Things To Consider At Your Sites

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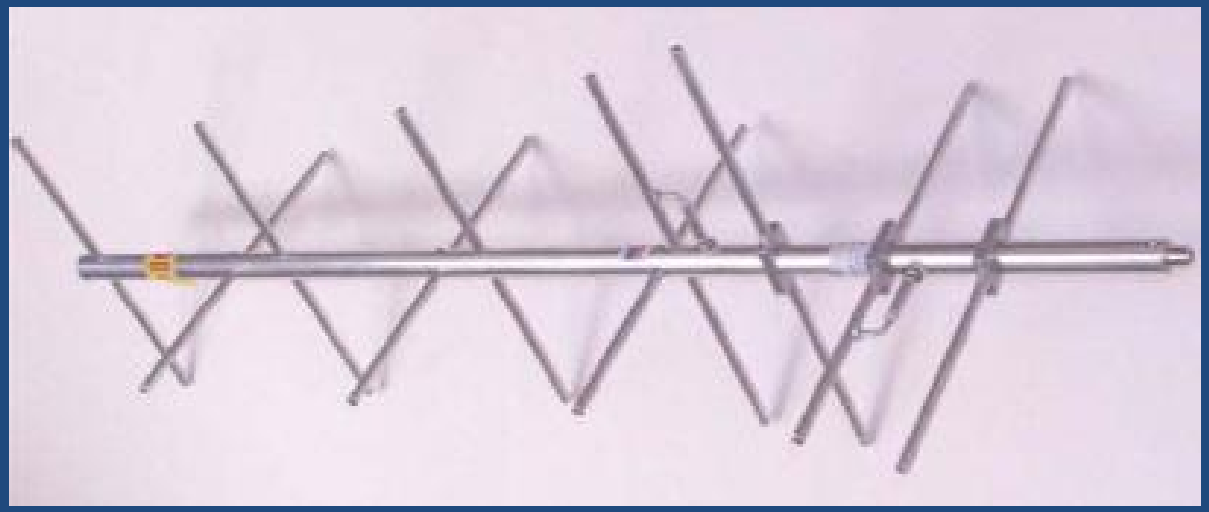
USGS Water Mission Area
2019 GOES DCS Training

Equipment Installation at Field Sites

- Masts or conduit for protection of cables
- Drip loops and drain holes
- Sealing of external connectors
- Keeping a clear view for antennas
- Solar panels
- Antenna aiming
- Raingage mounting considerations
- Orifice lines and outdoor cable runs

Types of Antennas

Crossed Yagi



Gain : 9 – 12 dB Gain

Beam Width : 35 – 45 Deg

Top Hat Antenna

Gain : 4 – 8 dB

Beam Width : 90 deg

Omnidirectional Antenna

Gain : 1 – 3 dB

Beam Width : 180 deg

In-line lightning arrester for DCP antenna coaxial cable manufactured by Polyphaser Corp.

Poly-phasers

Not protected

Protected

GOES Antenna installation

Weatherhead would be best

Careful with metal straps as they could cut into the outer cable jacket

GPS Antenna

Good example

Bad example

Types of GPS Antennas

Puck magnetic GPS antenna
Low cost around $20

Use where full view of sky

Bullet High gain GPS antenna
Higher cost around $80

Use where partial view of sky

Cabling and Connections

RG6

50 Ohms
Flexible
Cost efficient

Low loss RG6
Use for cables 75 feet or longer

Low loss Solid center conductor
Rigid solid shield
Expensive to use

2-Conductor 18AWG for 12-Volt Power

3-Conductor Foil-Shielded Tinned Copper Cable for SDI-12 Wiring

What is the bare wire used for?

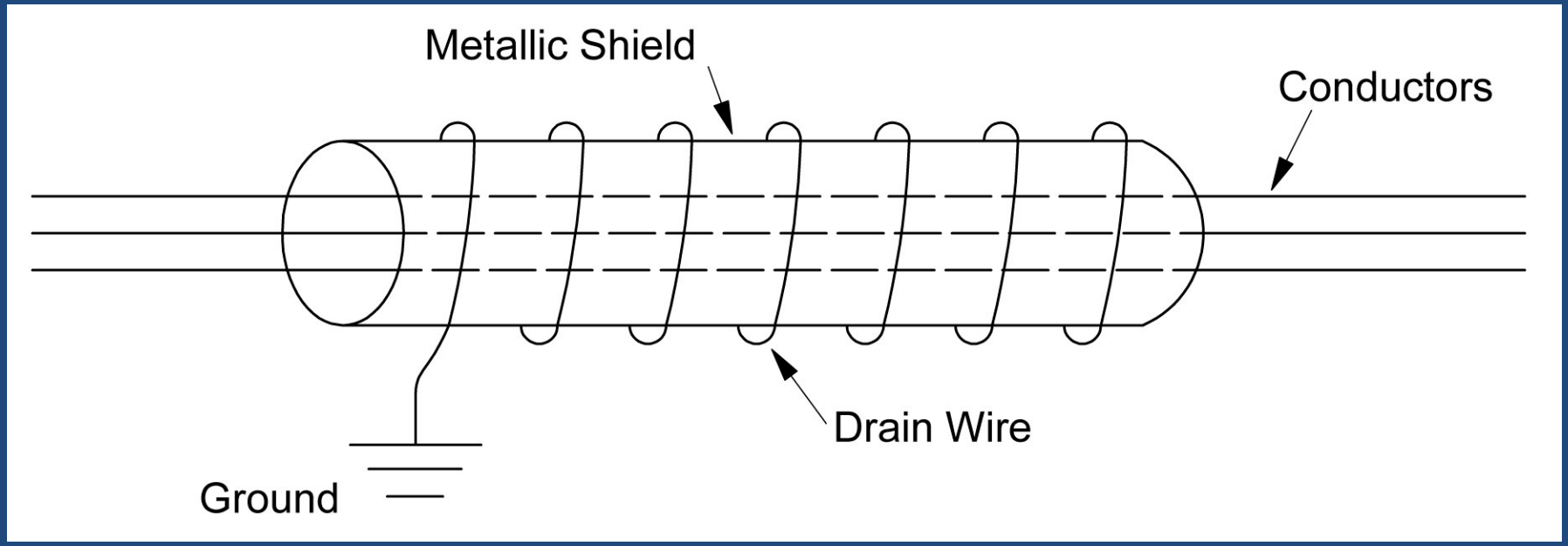
Shields/Drain Wires

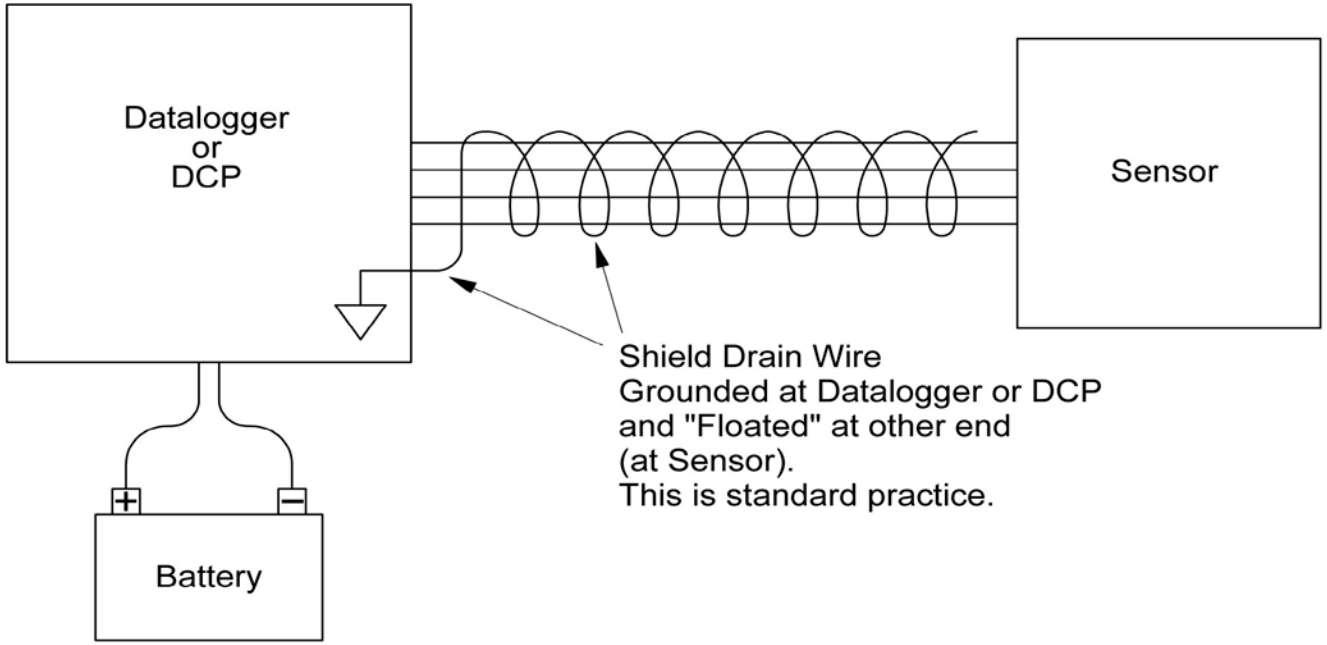
The purpose of the shield on a shielded cable is to provide protection to the conductor(s) inside from EMI (electromagnetic interference). Long wires/cables act almost like antennas, picking up electrical noise and interference.

If the shield is used properly, this electrical interference is “intercepted” by the metallic shield before it gets into the conductor(s) inside. The DRAIN WIRE is used to provide a means of connecting the shield to GROUND and providing a low-resistance path to ground for any noise signals or transients intercepted by the shield.

Ground Loops

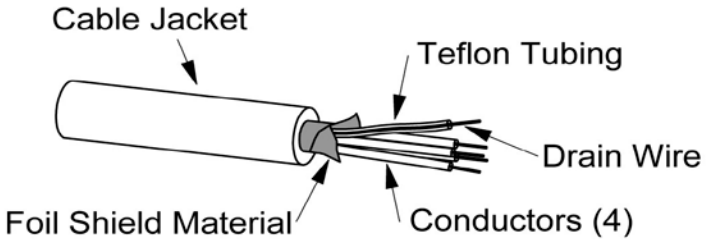
Be careful for ground loops. The drain wire should only be connected to ground on the battery side.





Rule of Thumb:
DO NOT USE THE SHIELD (and/or drain wire) TO CARRY ANY CURRENT.

The SHIELD provides a GROUNDED metal covering that surrounds the conductors inside.
The SHIELD should not be used as part of the circuit or as an "extra conductor".

