sturdy integrated handle

Simple Design

- Direct DC operation from battery, no costly inverter required
- Lock on lid standard
- Environmentally-friendly refrigerant

Homework to prepare for Class IV LOAD



1. DECIDE WHICH ESSENTIAL APPLIANCES AND LIGHTS YOU WOULD LIKE TO RUN WITH YOUR SOLAR SYSTEM.

2. WRITE DOWN ALL SPECIFICATIONS, WATTS OR AMPS NEEDED AND NUMBER OF HOURS OF OPERATION DAILY, WEEKLY.

WE WILL PROVIDE A PRINTOUT OF THE NEXT SLIDE FOR YOU TO FILL IN.

3. IF APPLIANCES ARE NOT AT HAND, FIND THE INFORMATION ON THOSE THAT WILL BE ACQUIRED

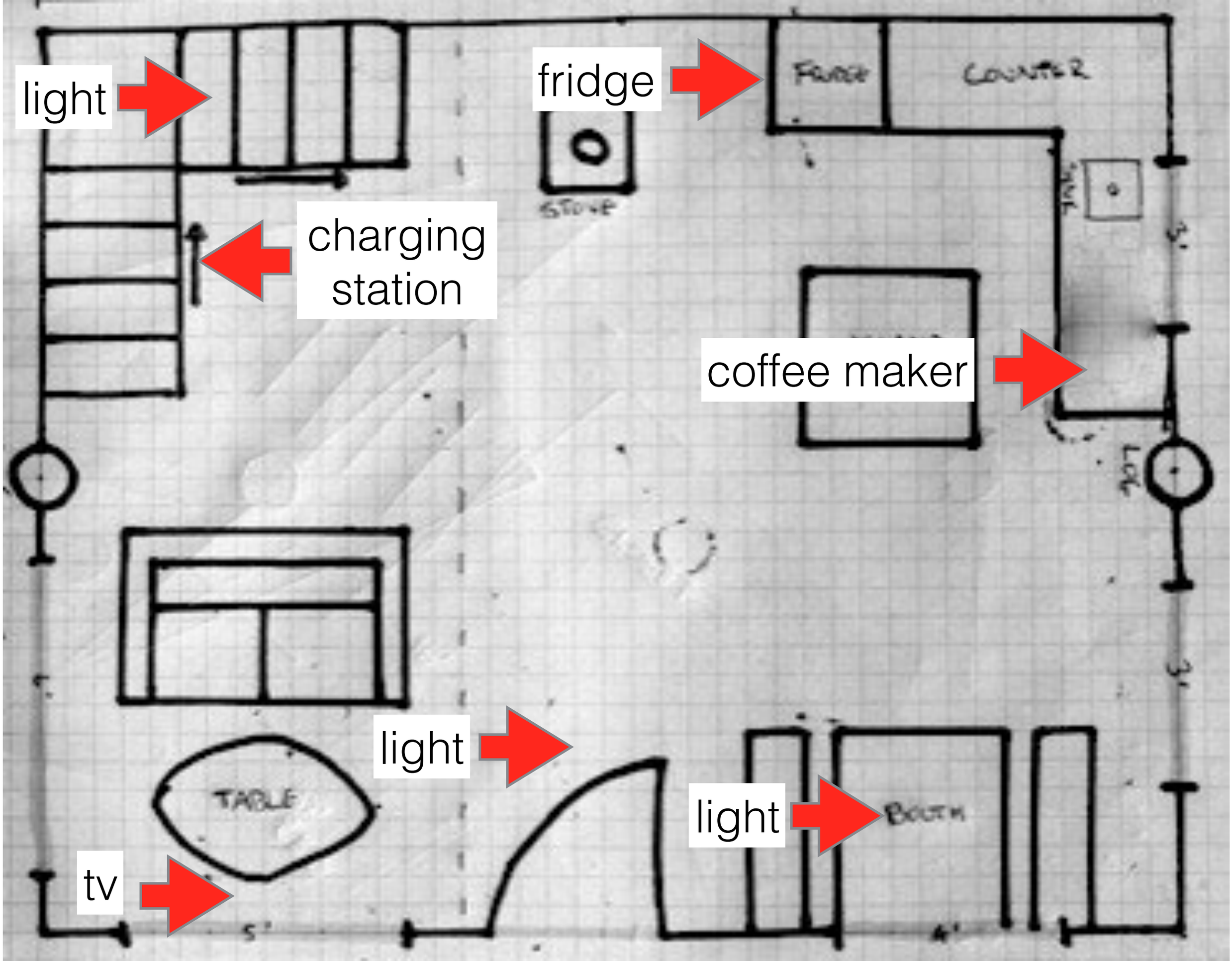
4. CREATE A SIMPLE PLAN. SHOW WHERE THE VARIOUS ELECTRICAL APPLIANCES WILL BE IN THE HOME YOU WILL BE SOLARIZING.

