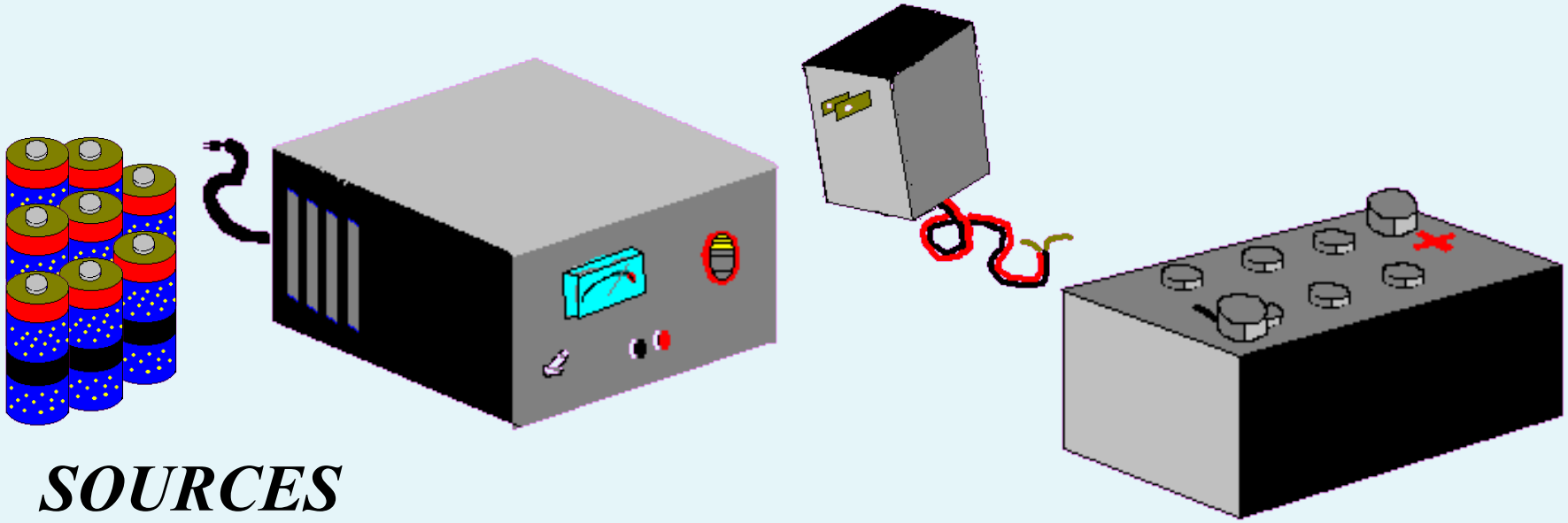
EMERGENCY MEASURES RADIO GROUP	**EMERGENCY MEASURES RADIO GROUP**
AMATEUR RADIO EMERGENCY SERVICE RAC	**OTTAWA ARES**

Two Names - One Group - One Purpose

EMRG-412
12VDC for the RADIO AMATEUR

12V DC AND AMATEUR RADIO

A GUIDE TO EVERYTHING DC RELATED



SOURCES

POWER SUPPLIES, AUTOMOTIVE, OTHER BATTERIES, OTHER SOURCES, CHARGERS

CONNECTIONS

WIRES, CONNECTORS, FUSES, HOLDERS, INSULATION

LOADS

RADIOS, RATINGS, LAMPS,OTHER APPLIANCES, SAVING POWER, NOISE

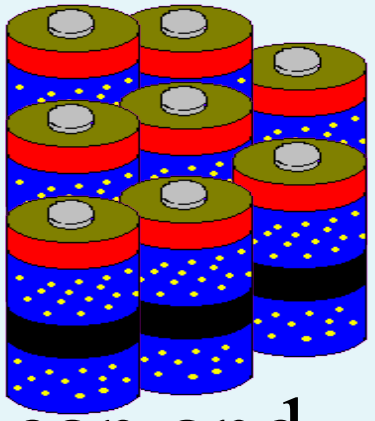
SOURCES

MANY SOURCES OF DC:

- **Batteries** –Rechargeable vs Primary: When? Li-Ion, Ni-Cd ,"Gel Cell", Ni-MH (Metal Hydride)
- **12v supplies** running off of AC mains
- **Automotive Power-** Lighter Sockets etc.
- **Others**.. Gas powered Generators, Solar, Wind ..Can you use a battery charger as a supply?