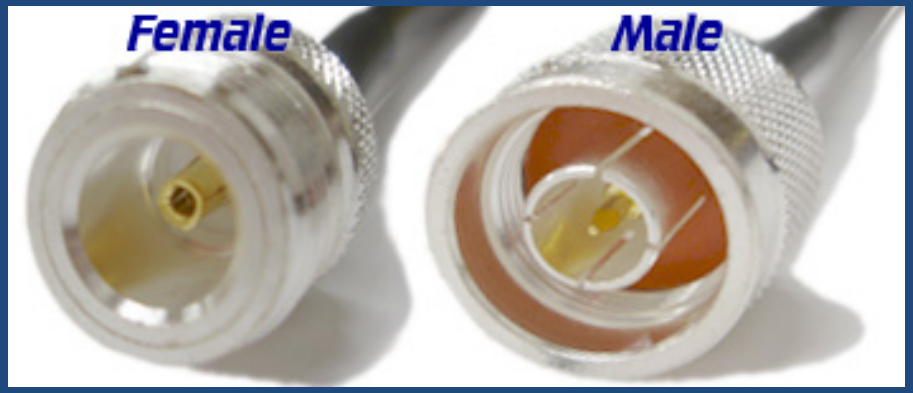


Teflon Tubing (AKA "spaghetti tubing") is often used on the end of a Drain Wire to prevent shorting out other lines, etc...

RF connectors

SMA RF Connector

N-Type RF Connector



TNC-Type Connector

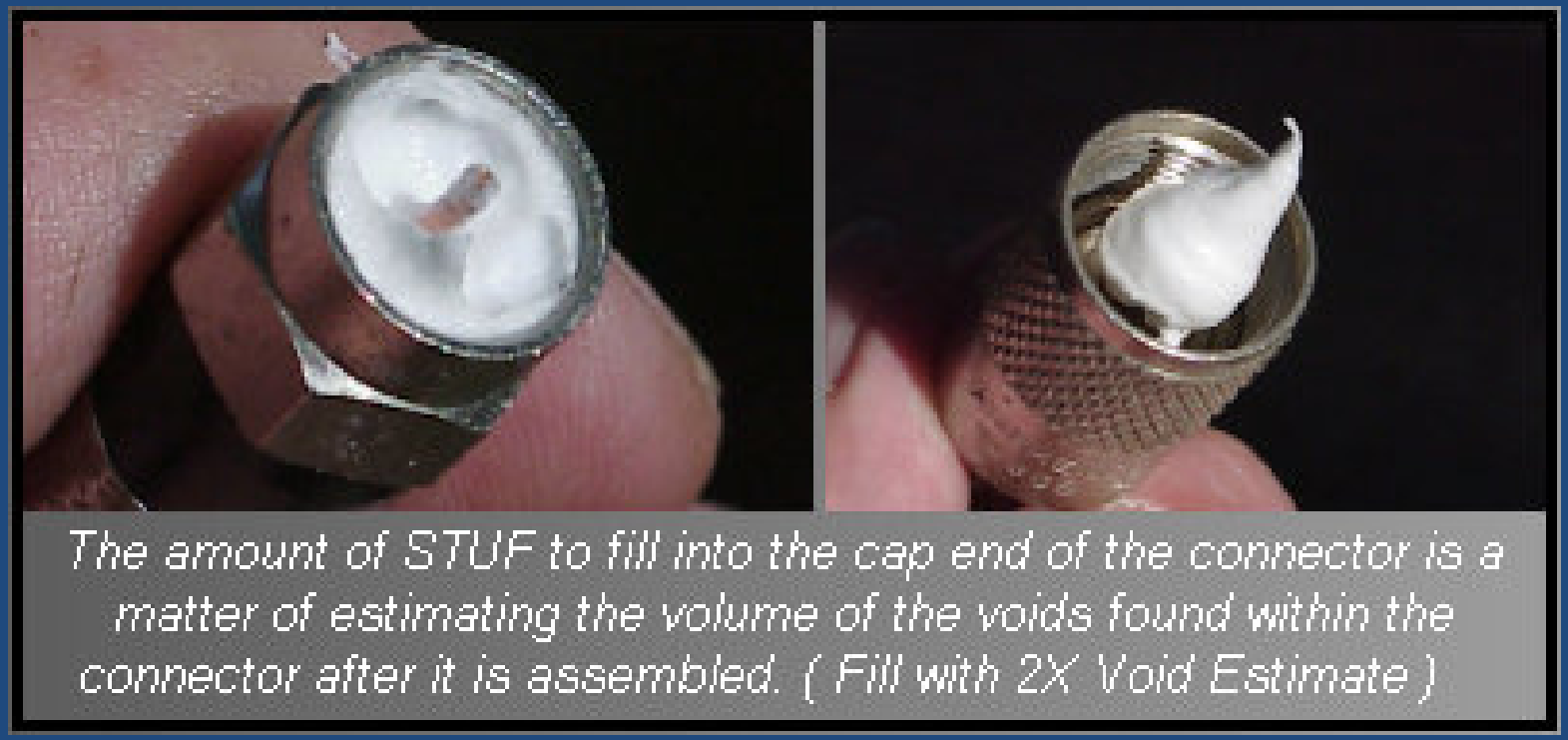
External Antenna Connections

Weatherproof

Weatherproof taken an extra step

Dielectric Filler

http://crossdevices.com/cross_devices_website2018_011.htm



The amount of STUF to fill into the cap end of the connector is a matter of estimating the volume of the voids found within the connector after it is assembled. (Fill with 2X Void Estimate)

GOES Antenna

Know how to aim an antenna

Before

After

If you aim your antenna toward trees in the winter when summer comes your transmissions will start dropping

Antenna Masts

Over time tie wraps will fail

Weatherhead

Protection of wires

All wires protected

Access port

Raingage considerations

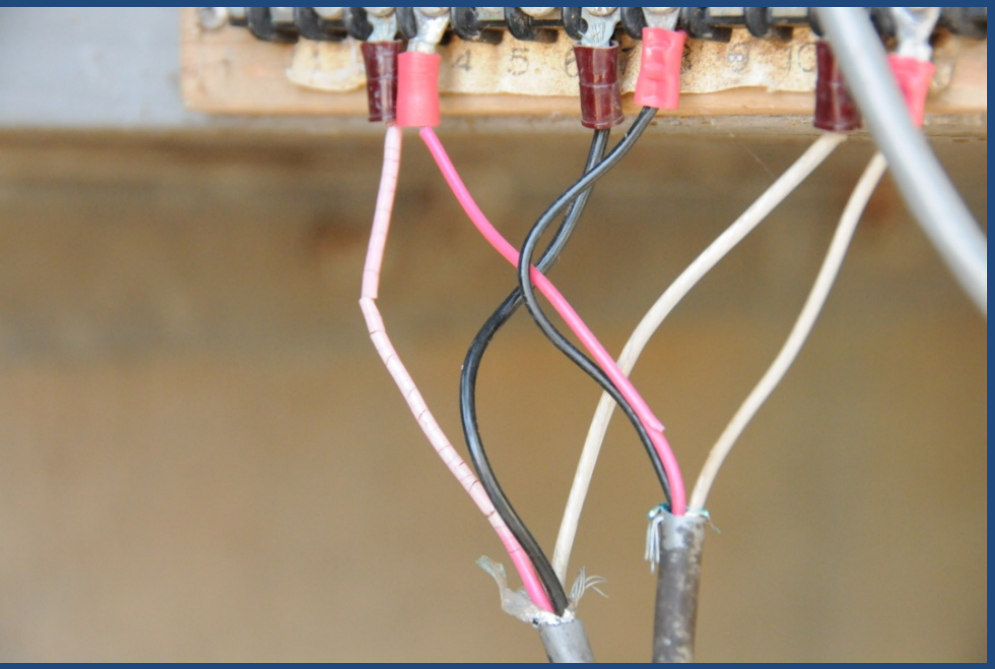
Field Site Maintenance Practices

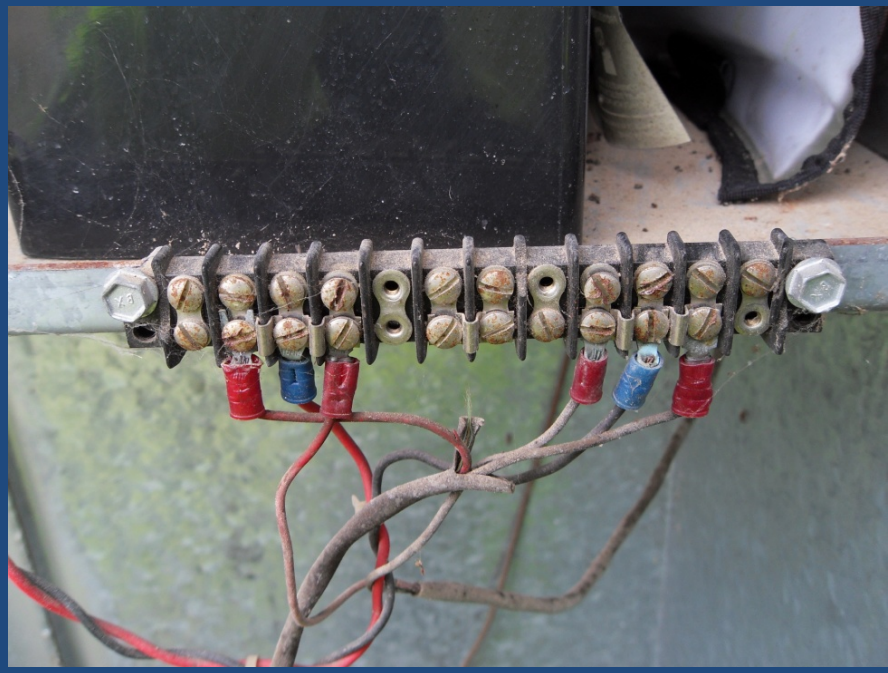
- Tightening and coating of connections
- Load testing of a battery
- Checking a solar panel
- GOES antenna
- GPS antenna
- Desiccants and vent tubes
- General cleanup

What happens when you have to troubleshoot the gage…..

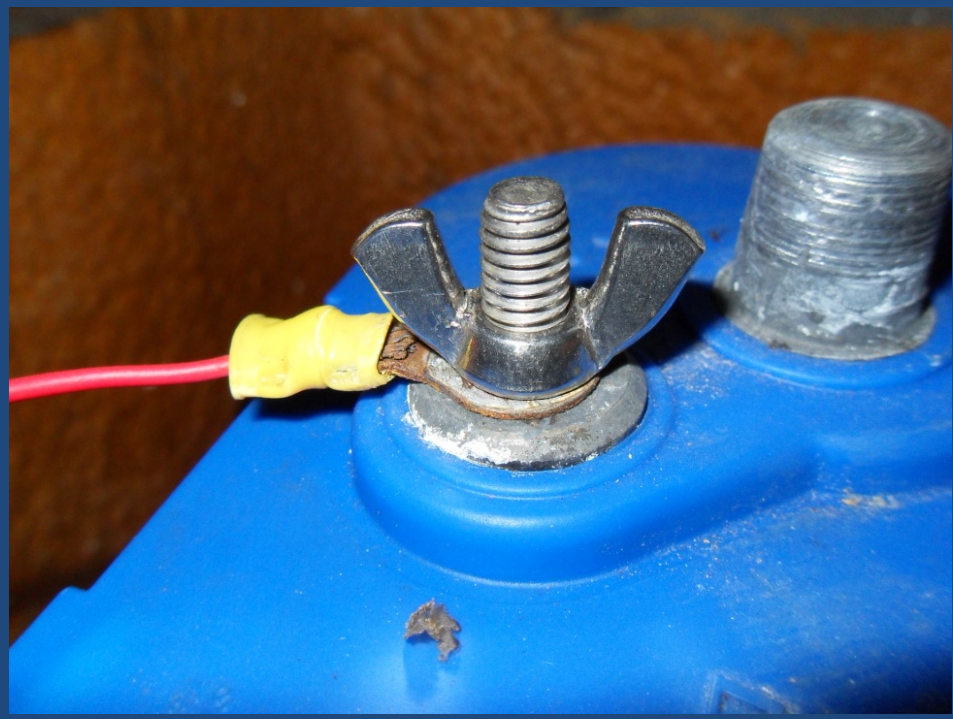
- You start out with a wiring nightmare.
- You can’t unhook parts and pieces to diagnose the problem.
- So you start replacing parts and sensors till you finally get it fixed.
- Then you realize your not sure what part fixed the problem.
- Now you have an assortment of parts and your not sure which one is the faulty component.

