Community Service Project

Solar-Powered Lighting

The Taylor High School BLADE club will bring solar-powered lighting to the picnic table pavilion in Bull-Branch Park in Taylor.

The students are excited at the opportunity to provide something that the public can enjoy.

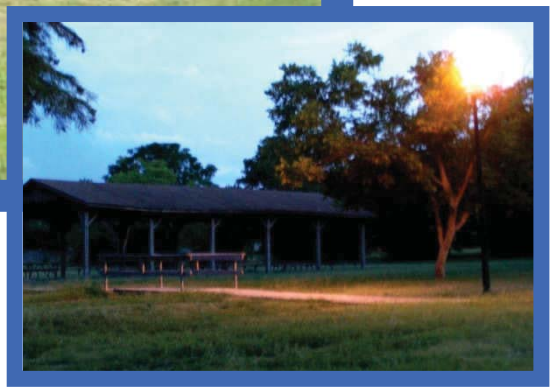
The project will be student-designed and built and paid for by donations from local businesses.

Project Cost: **$3,100**

Funding: **100% donations**

Completion: **May 2015**

Will provide **~7,000 lumens** at night.



B.L.A.D.E.

Beginners Learning Alternative Designs for Energy

About B.L.A.D.E.

Beginners Learning Alternative Designs for Energy

BLADE is an after-school club at Taylor High School. The club teaches students concepts in renewable engineering through fun, hands-on projects.

Previous projects include:

1. **BLADE VAN**, a mobile renewable power station,

2. **Movies in the Park** powered by renewable energy, and

3. Winning grants to have a **renewable system** installed at the high school.

Taylor High School / Legacy BLADE Club
Proposal to Install Solar-Powered Lighting
at the Picnic Table Pavilion in Bull Branch Park
Taylor High School / Legacy B.L.A.D.E. Club. THS.BLADE@gmail.com

Proposal:

The Taylor High School / Legacy BLADE club wishes to undertake a project to install solar-powered lighting at the picnic table pavilion in Bull Branch Park in 2015. The purpose of this project is to teach students real-life engineering / construction skills, demonstrate the benefits of small-scale solar, and provide community service.

The club will fund the project through donations and fundraisers and will maintain and warranty the project for a minimum of 4 years. The project will be constructed utilizing high-quality materials and is expected to last many years and require little maintenance.

Electrical components will be installed according to National Electric Code and good industry practice, and will be overseen by ACM Electrical Contractors and also club mentor John Jarmon, who is a Master Electrician. Design work is performed by club mentor Jonathan Rose, who is a licensed Professional Engineer in the State of Texas. All components are UL / ETL listed. All components will be protected against weather and against tampering by the public. Components are almost entirely low-voltage 24 VDC and will be completely de-energized during work.

Construction components will be rugged, durable, weather-resistant, and installed according to good industry practice. Pressure-treated lumber, galvanized bolts, and synthetic materials will be utilized. Mounting structures for the batteries and lights will be over-engineered so capable of supporting many times more weight than necessary.

All work will be performed to satisfaction of City inspector.
All work performed by students will be performed under direct supervision, with permission of students' parents, and with blessing of Taylor High School and Legacy High School administration. Most work will occur on the underside of the pavilion structure. Students will not be allowed on top of the roof of the pavilion.