SOURCES -BATTERIES

- **Primary**: The chemical reaction only goes one way. Most common these days is the Non-Rechargeable Alkaline



- **ADVANTAGES:** Relatively cheap and has a long storage life. Available anywhere.

- **DISADVANTAGE:** High cost per use despite low initial cost.

SOURCES- BATTERIES cont'd

Secondary, better known as rechargeable: The chemical reaction can be reversed by pushing current back through the battery.

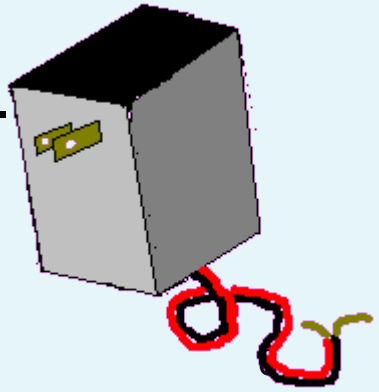
- **ADVANTAGES:** Cheap per use. Good if you use the radio all the time.

- **DISADVANTAGES:** Charge decays with time. Requires periodic recharging. Some types drop off suddenly. Some (rechargeable alkaline) have low peak current capability.

SOURCES- BATTERIES cont'd

Note:, No Ni-Cd battery you will see today has any "memory". What people perceive as memory is really ***burnout***. People leave their batteries on charge wa-a-y too long . The batteries overheat. The electrolyte vents out, leaving behind a battery with less capacity.

A cheap charger is enemy #1 for a Ni-Cd or Ni-MH battery. If you have one of these, try using a timer with it.



SOURCES- BATTERIES cont'd

How Much Battery Capacity?

What if you want to run your rig on a lead acid battery. What do you need to know before you get one?

SOURCES- BATTERIES cont'd

How Much Battery Capacity?

RTFM: Find the transmit and receive current for your rig (if multiple rigs, use the highest and sum receive currents.)

Specifications: General

Frequency Range: see Version Chart below

Channel Steps: 5, 10, 12.5, 15, 20 & 25 kHz

Frequency Stability: < +/– 5 ppm from –5 to +50 °C

Mode of Emission: F3

Antenna Impedance: 50 ohms, unbalanced

Supply voltage: 13.8V DC +/– 15%, negative ground

Current Consumption (typical):
Rx: 600 mA, Tx hi/low: 11.5/4A (2m), 9/3.5A (70cm)

Operating Temperature Range: –20 to +60 °C

Case Size (WHD): 140 x 40 x 155 mm (w/o knobs)

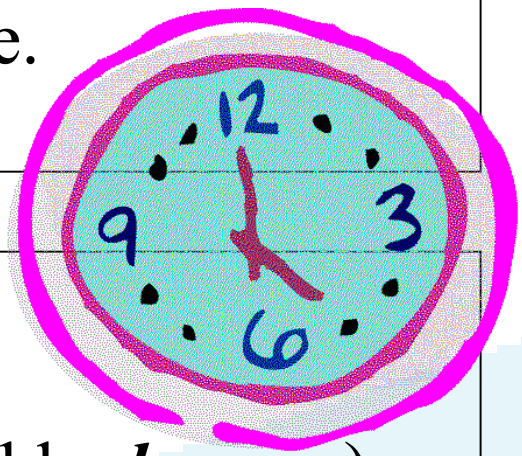
Weight: 1 kg (2.2 lb)

SOURCES- BATTERIES cont'd

How Much Battery Capacity?

Example rig draws 11.5A on transmit, 0.6A on receive

If you are "Net Control", assume a 50% duty cycle.
If you aren't NCS, use a lower duty cycle.
(maybe 25% to start)



How long will you be on station before you can recharge?
(assume 24 hours unless you know it will be ***longer***.)

SOURCES- BATTERIES cont'd

How Much Battery Capacity?

If you aren't transmitting, you are listening

You need (11.5 X 50%) + (0.6 X 50%) X 24 hours = 145.2 Ampere Hours.