Old corroded/brittle wiring control



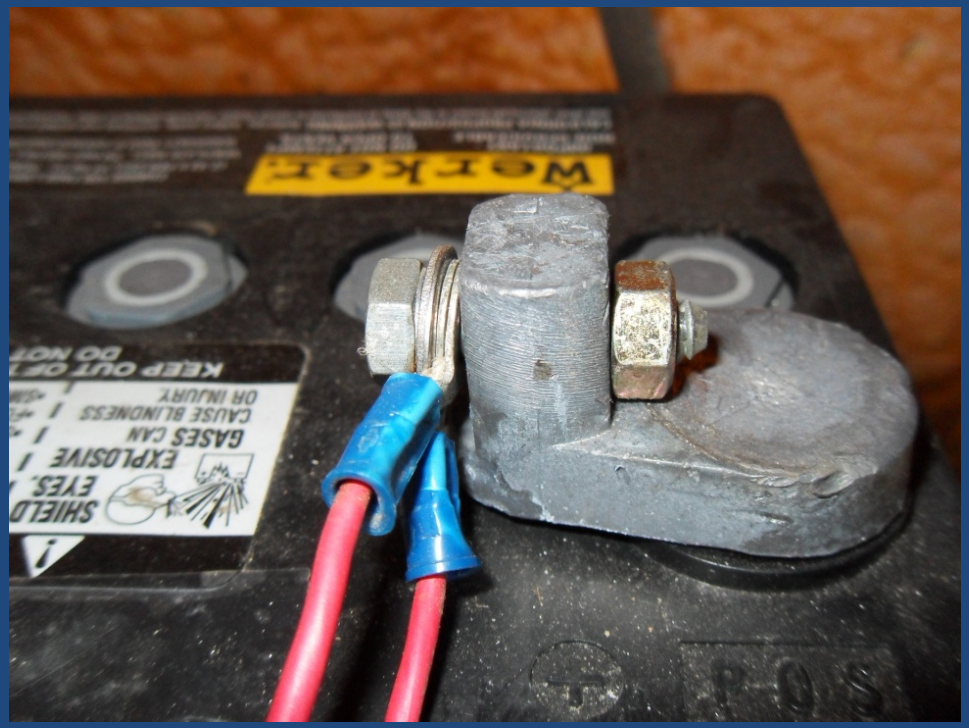


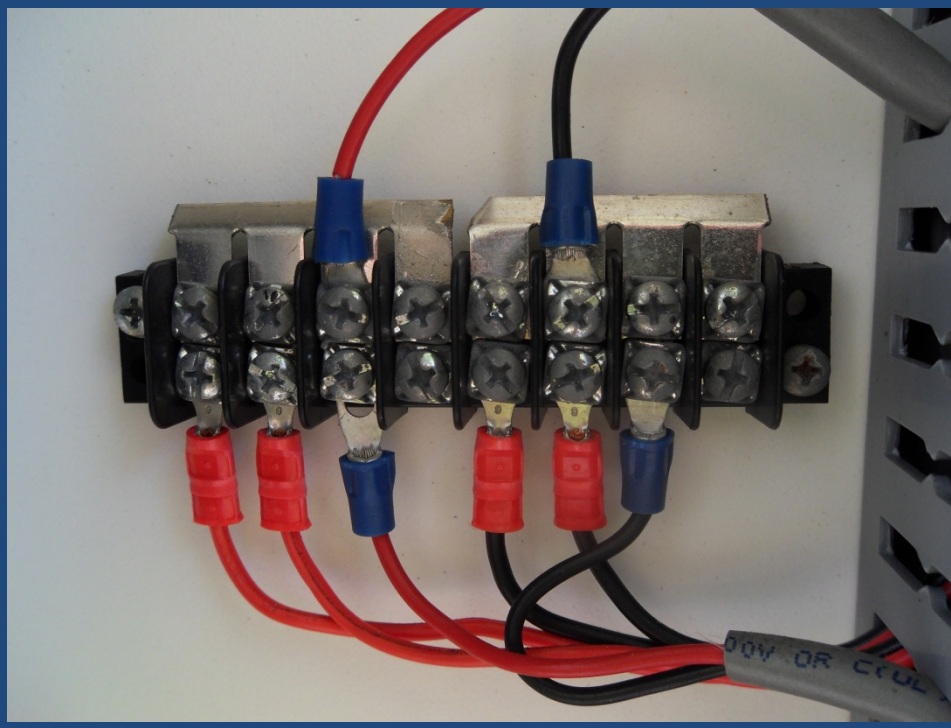
Corrosion



Multiple sensor connections to battery.

Loose Connections





doh!

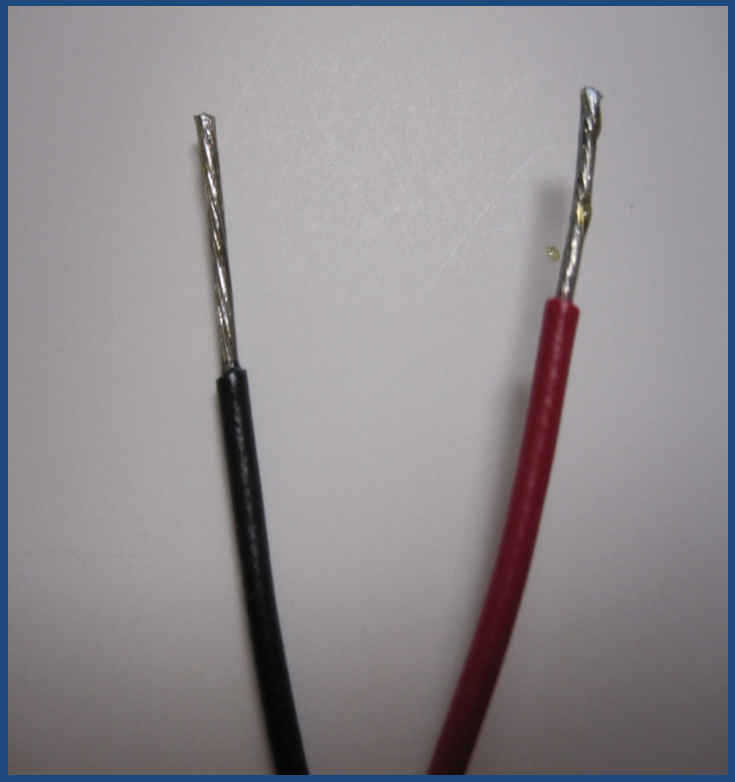
Wiring Practices in the Gagehouse

- Screw terminal blocks
  - Power distribution
  - Multiple sensor connections
  - Stainless steel parts, lock washers, etc…
- Proper crimping and soldering
- Keeping connections tight and corrosion-free
- Proper wire types and sizes
- Shielding of cables
- Routing and securing wires and cables

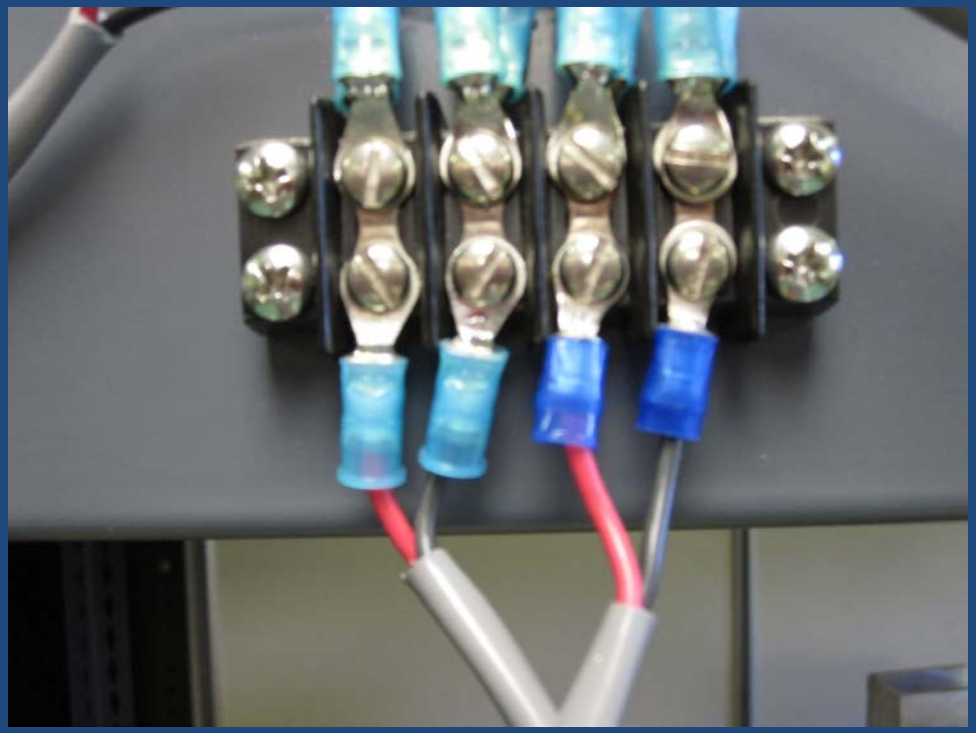
Frayed wire ends, prevented by tinning with solder.