BLADE Solar Pavilion

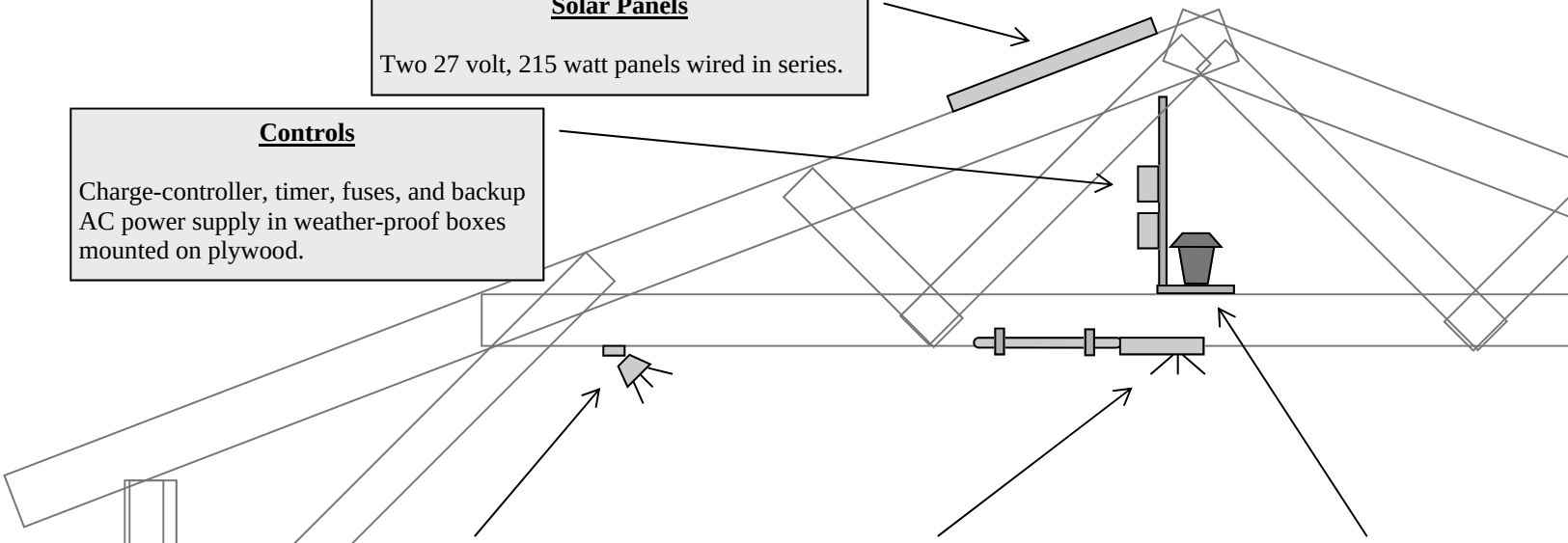
Solar Pavilion

Solar Panels

Two 27 volt, 215 watt panels wired in series.

Controls

Charge-controller, timer, fuses, and backup AC power supply in weather-proof boxes mounted on plywood.



Security Lights

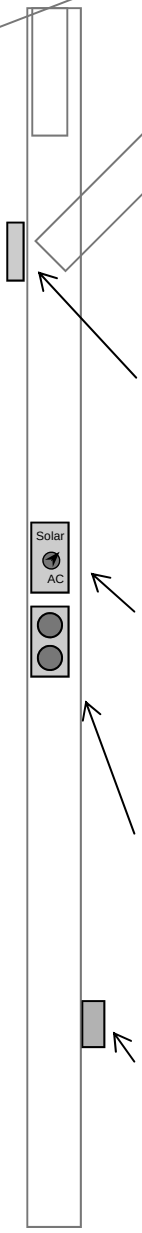
Small lights remain on all night.

Main Lights

Three high-quality LED streetlights. ~10,000 lumens total.

Batteries

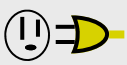
Two deep-cycle marine maintenance free secured by chain & lock. Requires replacement every 2-3 yrs.



Main Disconnect

Accessible breakers also serve as over-current protection for battery and solar panel.

Dual Power



Should batteries or solar fail, System can be switched to run off utility power.

Light Switch

Rugged push-button. Hit start and main lights come on for 30 minutes. Smaller security lights remain on most/all night.

Ground Jumper

Solar ground tied to AC ground at outlet. NEC does not require separate grounding rod for PV solar system.

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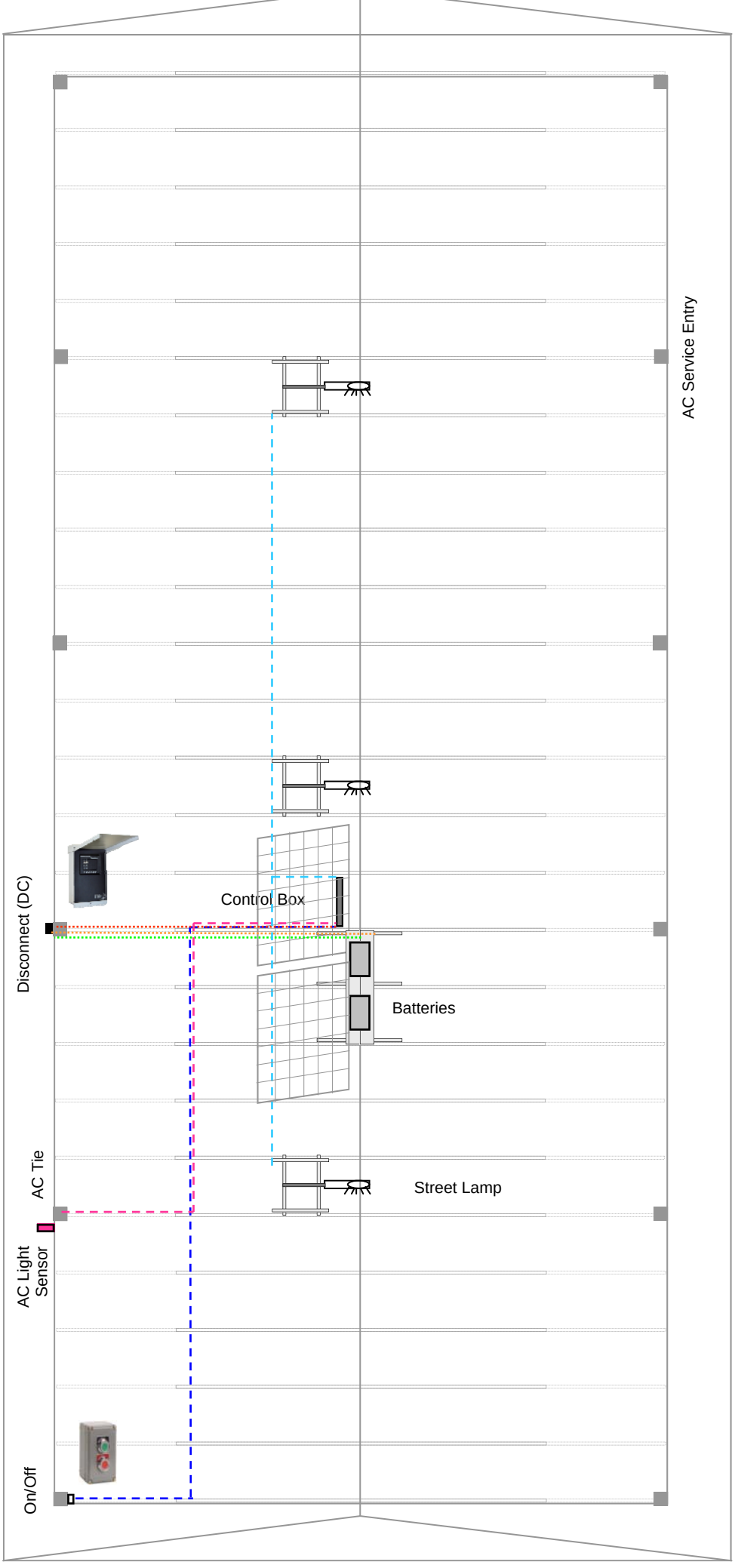
Beginners Learning Alternative Designs for Energy