Since it isn't a good idea to take more than 50% of the charge out of a lead acid battery, divide this by 0.5 = **290 AH ! This is a serious battery.**

SOURCES- BATTERIES cont'd

How Much Battery Capacity?

Do you **NEED** that much capacity?

Maybe, if you make a habit of operating off the battery often, for long periods of time.

If you are only going to run on the battery for a few days per year, you can likely get by with less.

The deeper a battery is discharged, the fewer cycles it will last.

SOURCES- BATTERIES cont'd

How Much Battery Capacity? (What's an AH?)

"10AH"	Duration						
	20H	10H	5H	3H	1H	30m	20m
Current	**.5 A**	.9 A	1.5A	2.2A	5 A	7.5A	10 A
Capacity	**10AH**	9AH	7.5AH	6.6AH	5AH	3.7AH	3.3AH

How does this relate to the automotive "Cold Cranking Amps", or Reserve Capacity?...

SOURCES- BATTERIES cont'd

AUTOMOTIVE BATTERY RATINGS:

- Cold Cranking Amps: Current it can provide for 30 seconds without dropping below 7.2 V at -18˚C/0˚F **(not too useful a measure for us)**
- Marine Cranking Amps, Cranking amps same as cold cranking amps except at 0˚ C/32˚F **(ditto)**
- Reserve Capacity: Time it can supply 25A while remaining above 10.5V@ 25.7˚C/80˚F
- AH =approx. Reserve Capacity X 0.6 **(This is a number we can work with)**

SOURCES- BATTERIES cont'd

OTHER BATTERIES

•USED BATTERIES FROM ALARM SYSTEMS, UPS SYSTEMS
Maybe OK, maybe not depending on the charge system used before replacement.
Check the open circuit voltage before accepting/ buying

•ALL IN ONE BATTERY BOOSTER PACKS/ INVERTERS/ POWER PACKS
May be OK, but I haven't had much luck with them.
Chargers seem mediocre, and the batteries seem to be pretty old by the time they make it into the sales flyer.

SOURCES- CHARGERS

Battery chargers:

•Often put out really bad D.C.

•Often can't supply enough current to run the radio.

•So...
Charge the battery, then remove the charger ... and run the radio.

SOURCES- CHARGERS

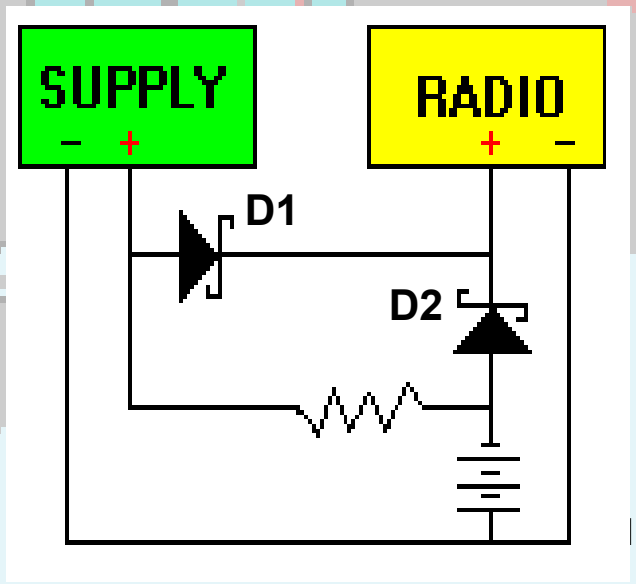
When float charging: Consider setting the maximum voltage below the **limit** You will never fully charge the battery that way, but you will never kill it, either.

Which is more useful to you, a battery well charged to 80% of its capacity, or one that has 5% capacity because the electrolyte has been driven off by overcharging?

SOURCES- AC SUPPLIES

Regulated Power Supplies:

- An excellent way to get DC, ***IF*** you have AC.
- Can be used to float charge a battery.
- Can be wired so the battery takes over "if" AC fails.



SOURCES- AUTOMOTIVE

- Direct to battery, or through “Lighter socket”? (is it your vehicle or someone else’s?)
- Either way, Ensure it is fused correctly
- Try to have extra noise filtering on hand.
- Remember the cable run is always longer than you think it is. (See “connections”.. later)

SOURCES- AUTOMOTIVE

Try to route the wiring directly from battery + and – to the rig.
Keep wires away from:

.Motors, the ignition system, other noise makers
.Computers, Airbags or other susceptible systems.
.Moving or Hot parts
.Antenna cables – Your own or the broadcast set.

