



The Forgotten Part of Your Station: Your Power Supply

Dale Henninger – W0DHz



Power is the most overlooked part of the station



Distorted audio and splatter

Low voltage on transmit peaks makes the final amplifier run out of headroom.



Less power than you paid for

A 100 W radio fed 12 V delivers roughly 75 W of clean output.



Warm wires and connectors

Heat is wasted power, and a hot joint is a failing joint.

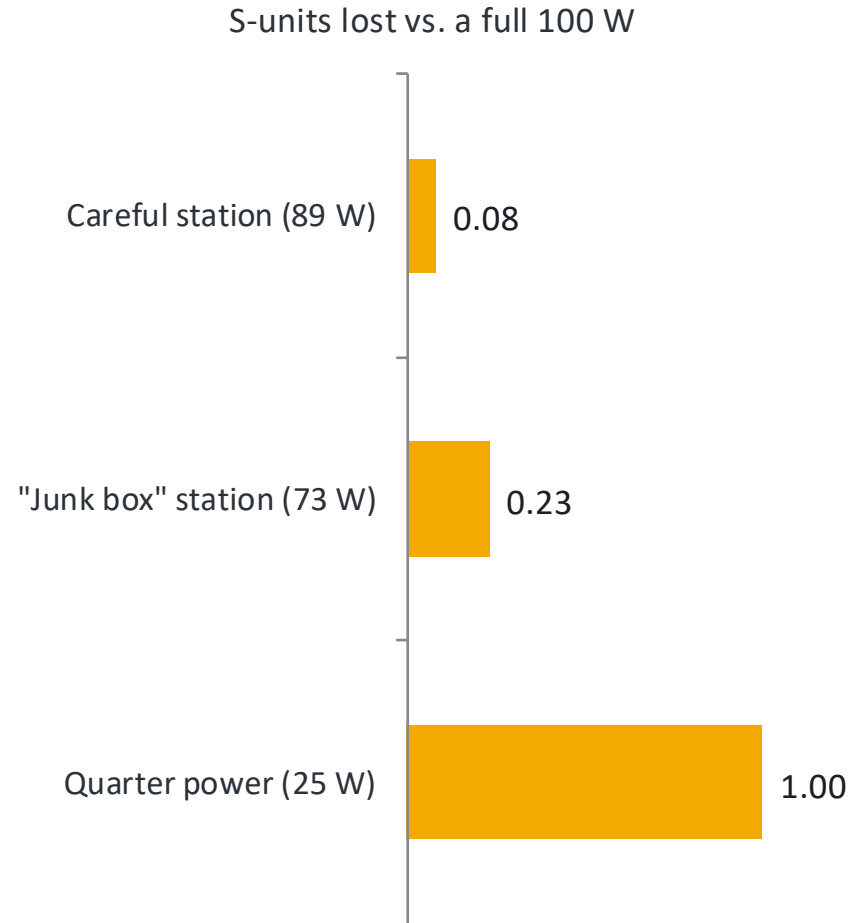
Power isn't everything, but every watt counts

75 W

must be lost from 100 W to drop your signal one S-unit at the other station

1 S-unit = 6 dB = ¼ the power
100 W → 25 W

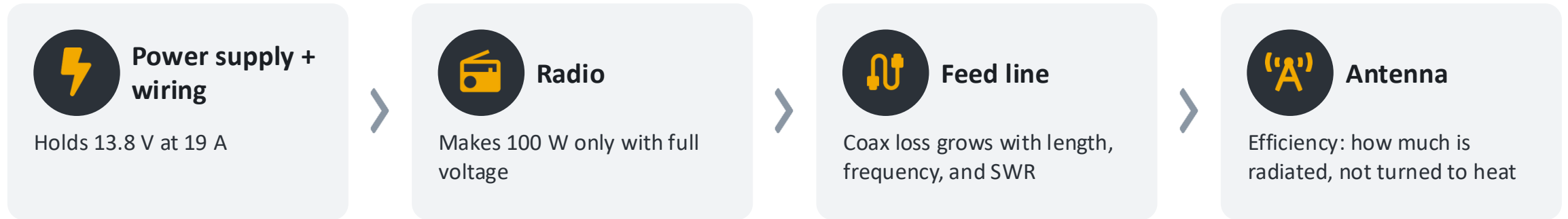
Many S-meters are not calibrated to 6 dB per unit, so treat this as the standard, not your meter.