North

Fishing Pond

1 cm = 2.0 feet

Switched Lights
14 AWG 38’ Red+Blk+Grn

Security Lights
14 AWG 32’ Red+Blk+Grn

AC Service
12 AWG 45’ Blk+Wht
12 AWG 45’ Grn

DC Disconnect Solar
14 AWG 20’ Red

DC Disconnect Batt
10 AWG 20’ Red
12 AWG 20’ Grn

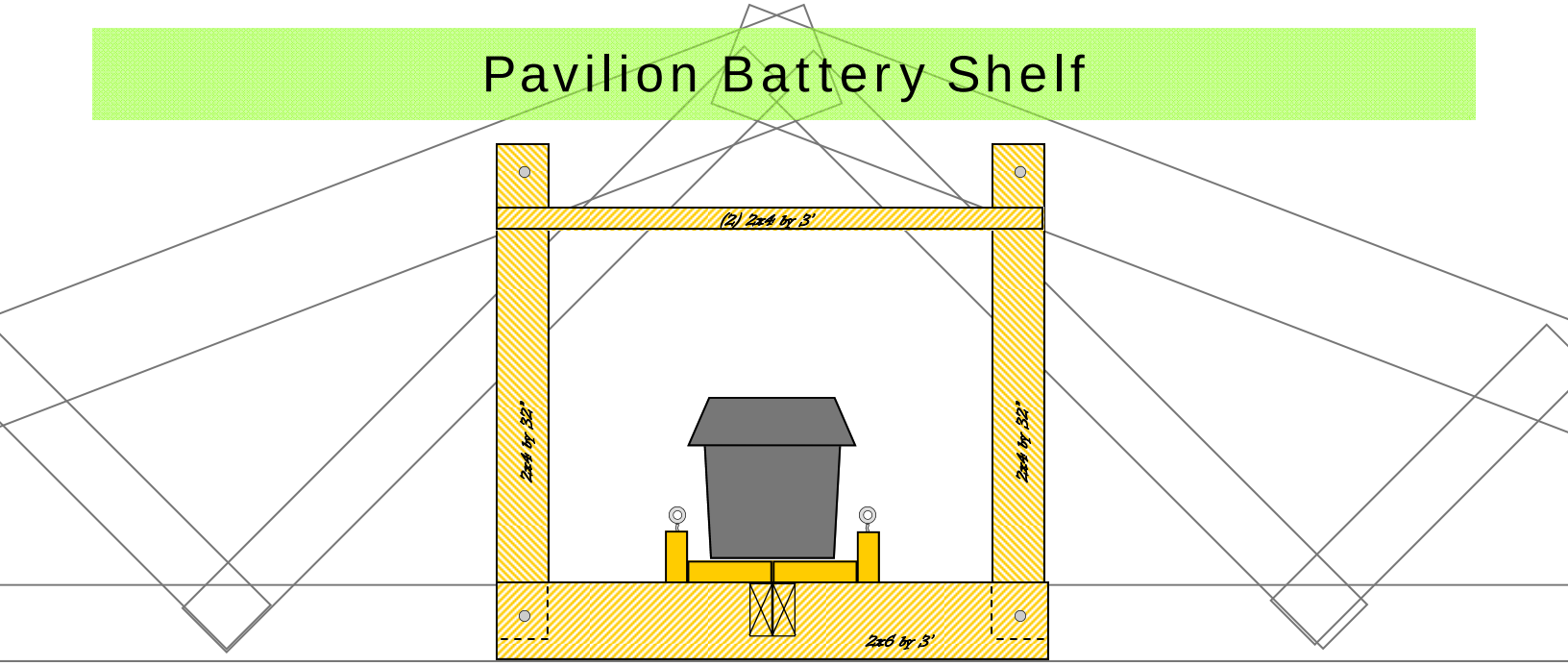
To Solar Panels
14 AWG 8’ Red+Blk+Grn

TOTALS

All stranded Cu THHN
14 AWG Red: 100’
14 AWG Blk: 100’
12 AWG Blk: 50’
12 AWG Wht: 50’
14 AWG Green: 100’
10 AWG Red: 20’