SOURCES- AUTOMOTIVE

Finding a place to run the cable isn't always really easy. My preferred route in vehicles I don't own is through the door edge. If you own the vehicle, look for an existing opening in the firewall. If none are available, look carefully AT BOTH SIDES before drilling through it. Make the hole big enough for your DC cable as well as a grommet or other protection

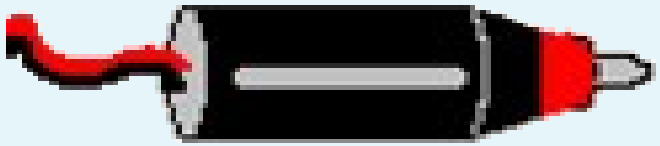
- Speaking of protection.. **Fuse at the battery**

To protect against shorts along the cable run.

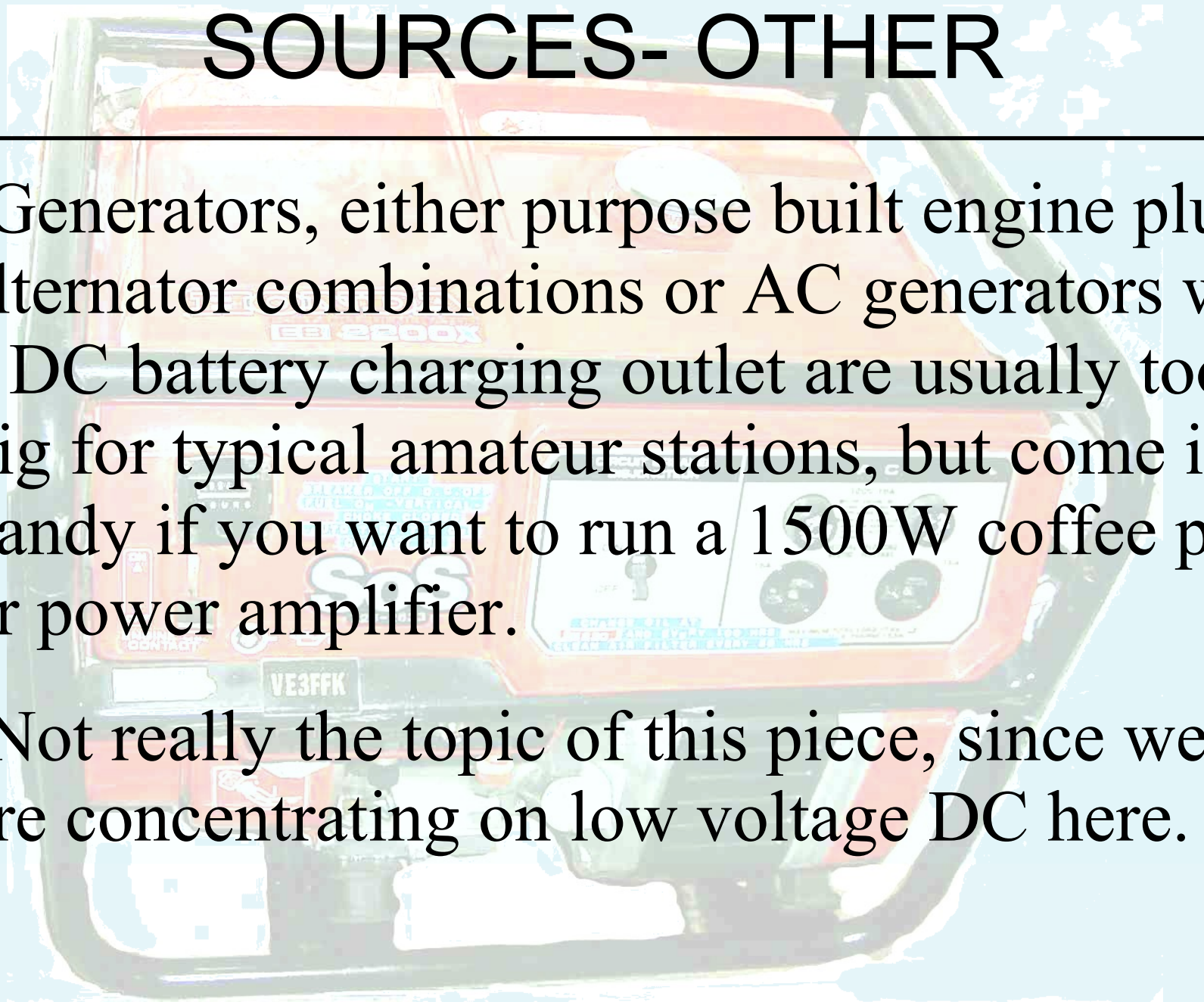
SOURCES- AUTOMOTIVE

- No matter where you get your DC from in a car, expect it to be noisy. Record your audio as received and listen for alternator or other noise.

- Lighter sockets aren't built with any means of retaining the plug. Therefore it WILL vibrate out over time. This is more of a problem with higher power systems where the wire is heavier.