Untinned wire ends

Tinned wire ends

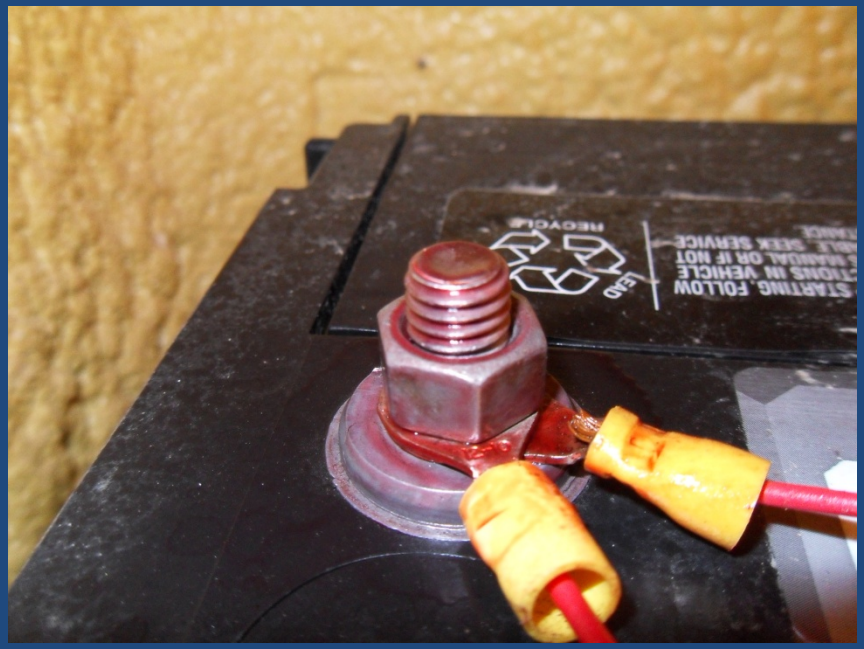


Properly double-crimped and soldered ring terminals

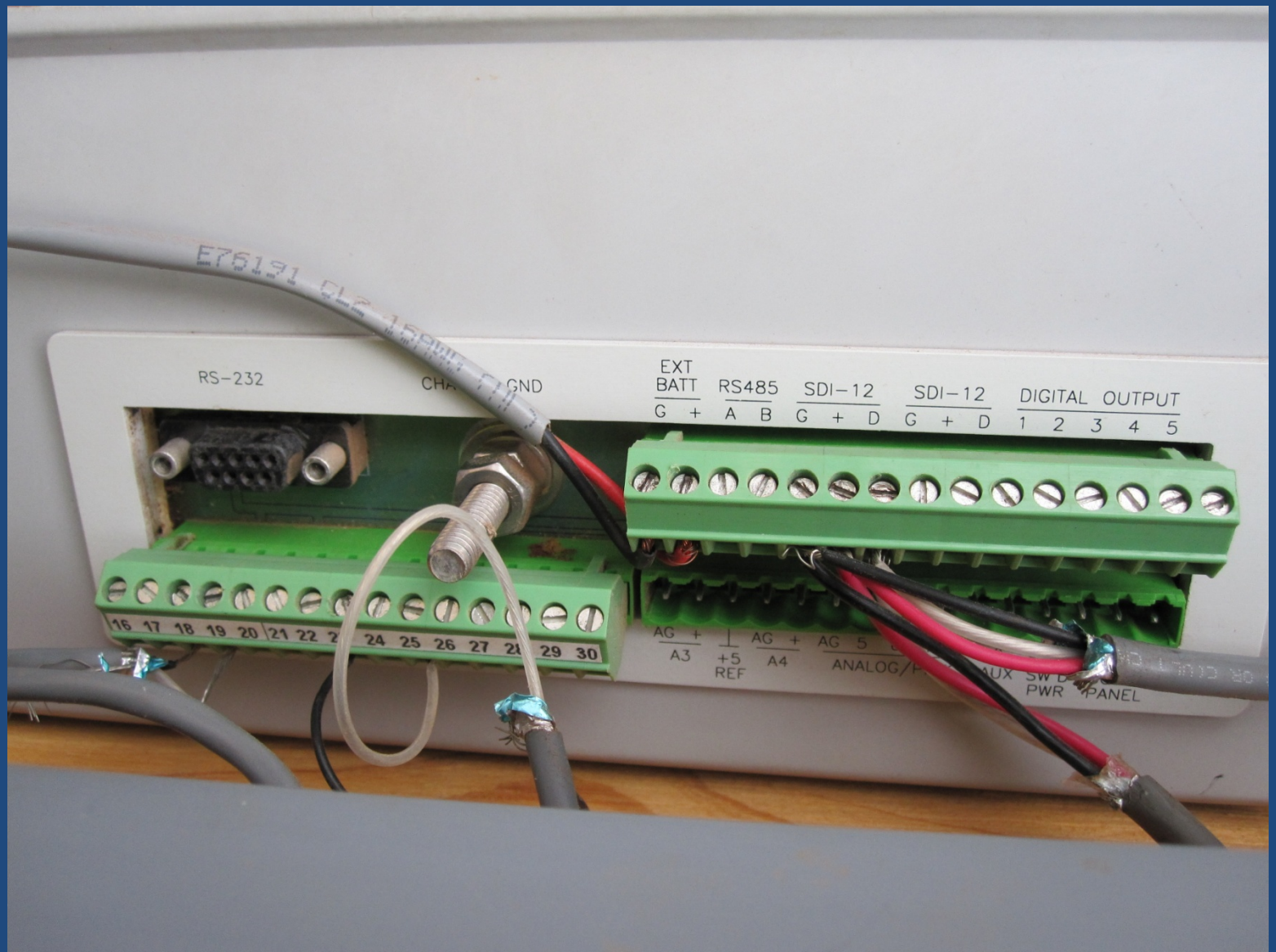


Soldered Connections

Corrosion issues/remedies



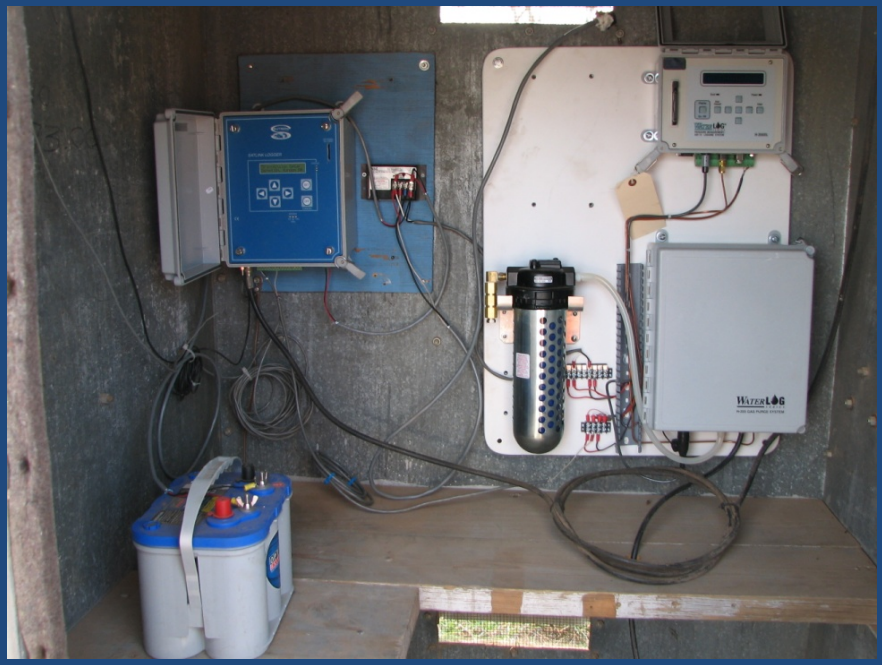
Power distribution. Why use terminal strips?



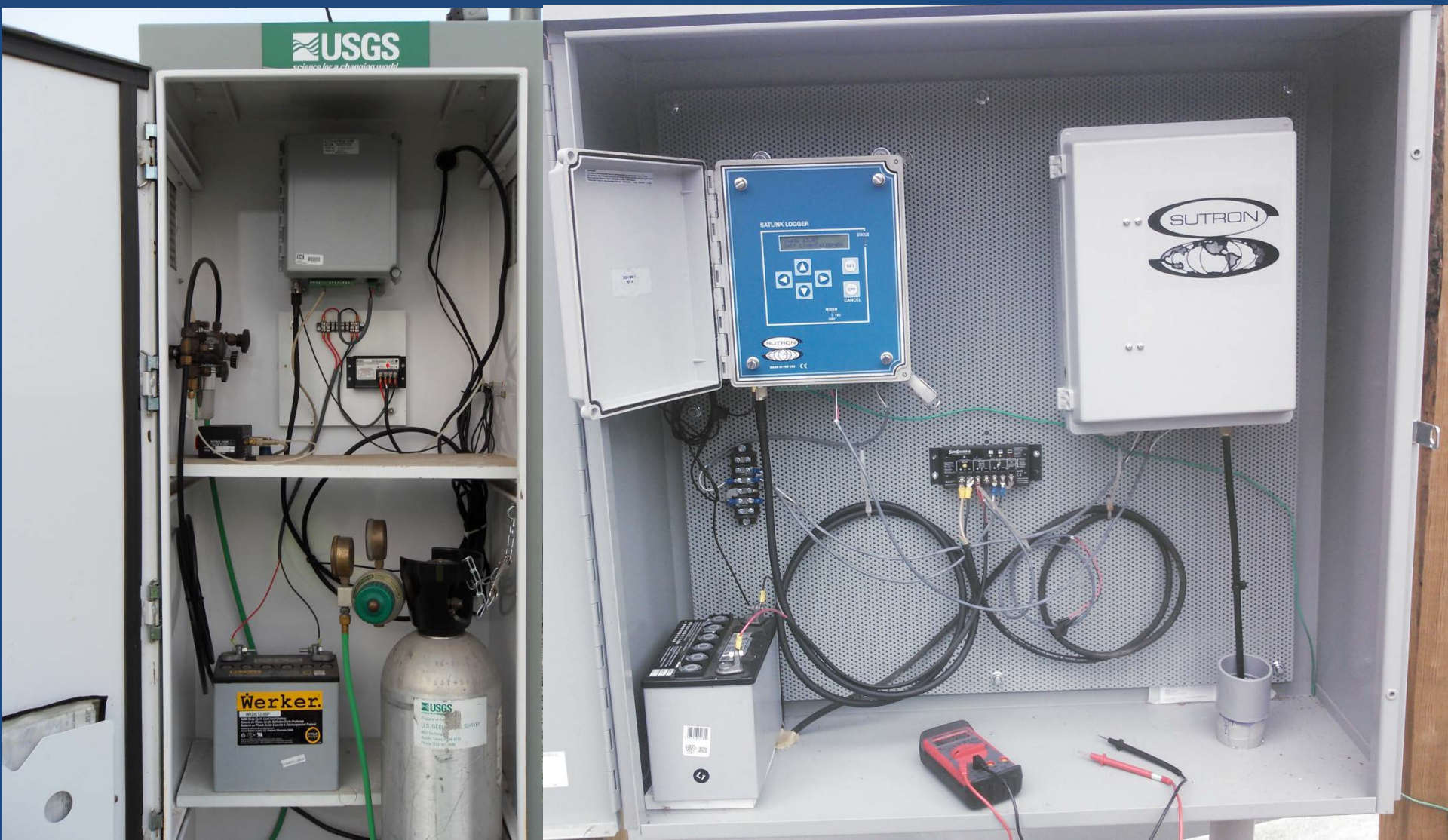
General Cleanup

Before

After



No matter what style gage house you use…keep it in “tip top” shape.