Why it still matters

- Losses stack: power wiring, feed line, connectors, and SWR all add up in dB
- On a weak or fading path, a fraction of an S-unit can decide whether you are copied
- Low voltage also costs signal quality: splatter and distorted audio
- Wasted watts become heat in your wiring

Your station is a chain: every link costs signal



✓ Careful station

13.05 V

careful wiring

89 W

−0.5 dB

79 W

100 ft LMR-400, low SWR

75 W

full-size dipole, ~95%

✗ Station with losses everywhere

11.76 V

thin, long wiring

73 W

−1.4 dB

41 W

100 ft RG-58 at 3:1 SWR

21 W

compromise antenna, ~50%

Radiated: 75 W vs. 21 W. No single link looks terrible, but together they cost the second station more than one S-unit (−6.9 dB).

What your radio needs at its power jack

13.8 V

nominal supply voltage

11.7 – 15.9 V

allowed range ($\pm 15\%$)

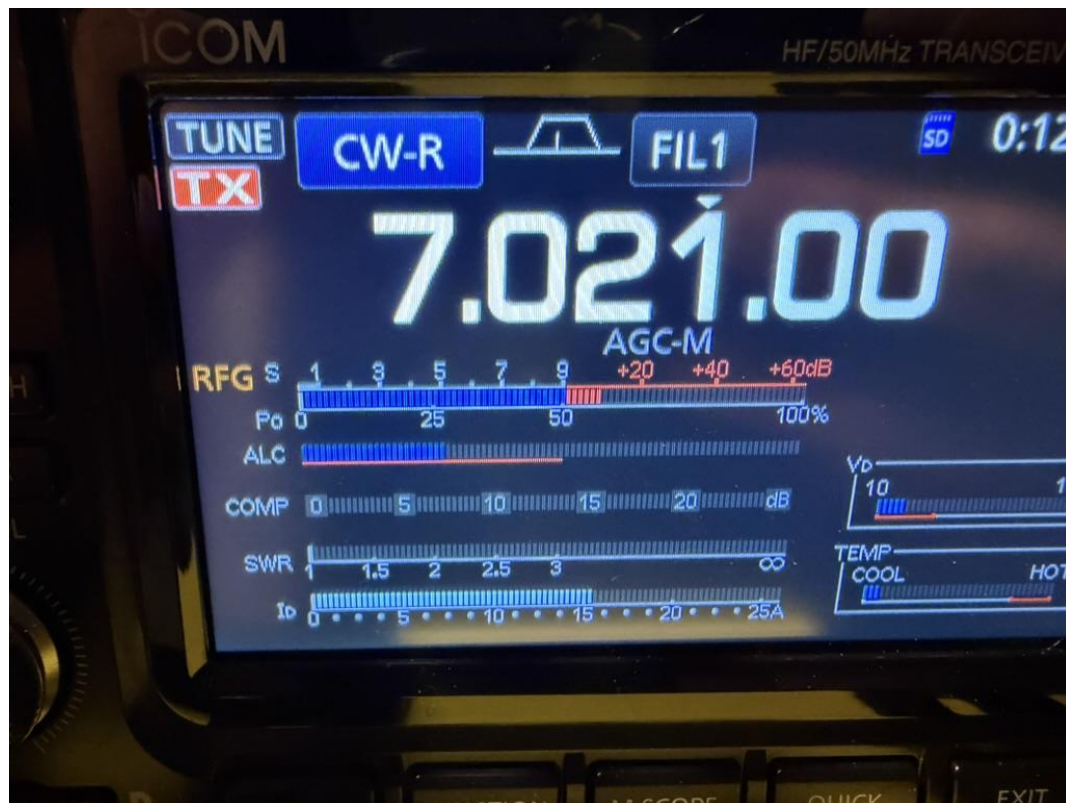
17 – 19 A

draw at 100 W transmit

Voltage and current together: a supply that holds 13.8 V at 5 A but sags at 19 A does not meet the radio's needs.

Measure at the radio, not at the supply. Everything in between subtracts voltage.