SOURCES- OTHER

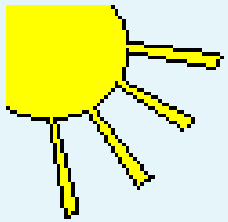


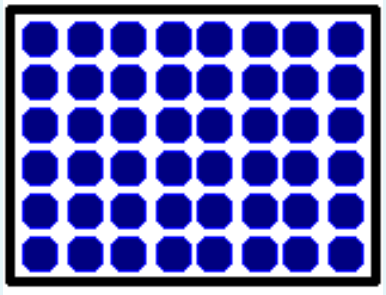
- Generators, either purpose built engine plus alternator combinations or AC generators with a DC battery charging outlet are usually too big for typical amateur stations, but come in handy if you want to run a 1500W coffee pot, or power amplifier.
- Not really the topic of this piece, since we are concentrating on low voltage DC here.

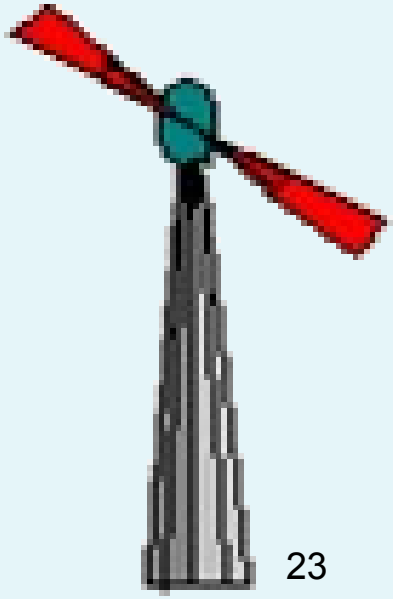
SOURCES- OTHER

•Solar panels, wind and manually cranked generators are an OK, if expensive source of DC to recharge your batteries -- if you plan on being away from commercial mains for a month or more.

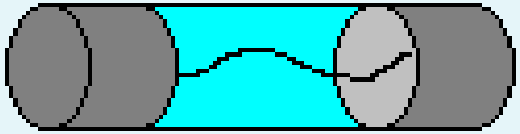
•Give it a ***lot*** of thought before going that route.





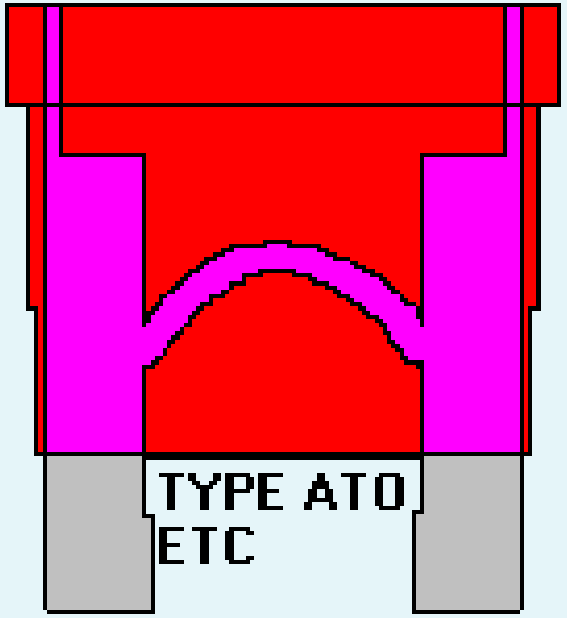


CONNECTIONS -FUSING



Pick a fuse appropriate for the wire size and current you are running.