HOMEWORK

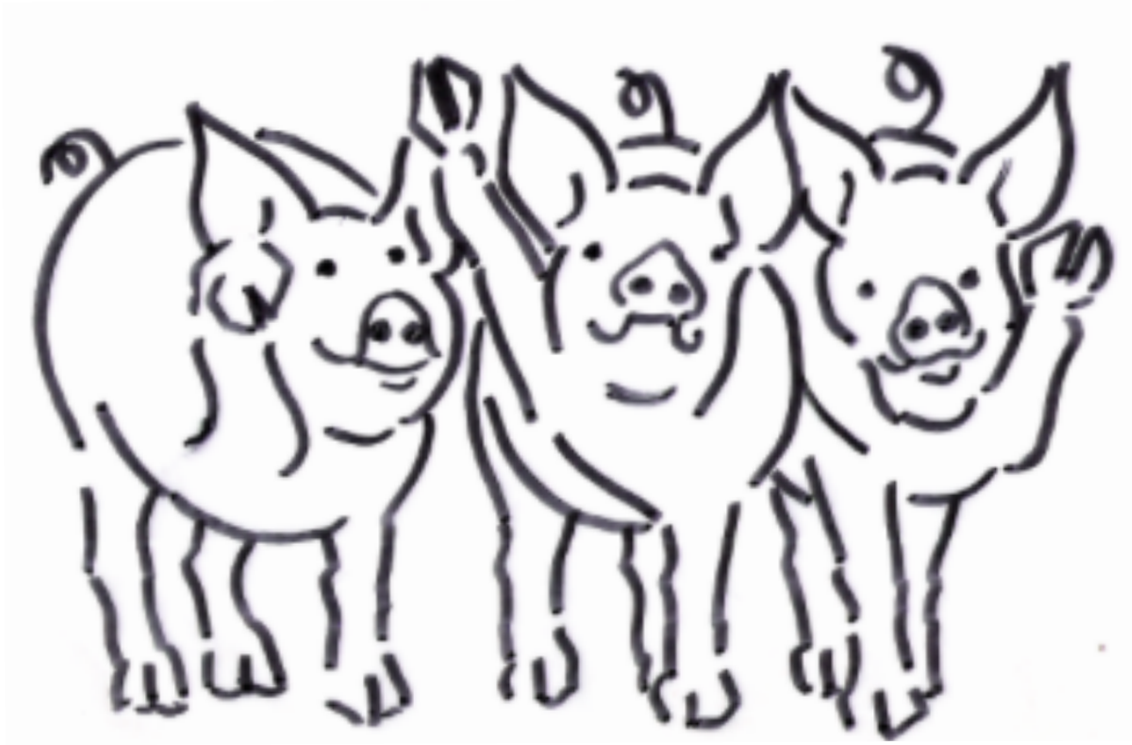
Make a wish list of appliances to run on your system.

APPLIANCE	VOLTS	X AMPS	= WATTS

Most appliances have a label,
often hard to read.
Try to get whatever info you can find.


light
fridge
charging station
coffee maker
tv
light
light
FRIDGE
COUNTER
STOVE
SINK
TABLE
BOOTH
5'
4'

the end



just a swine wave until
the next class
LOAD