Conduit: 150’ 1/2 inch EMT
Duplex metal boxes: 8

Pavilion Battery Shelf



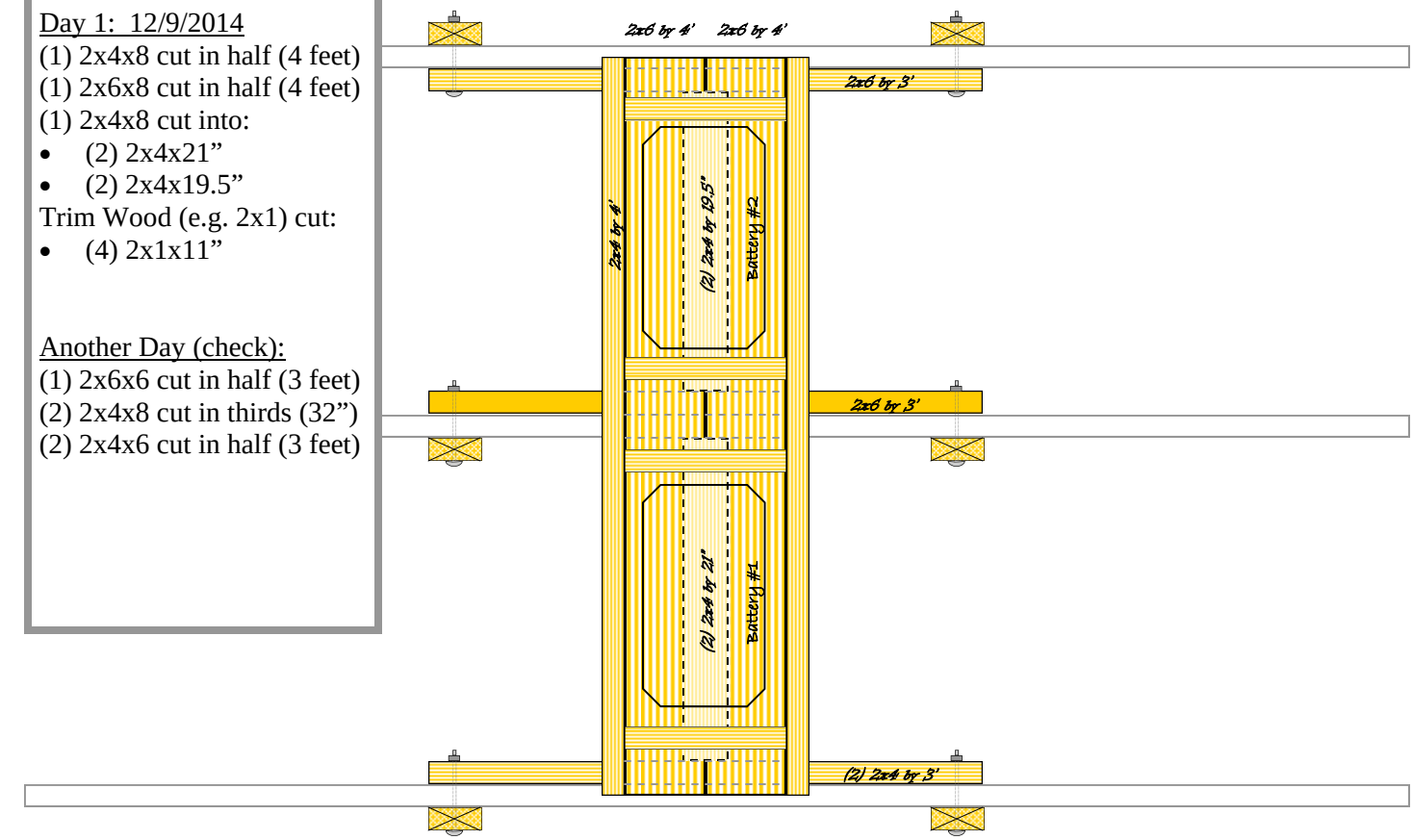
BATTERY SHELVES

"Measure twice, cut once."

Day 1: 12/9/2014
(1) 2x4x8 cut in half (4 feet)
(1) 2x6x8 cut in half (4 feet)
(1) 2x4x8 cut into:
- (2) 2x4x21"
- (2) 2x4x19.5"

Trim Wood (e.g. 2x1) cut:
- (4) 2x1x11"

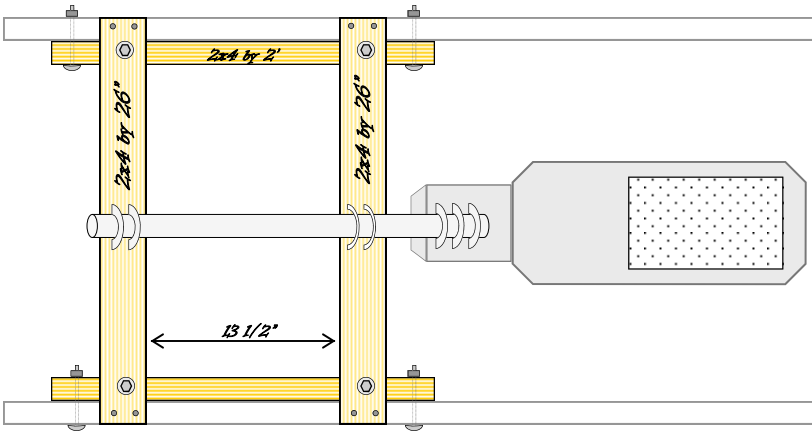
Another Day (check):
(1) 2x6x6 cut in half (3 feet)
(2) 2x4x8 cut in thirds (32")
(2) 2x4x6 cut in half (3 feet)



Galvanized bolts will be used at critical load-bearing locations. Wood screws and nails used elsewhere.