.Fuse at about 150% of the maximum current you will use.

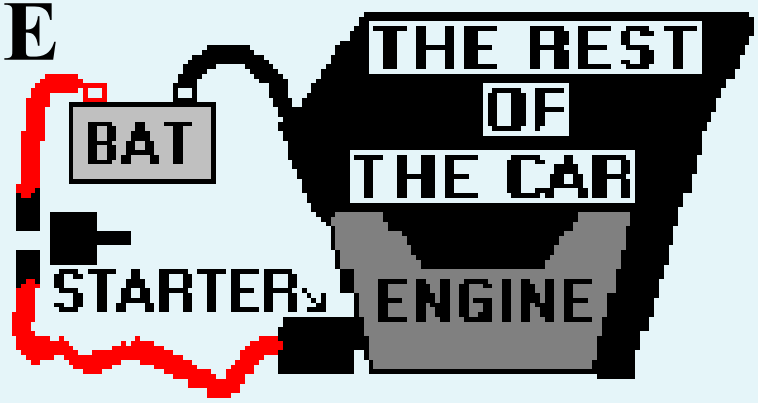


.Use a **LOW VOLTAGE** Fuse.

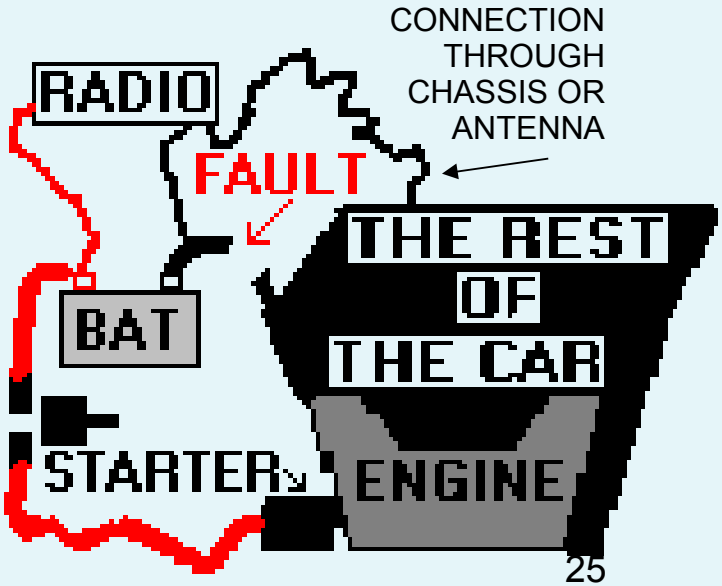
I now prefer ATO because they are easier to identify and test, and are more vibration resistant than glass types. Use which ever you like, but bring spares.

CONNECTIONS -FUSING

WHEN AND WHY YOU FUSE A RADIO NEGATIVE LEAD



1. It does no harm.
2. If your radio is connected directly to the battery AND the vehicle's ground system fails, the starter return current may travel through your radio negative lead.



CONNECTIONS- Wires

Wire size required to keep voltage drop below 3% in a 12V system							
Power	Current	**Distance- Battery to Radio (Feet)**					
(Watts)	(Amps)	10 Ft.	15 Ft.	**20 Ft.**	30 Ft	40 Ft.	50 Ft.
60	5	14 Ga	12 Ga	10 Ga	10 Ga	8 Ga	6 Ga
120	10	10 Ga	10 Ga	**8 Ga**	6 Ga	6 Ga	4 Ga
180	15	10 Ga	8 Ga	6 Ga	6 Ga	4 Ga	2 Ga
240	20	8 Ga	6 Ga	6 Ga	4 Ga	2 Ga	2 Ga
300	25	6 Ga	6 Ga	4 Ga	2 Ga	2 Ga	1 Ga

CONNECTIONS -Wires

I use speaker wire for a lot of my DC wiring because it:
--is big enough (10-12Ga)
--has thick insulation
--is relatively cheap, compared to red/black zip cord.