Standardization of Setups and Data Collection

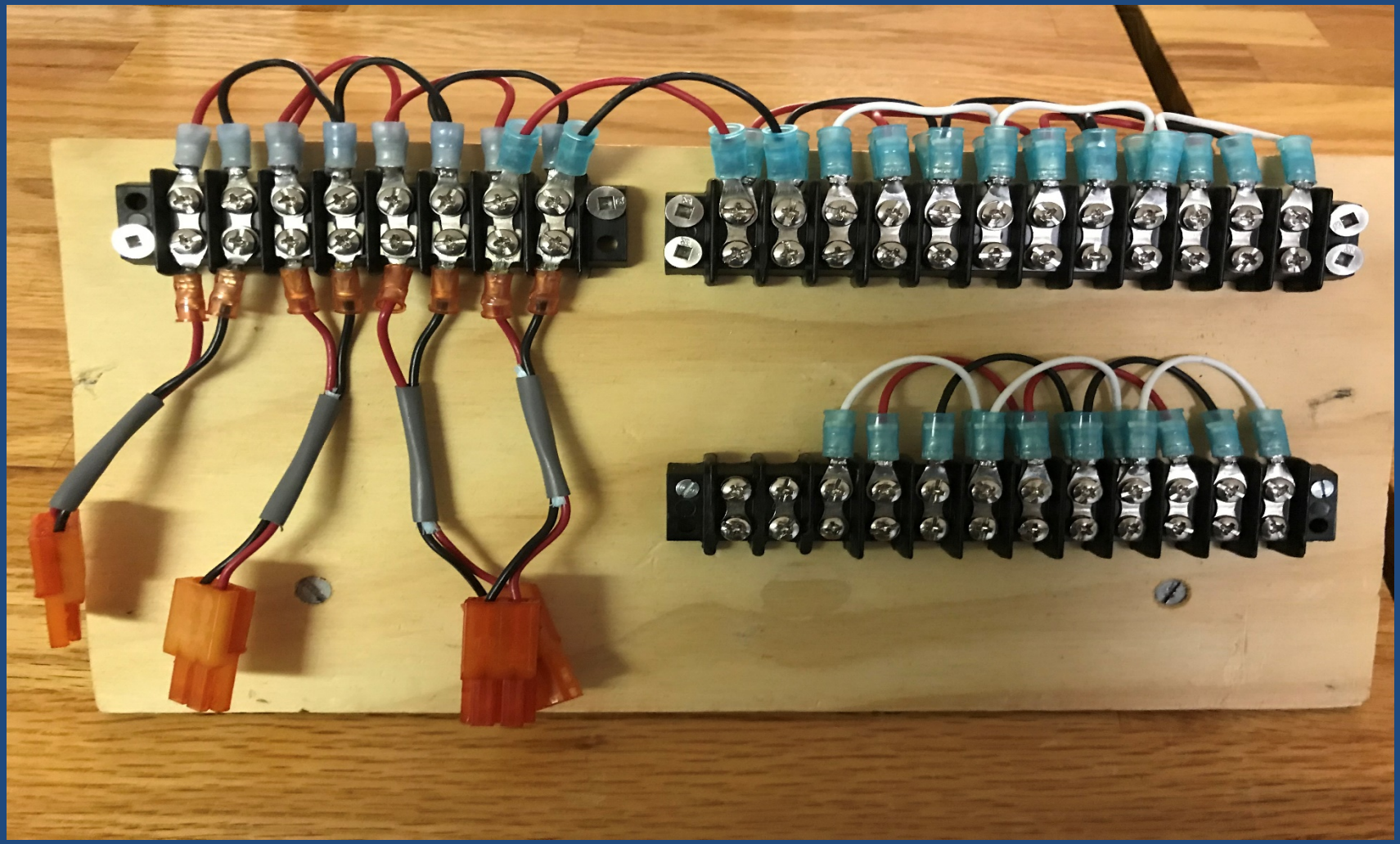
- A few setups/programs would cover most all sites in most offices
- Troubleshooting different sites becomes very “routine” and simplified
- Only a few DECODES configurations needed
- Compare “apples to apples” when looking at data from different sites
- Familiarity with “what to watch for” at sites

Useful Tools and Equipment for Field Technicians

- Electronics toolkit and multimeter
- Battery load tester
- RF wattmeter and accessories
- Spare equipment and cables
- Terminals, splices, wire/cable, etc…
- Mounting hardware, wire routing, etc…
- The well-equipped field vehicle

Cable and conduit clamps aid in the routing of wires and cables in and around the gagehouse.

Power and SDI Terminals



Electronics Toolkit

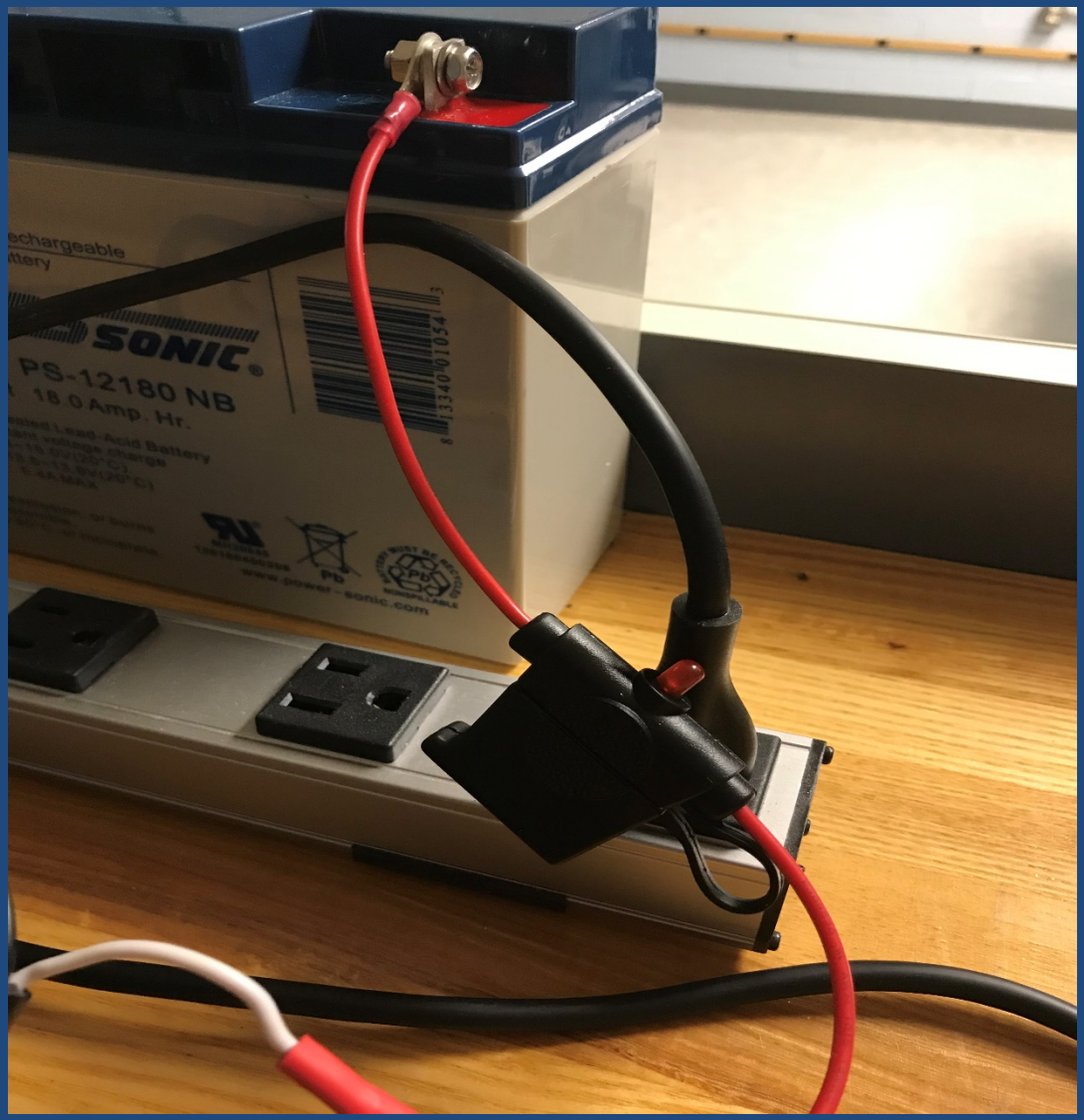
Digital Multimeter w/case and test leads