1 inch = 1 foot

Pavilion Light Mounts



LIGHT MOUNTS

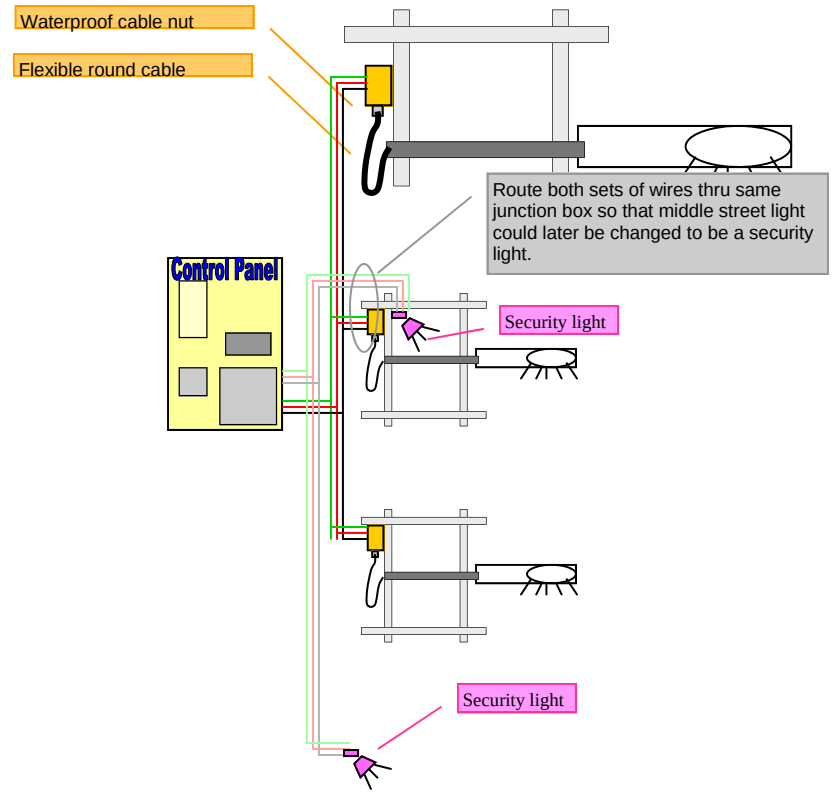
"Measure twice, cut once."

(1) 2x4x8 cut into:
- (4) 2x4x24"

(1) 2x4x8 cut into:
- (2) 2x4x24"
- (1) 2x4x26"

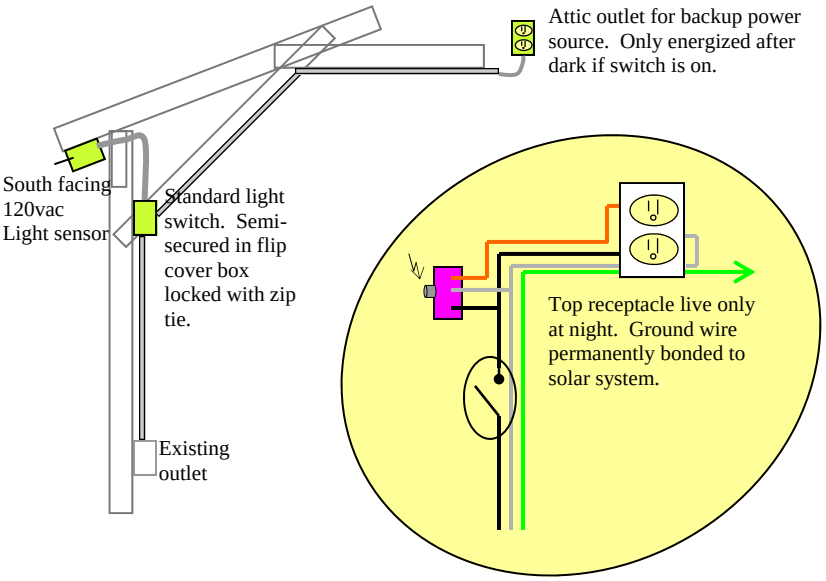
(2) 2x4x8 cut into:
- (5) 2x4x26"