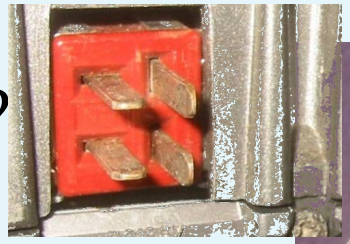
I can tell the difference between the + and – conductors.

In any case, always use stranded **(not solid)** wire for mobile installations. 12 Ga House wire may be OK for wiring the home station with DC, but the vibration in a car or truck will kill it in short order.

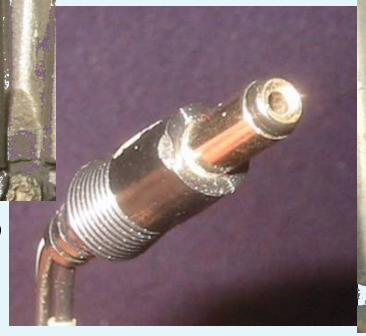
CONNECTIONS -Connectors

We mentioned lighter plugs earlier. What does *your* rig need?

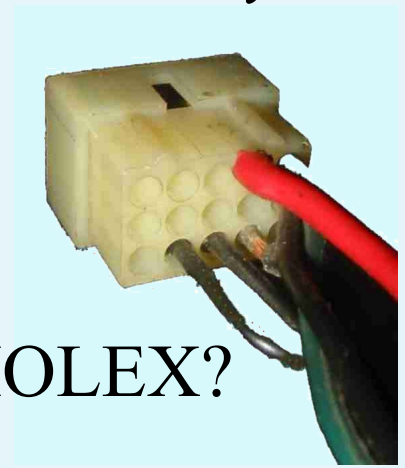
JONES?



COAXIAL?



MOLEX?



POWER POLE?

If you want to be able to interchange rigs and power supplies in an emergency, find out what everyone else is using and make an adaptor from yours to theirs...

Around here the standard is the Anderson Power Pole

CONNECTIONS -Connectors

If no local common connector, look for one that:

- Can't be confused with something else.

- Can't be connected backwards

- Handles all the current you might want

- Can be locked together

- Cheap, available and water proof (can't have everything)

LOADS

- WHAT 12V DC REALLY MEANS check your specs.
- This rig will work on 15.87 to 11.73 V but the power out is specified at 13.8 V

Specifications: General

Frequency Range: see Version Chart below

Channel Steps: 5, 10, 12.5, 15, 20 & 25 kHz

Frequency Stability: < +/- 5 ppm from –5 to +50 °C

Mode of Emission: F3

Antenna Impedance: 50 ohms, unbalanced

Supply voltage: 13.8V DC +/- 15%, negative ground

Current Consumption (typical):
Rx: 600 mA, Tx hi/low: 11.5/4A (2m), 9/3.5A (70cm)

Operating Temperature Range: –20 to +60 °C

Case Size (WHD): 140 x 40 x 155 mm (w/o knobs)

Weight: 1 kg (2.2 lb)

LOADS

- The power output of the rig in this example is 50W. It's input current is 11.5 A and the supply is 13.8 V
- This means the input power is 158.7 W, which means the rig itself must get shed over 100W worth of heat.
- The fan on the back doesn't look big enough all of a sudden.
- Now stuff the rig into a dash board, right in front of the heater. Better yet, put it on top of the dash, in the sun. They make heatsinks black so they radiate better, but a good radiator is also a good absorber of heat.

LOADS

•Depending on the situation, you may also be running a fan, or a lamp. Look for an LED lamp, rather than a regular incandescent.

•In some situations, I use a "seat heater" designed for automotive use. It costs me another 3 amperes.

•In some (car rally) situations you may also have to power a light bar or siren.

•Use a good antenna and low power, rather than high power and a crappy antenna. It has other dividends too.

SAFETY

Although it is theoretically possible to electrocute yourself with 12V DC, I've never met anyone who has killed themself this way.

•Your biggest hazard will be heat, from conductors (rings or wrenches) getting across an unfused source. **(ie battery terminals)**

•Related to this is the fire hazard. Imagine a short in a Gell Cell pack in your vest pocket (been there, done that) or on your belt.