RF Wattmeter Kit

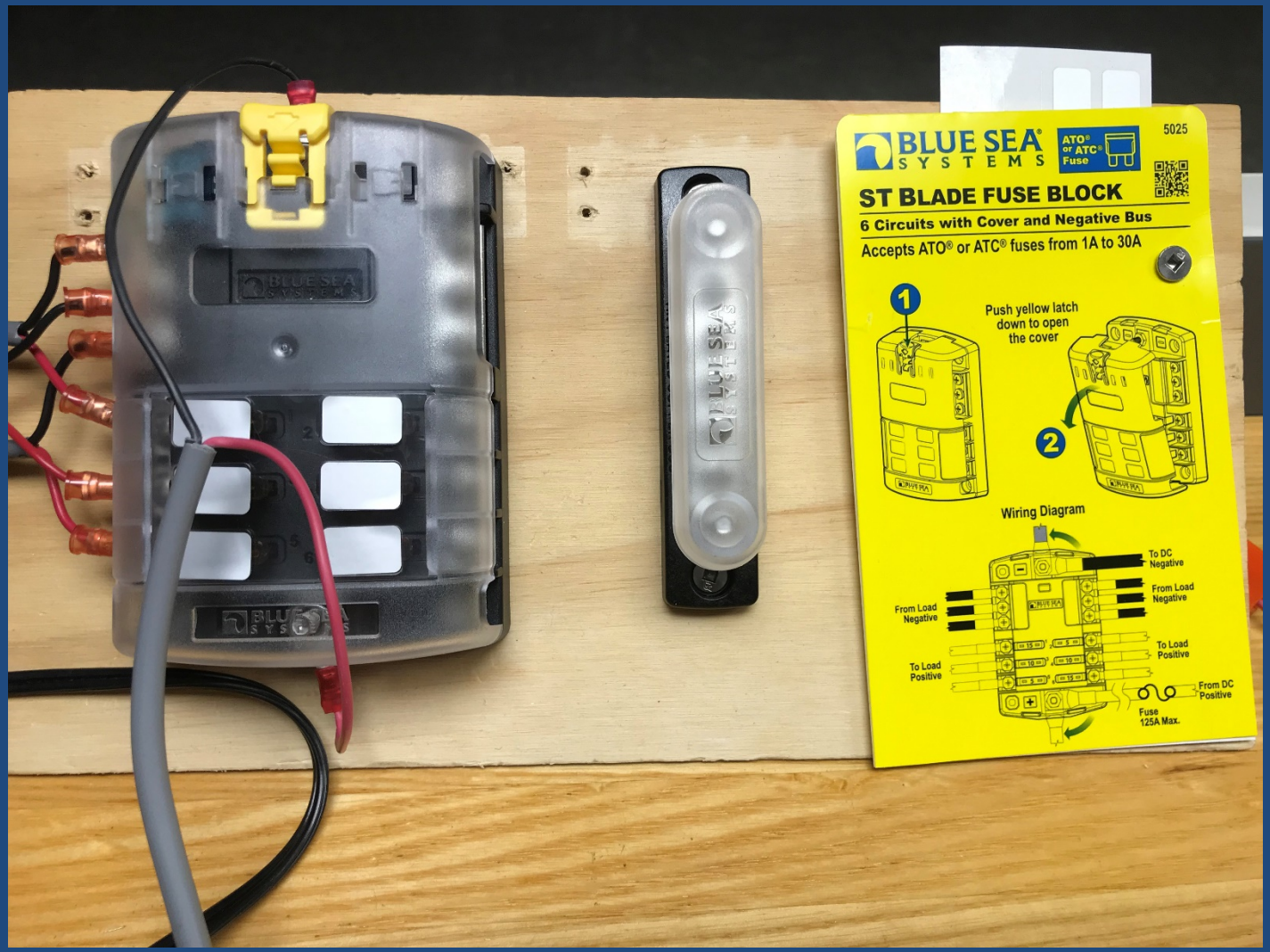
Wattmeter

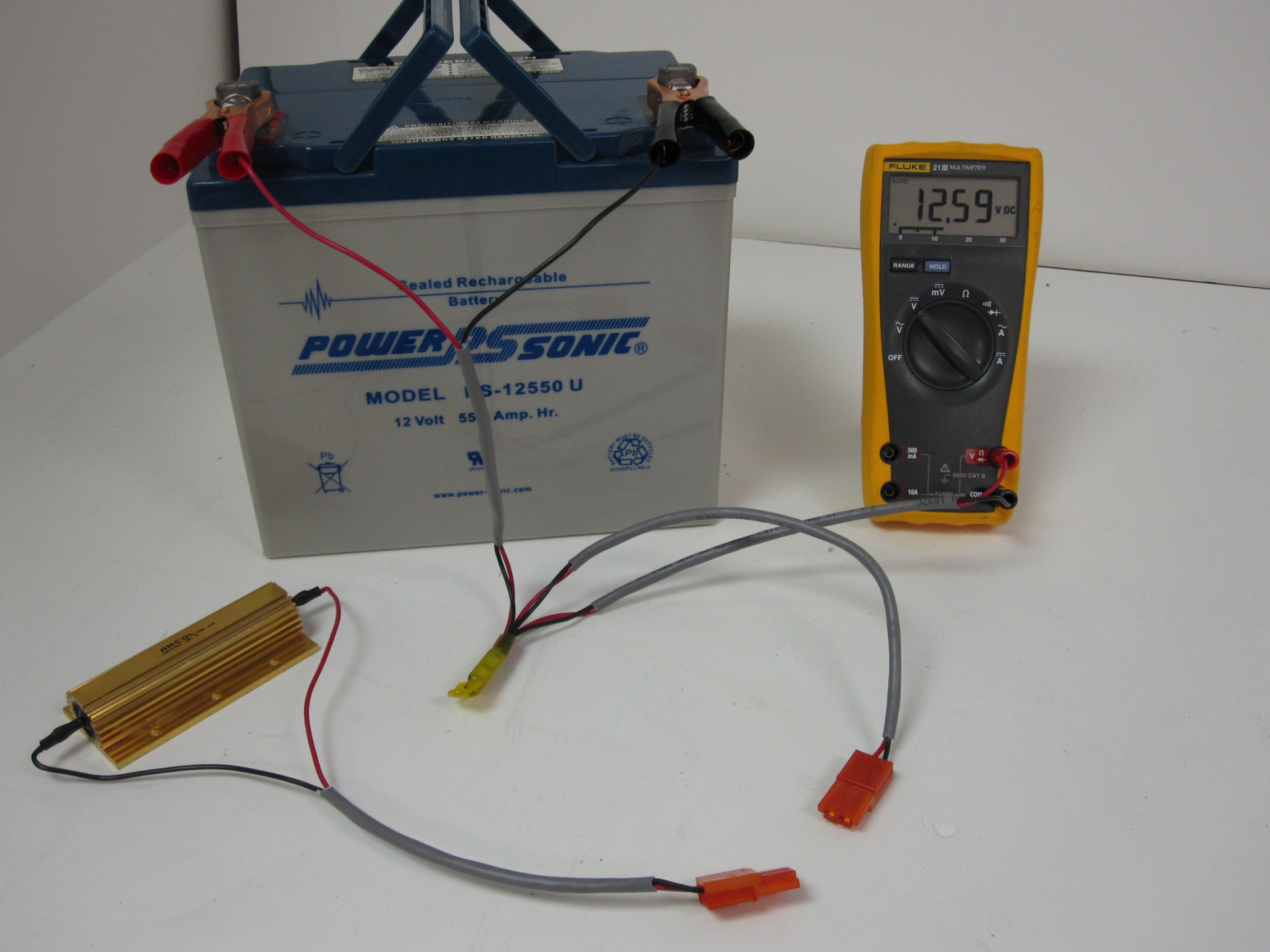

NISSEI
DIGITAL SWR METER
TX
ANT
RS-50
VHF/UHF
POWER
LIGHT
OFF/ON
OFF/ON

Battery Connections-Fused



Fuses


BLUE SEA SYSTEMS
ATO® or ATC® Fuse
5025
ST BLADE FUSE BLOCK
6 Circuits with Cover and Negative Bus
Accepts ATO® or ATC® fuses from 1A to 30A
Push yellow latch down to open the cover
Wiring Diagram
To DC Negative
From Load Negative
From Load Negative
To Load Positive
To Load Positive
From DC Positive
Fuse 125A Max.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300 mA
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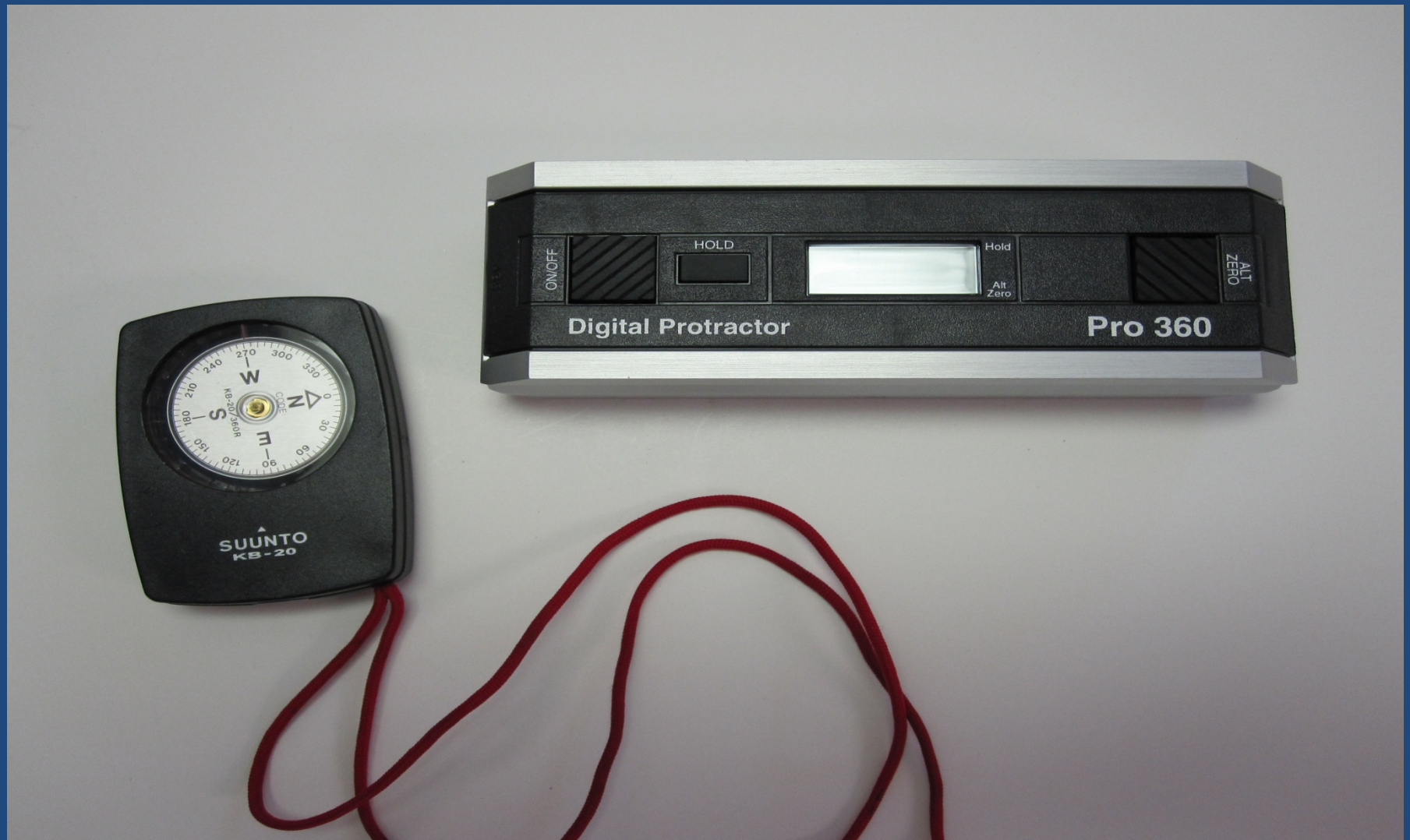
FUSED
600V CAT III
COM

Load Tester


USGS
science for a changing world
Battery
- +
Reset
Internal Load
ON
ON
External Load
HIF Load Tester

Magnetic Compass and Digital Inclinometer



SunSaver Regulators

Do you use or not use the load portion of the regulator?

The sealed or flooded jumper wire selection.

SunSaver 6 information

SunSaver 6 Voltage Regulator for Solar Panels

HIF Stk. No. 5305041

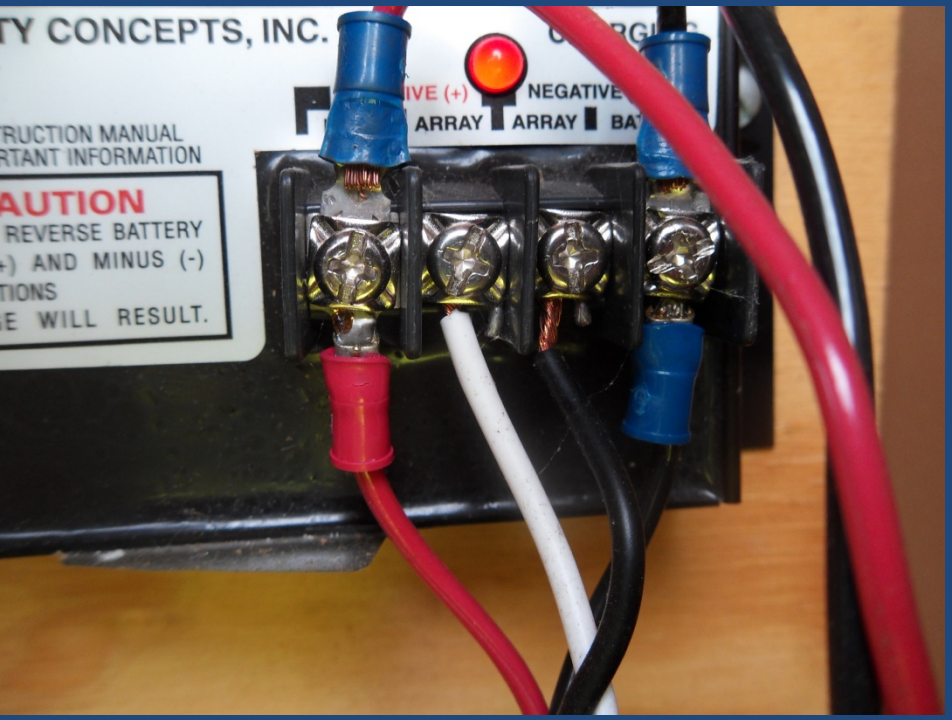
The SunSaver 6 is a 12 Volt, 6-Amp charge controller for solar panels. It uses an advanced series-switching PWM charging technique that is optimized for longer battery life. A green LED indicator will light whenever sunlight is available for battery charging. The unit weighs only 8 ounces and measures 6" x 2.2" x 1.3" and can be mounted in any orientation. Self-consumption of power is typically below 10 mA. The controller will operate from -40 to +85 °C and has a temperature-compensated charge voltage output.