Lights



1 inch = 1 foot

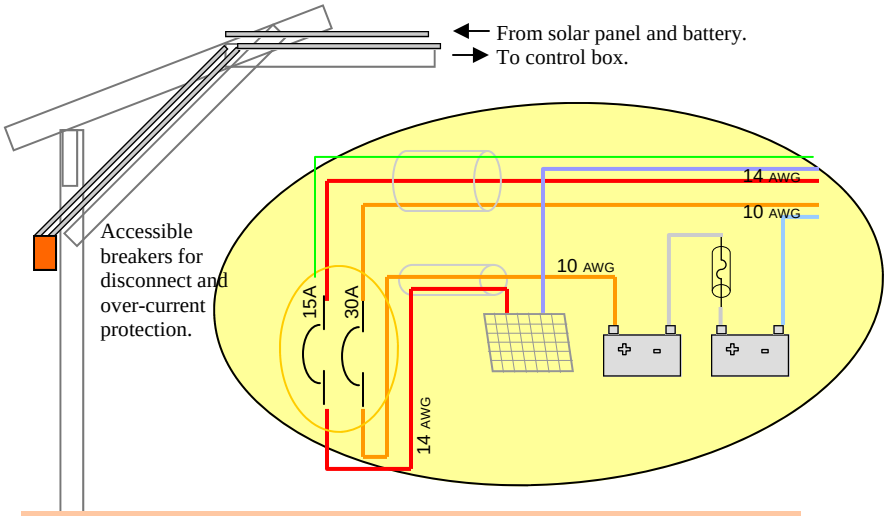
Backup Power



To increase system reliability, the lights can also run from utility power. The control panel in the attic has a 120vac / 24vdc power converter to step down the voltage to 24vdc system voltage. The converter plugs into the top receptacle of an electrical outlet mounted in the pavilion attic. The electrical outlet is connected to the existing pavilion service outlets but has two devices to interrupt current: a public-accessible switch and a light sensor. Thus, only at night when the switch is turned on will the top receptacle energize the power converter. The control panel is wired so that it will operate on utility power whenever the power converter is energized; else it will default to solar battery power.

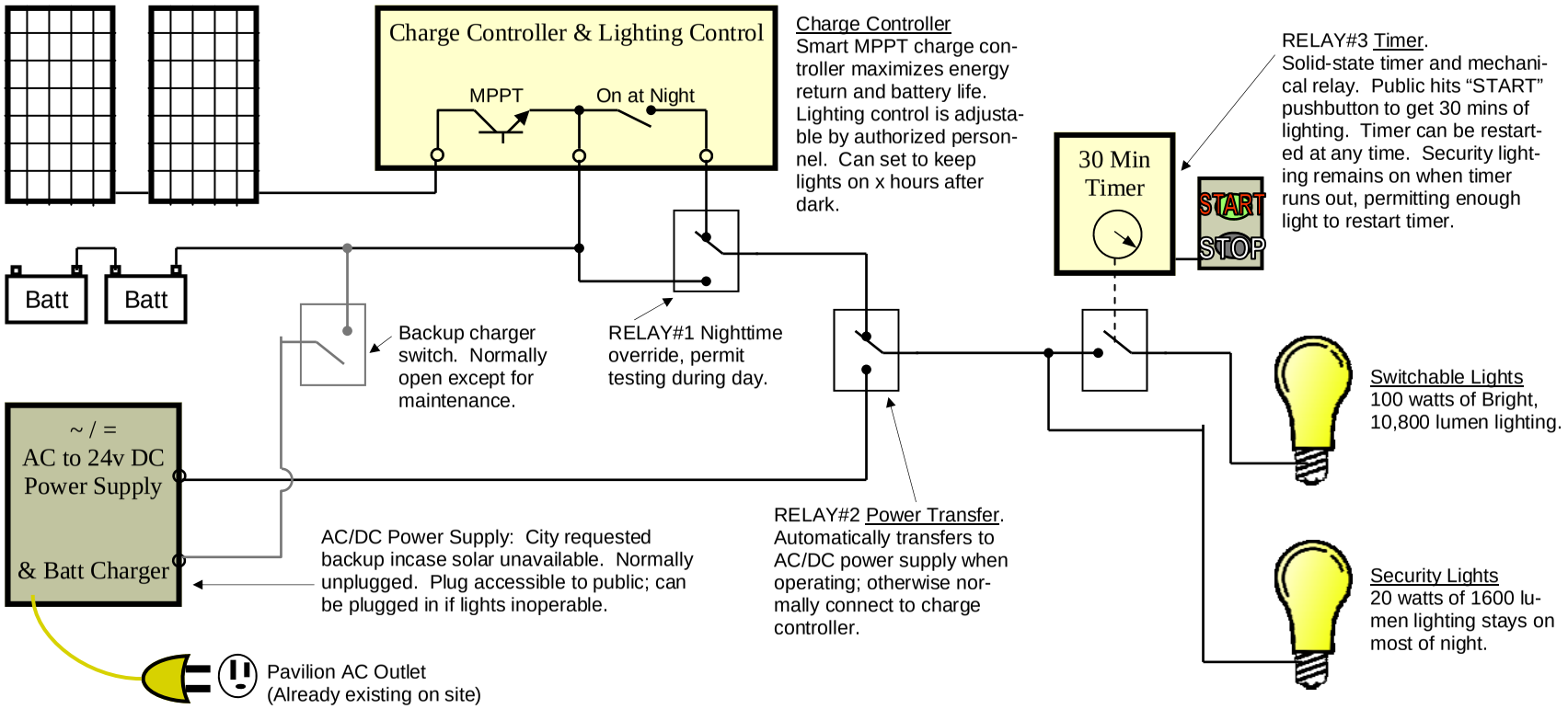
The switch should normally be turned off so that the system operates on solar power. In case solar power should fail, any member of the public can cut the zip tie securing the switch cover and turn on the switch.