•There are a few ways to make a battery explode in your face. -Avoid them.* Keep the acid out of your eyes too.

•Lead is heavy, don't drop it on your toes, even if you ***are*** wearing safety boots. Orange crates are ***light duty*** shelving.

*Over charge a battery in a confined space, and create a spark while doing so. Short the battery, and leave it shorted. For an extra kick, seal the vents.

SAFETY

YOUR BEST BETS for an unexciting installation**:**

•FUSE EARLY AND OFTEN -Put a big fuse at the battery (it only has to protect against a "dead short"). Use another one near the rig, sized to the radio manufacturers recommendations.

•USE INSULATED TOOLS when hooking up the battery. Wrap a few layers of tape around the handle of the wrenches you use.

•LOSE THE BLING. Rings, metal watchbands, bracelets and neclaces are a bad idea when working around automotive batteries. If the ring won't come off, cover it with a layer of tape.

•WATCH THE ROUTING. Make sure the wire won't be crushed or grounded when you close the hood, door or window.

– Wrap Up

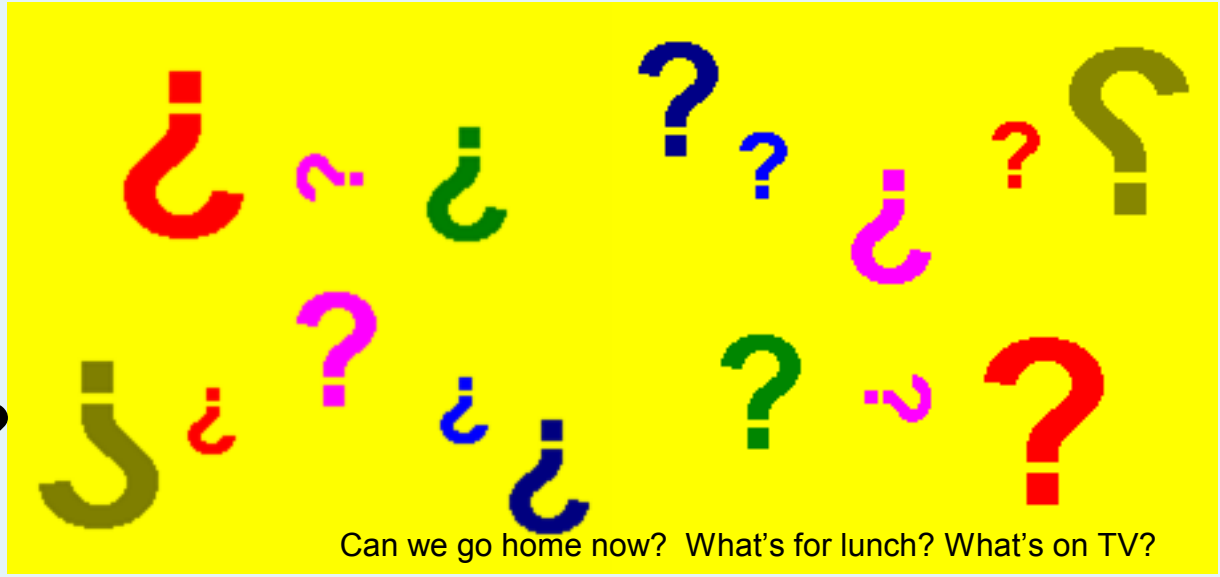
- Use big wire and a big battery
- Fuse early and often
- Standardize your power connectors

- Charge early and often
- Keep cool

..ZZZ?

..ZZZZ

QUESTIONS?



Can we go home now? What's for lunch? What's on TV?

CHARGERS and TEMPERATURE

Temp ˚ C	Voltage
50	13.80
40	13.98
30	14.19
25	14.34
20	14.49
10	14.82
0	15.24
-10	15.90
-20	17.82

When float charging *: The charger should be set 0.6V lower than the table at left.

*FLOAT CHARGING = Leaving the battery and charger connected for a long time.

(BELOW -20c NOT MUCH HAPPENS)

www.emrg.ca

The EMRG web site provides information related to Amateur radio emergency communications, specifically as it relates to the City of Ottawa.

- Project Information
- Newsletters
- Upcoming Events
- Documentation
- Links to related information

Information: training@emrg.ca