Note: *Remove the tab from the SunSaver 6 for all batteries that are not gel cells. If the battery is not labeled as a gel cell, check the manufacturer's specifications. If you have a SunSaver 6 that has the load disconnect feature (P/N SS-6L-12V), the load terminals should NOT be used. This feature will protect your battery from deep discharge, but at the expense of your data. Instead, your equipment should be attached directly to the battery or to a terminal strip powered directly from the battery.*

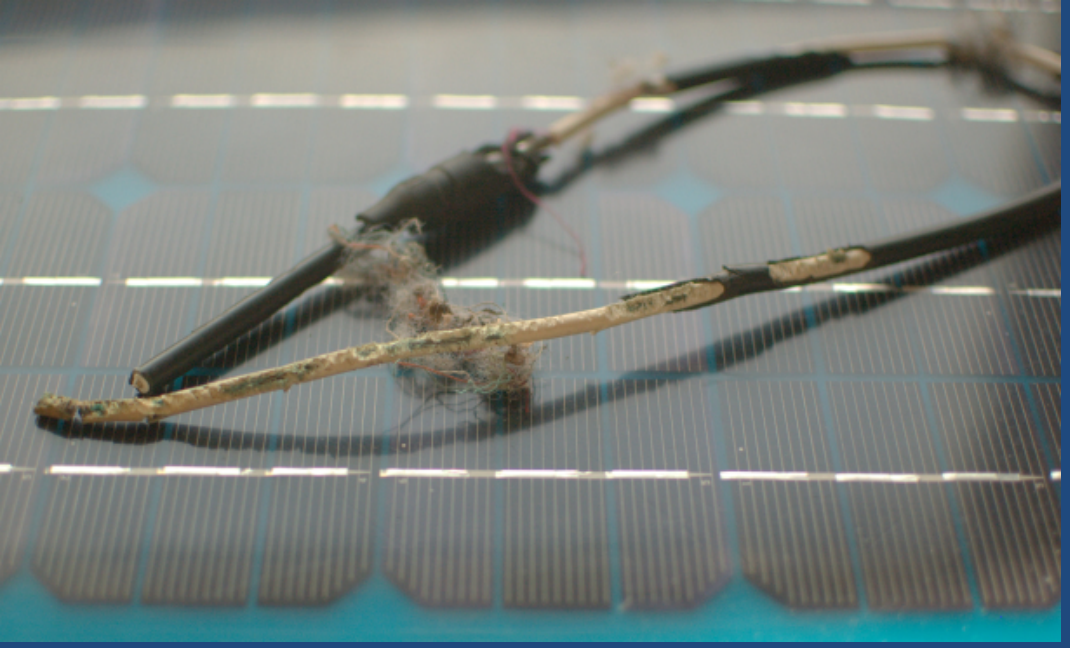
HIF Stk. No.	Product Name	Part Number
5305041	SunSaver 6 Voltage Regulator for Solar Panels	SS6

Regulator wiring control

No terminals



Multiple wires in a terminal connector



Squirrels chewed insulation

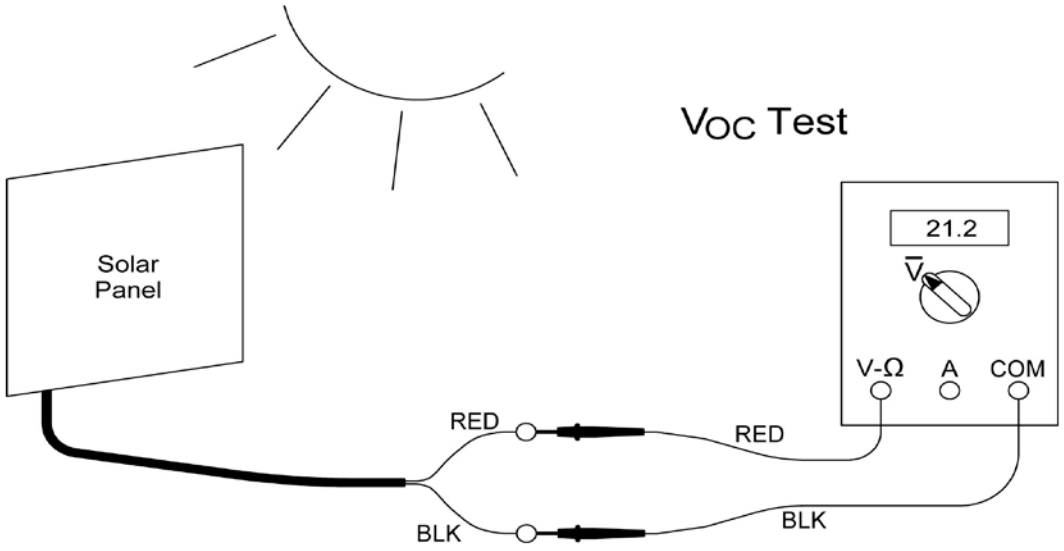
Don’t lose upto 30% of your power keep them cleaned

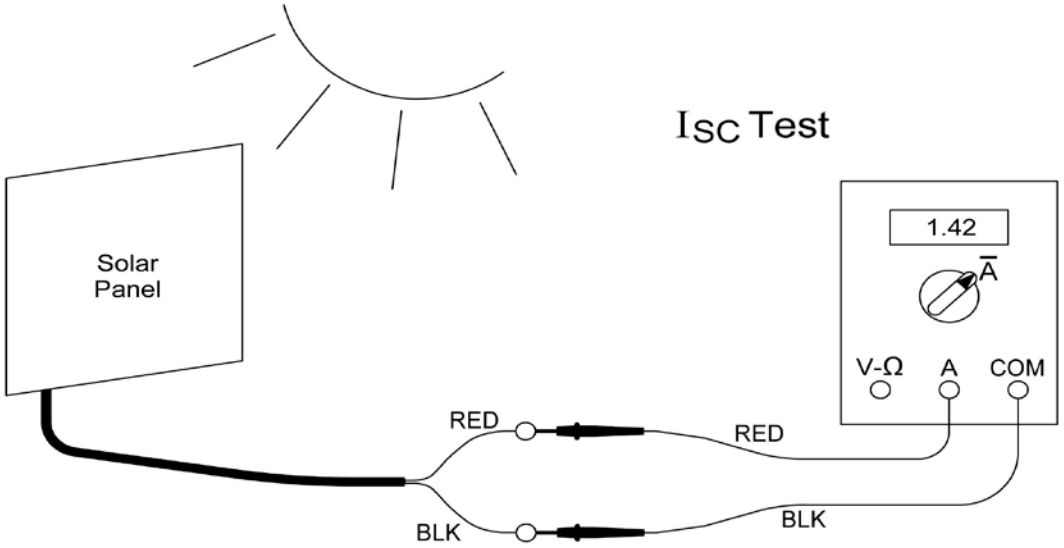
Testing Solar Panels

Solar Panel Specifications:

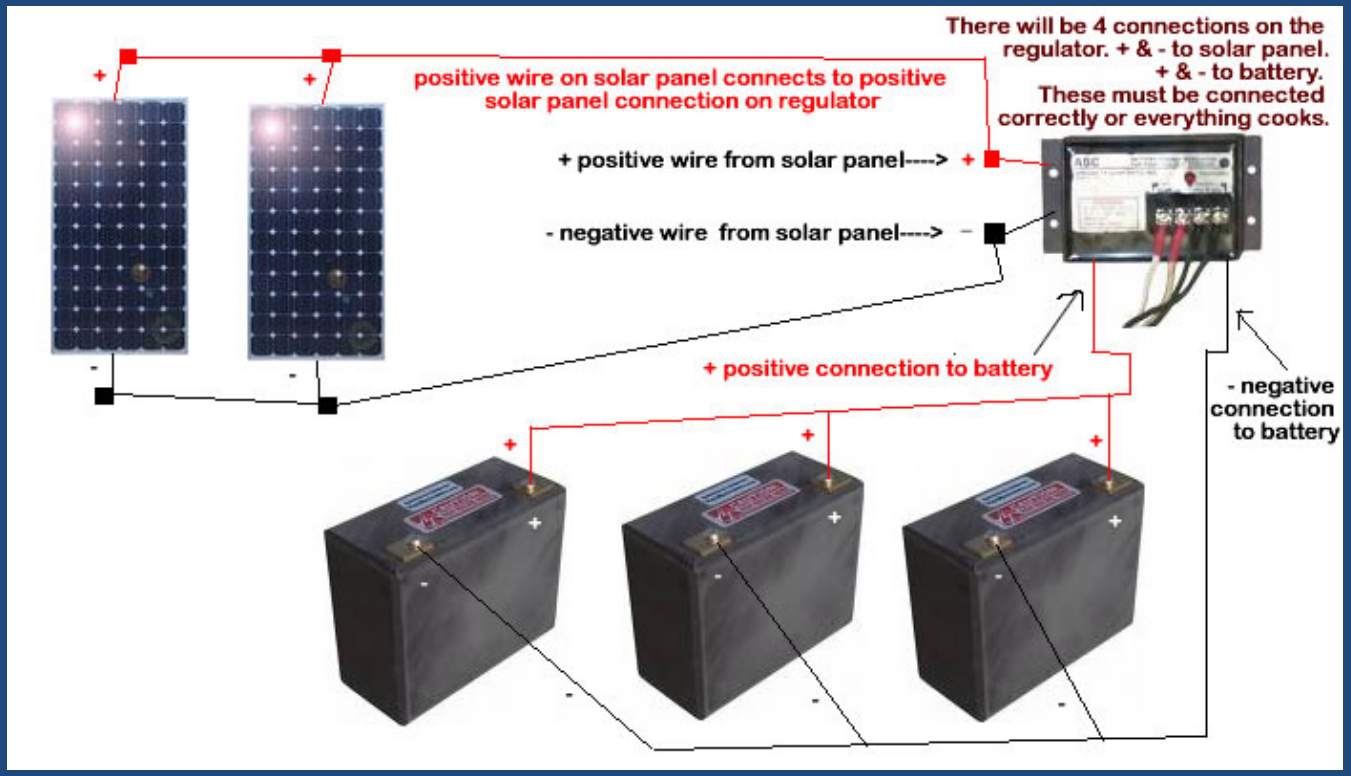
Open-Circuit Voltage V_{OC} = _____ Volts