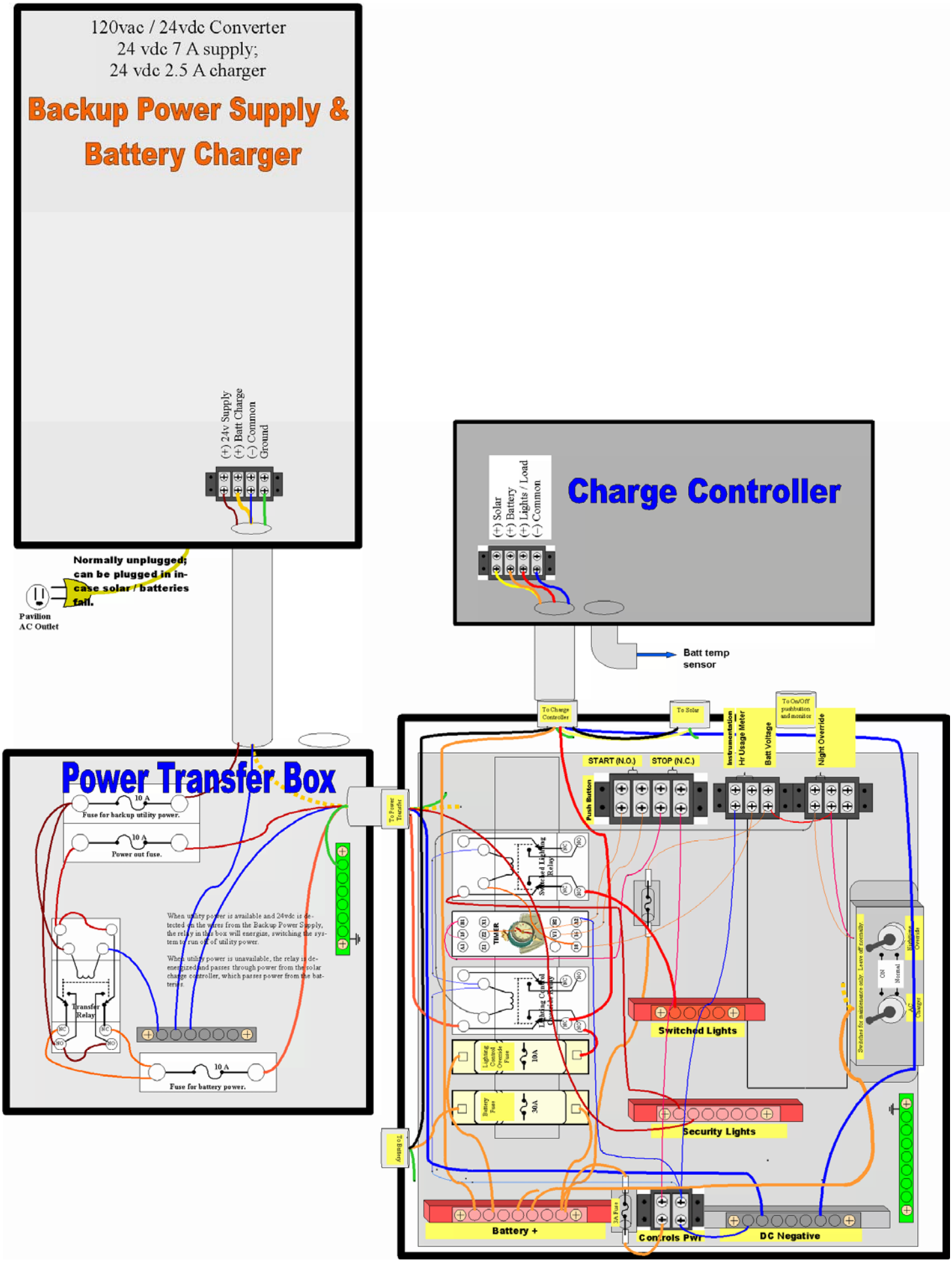
Protection & Fault Interruption



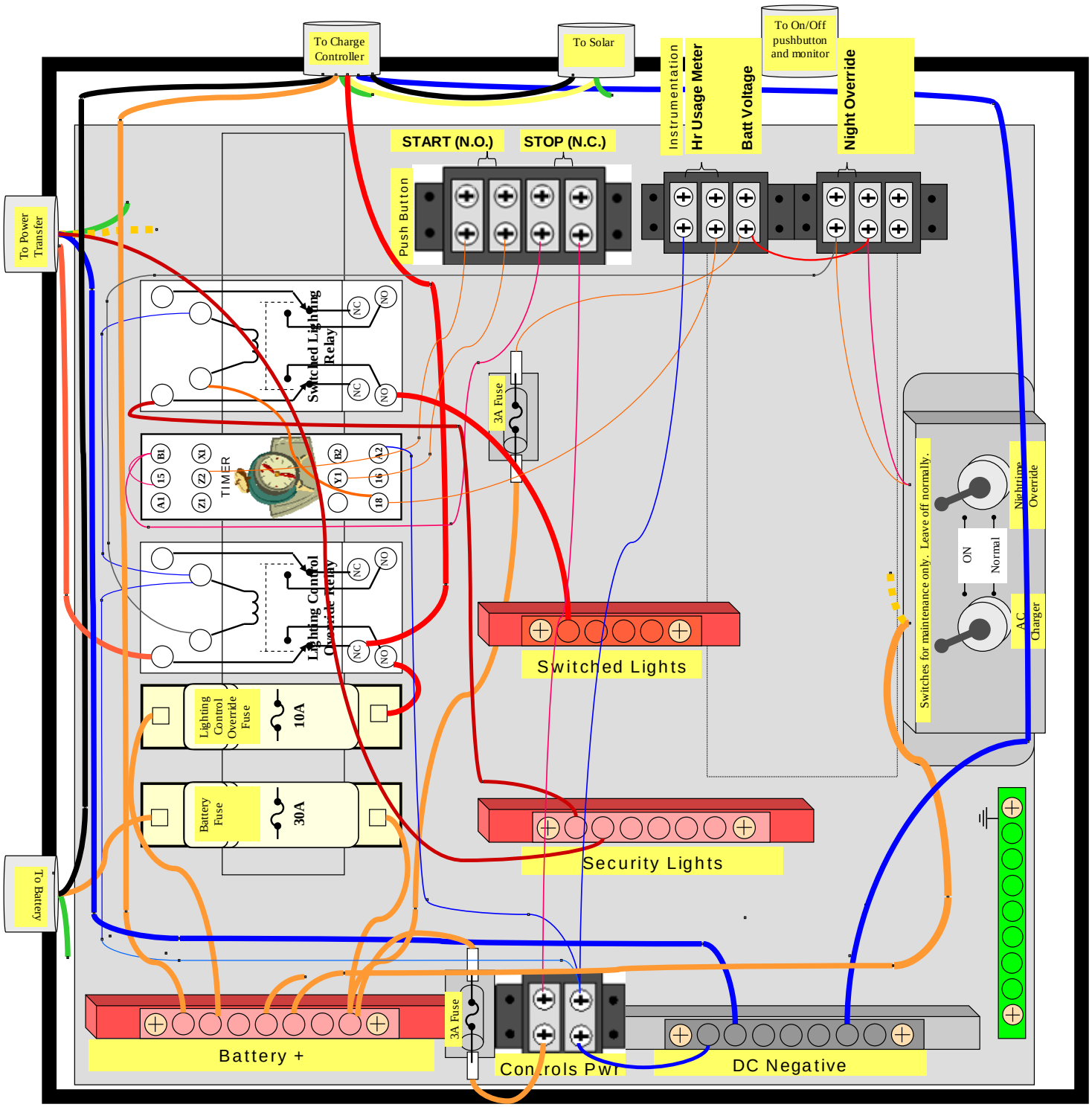
Over-current protection provided by two breakers in outside accessible box — 15A for solar panels and 30A for batteries. Cuts off power from panel and batteries.

BLADE Solar Pavilion
OVERVIEW




120vac / 24vdc Converter
24 vdc 7 A supply;
24 vdc 2.5 A charger
Backup Power Supply & Battery Charger
(+) 24v Supply
(+) Batt Charge
(-) Common
Ground
Normally unplugged; can be plugged in in-case solar / batteries fail.
Pavilion AC Outlet
Charge Controller
(+) Solar
(+) Battery
(+) Lights / Load
(-) Common
Batt temp sensor
Power Transfer Box
10 A
Fuse for backup utility power.
10 A
Power out fuse.
When utility power is available and 24vdc is detected on the wires from the Backup Power Supply, the relay in this box will energize, switching the system to run off of utility power.
When utility power is unavailable, the relay is de-energized and passes through power from the solar charge controller, which passes power from the batteries.
Transfer Relay
10 A
Fuse for battery power.
To Power Transfer
To Charge Controller
To Solar
Instrumentation
Hr Usage Meter
Batt Voltage
To On/Off pushbutton and monitor
Night Override
START (N.O.)
STOP (N.C.)
Push Button
Switched Lighting Relay
TIMER
Lighting Control Override Relay
Lighting Control Override Fuse
10A
Battery Fuse
30A
To Battery
Switched Lights
Security Lights
Switches for maintenance only. Leave off normally
ON
Normal
Kitchen Outlets
AC Charger
3A Fuse
Battery +
Controls Pwr
DC Negative

Control Box


To Charge Controller
To Solar
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Instrumentation
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Batt Voltage
Night Override
START (N.O.)
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Push Button
To Power Transfer
Switched Lighting Relay
NC
NO
3A Fuse
TIMER
Lighting Control Override Relay
Switched Lights
Nightime Override
ON
Normal
AC Charger
Switches for maintenance only. Leave off normally.
Lighting Control Override Fuse
10A
Battery Fuse
30A
Security Lights
To Battery
3A Fuse
Battery +
Controls Pwr
DC Negative