Short-Circuit Current I_{SC} = _____ Amps

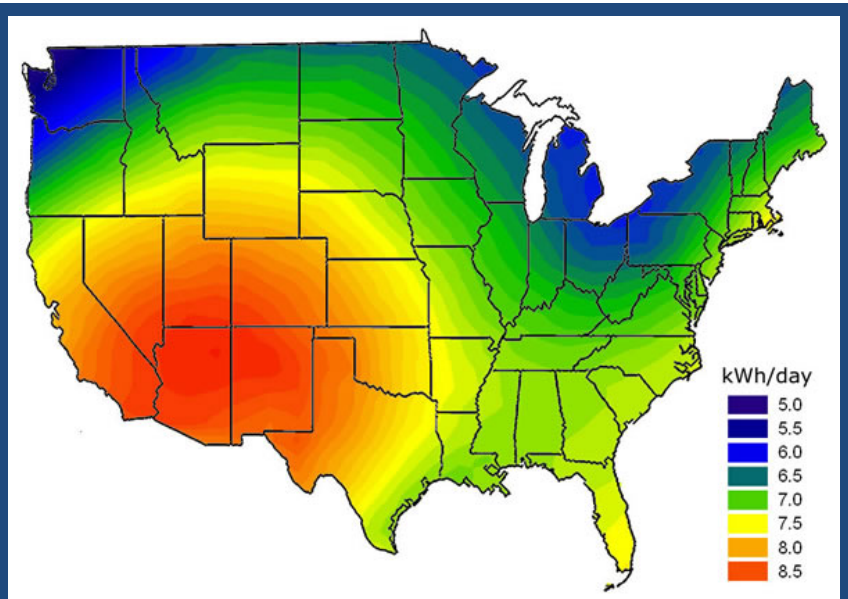




Connecting multiple panels and batteries



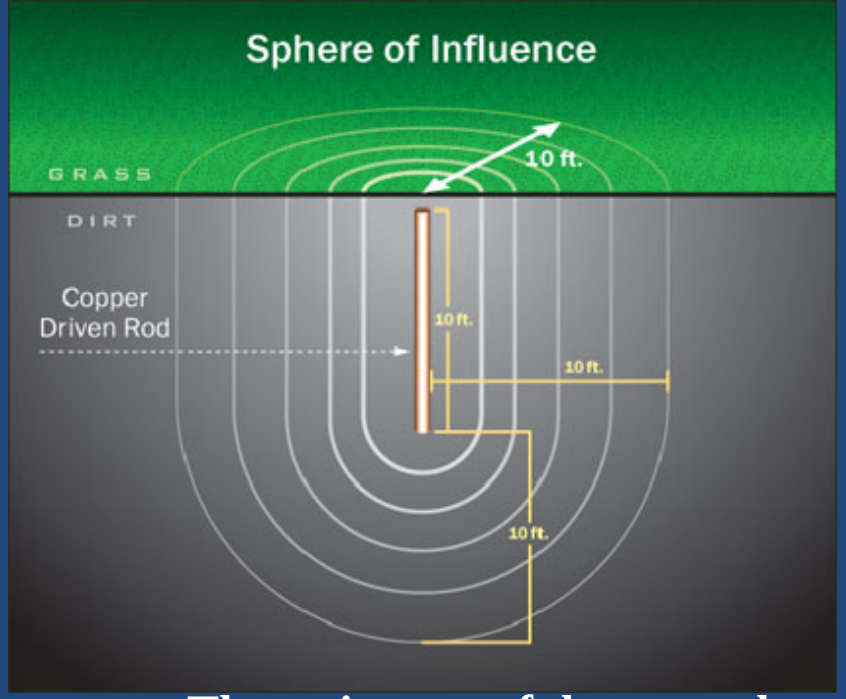
Solar Sun Chart



Grounding Practices at Field Sites

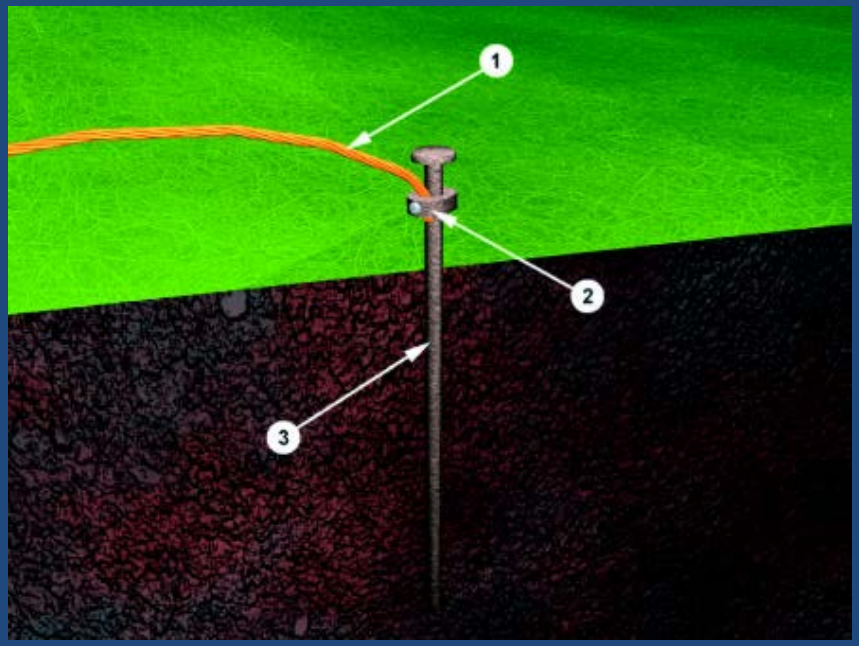
- The Earth ground electrode
- Testing an earth electrode
- Connections to the earth electrode
- Common-point grounding in the gagehouse
- Shielding of sensor and data cables
- Protective devices
- The “floating” system

Ground Electrodes



Three basic components:

1. **Ground conductor**
2. **The connection of the conductor to the ground electrode**
3. **The ground electrode itself**



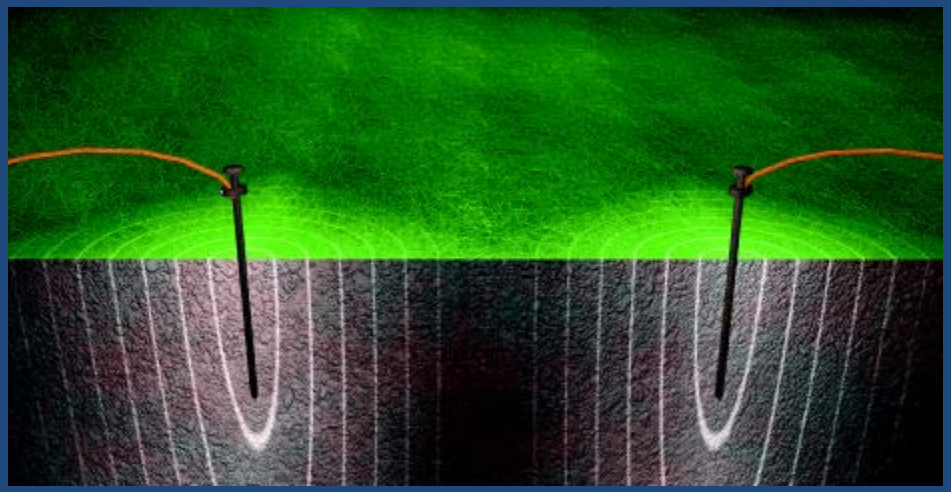
The resistance of the ground electrode has 3 basic components:

A) The resistance of the ground electrode itself and the connections to the electrode.

B) The contact resistance of the surrounding earth to the electrode.

C) The resistance of the surrounding body of earth around the ground electode.

Multiple ground electrodes



One way of lowering ground resistance is through the use of multiple ground electrodes. In this system more than one electrode is driven into the ground and connected in parallel to lower the resistance. Each ground electrode has it's own sphere of influence and for additional electrodes to be effective the spacing of additional rods needs to be at least equal to the depth of the driven rod. Without proper spacing the spheres of influence will intersect and the lowering of the resistance will be minimal and of little value.

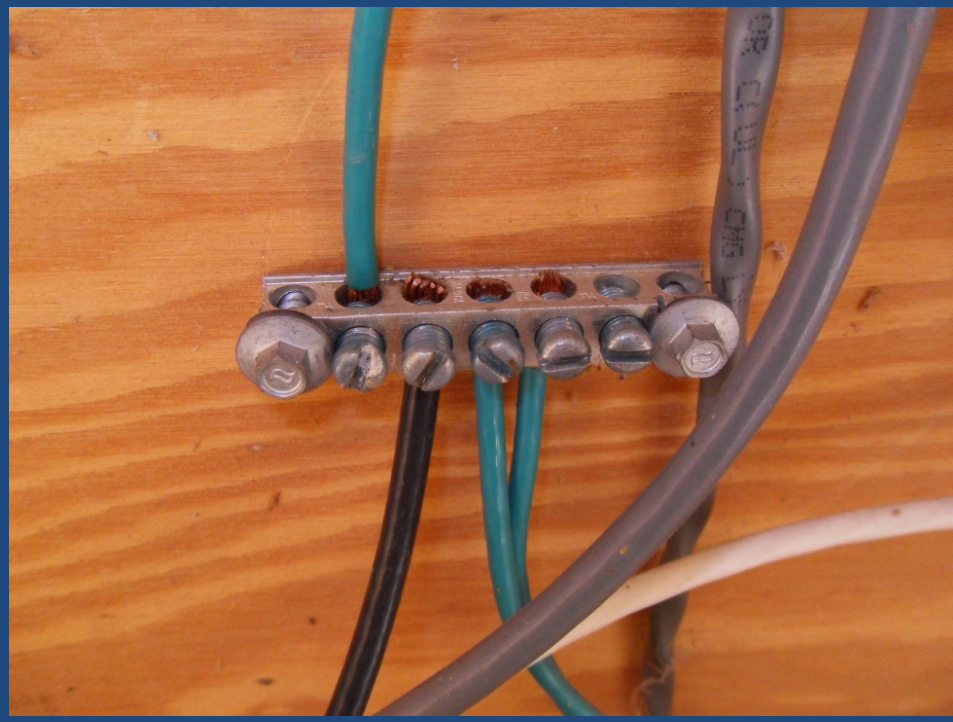
Earth Resistance Meters (Megger)

Grounding

Clamp style connection

Cad weld connection

Different ground terminal blocks



Floating System?

Contact information

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  - email rwpardee@usgs.gov