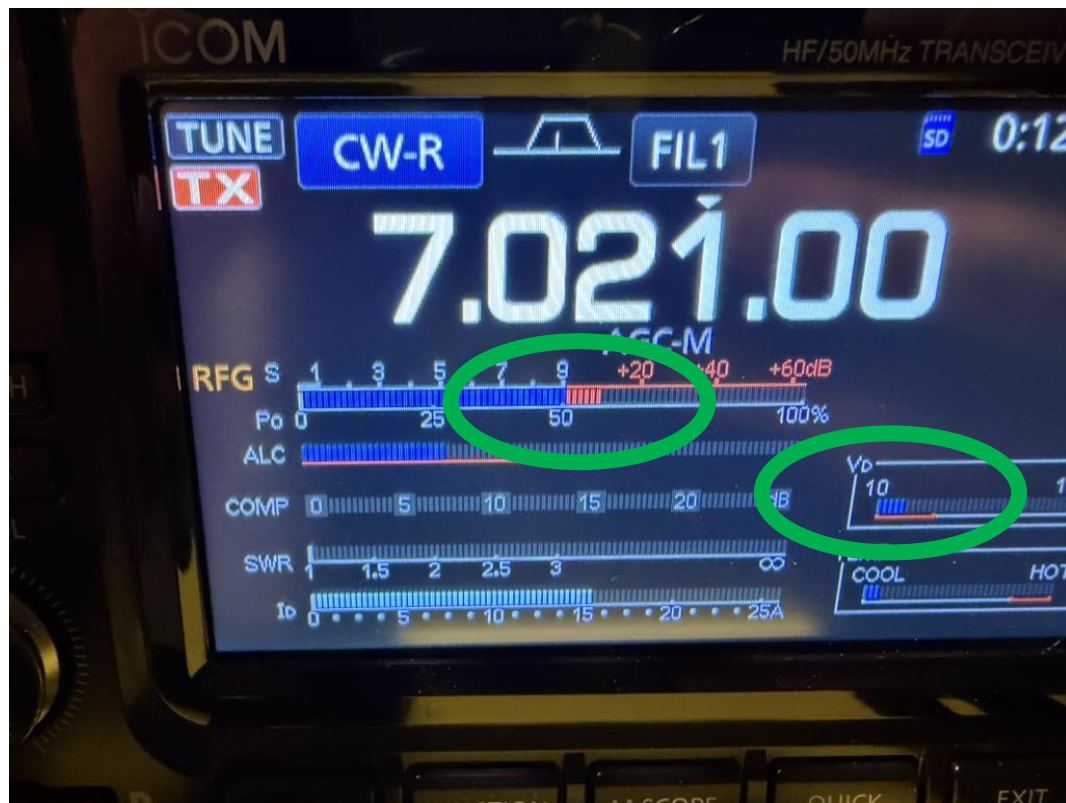
What is wrong with this image?



Question?

Do you really watch your rig meters when you are transmitting?

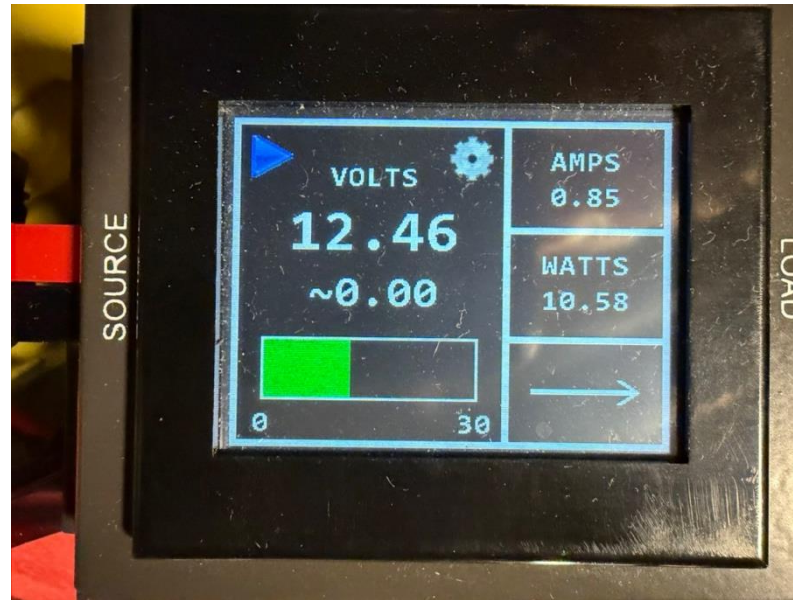
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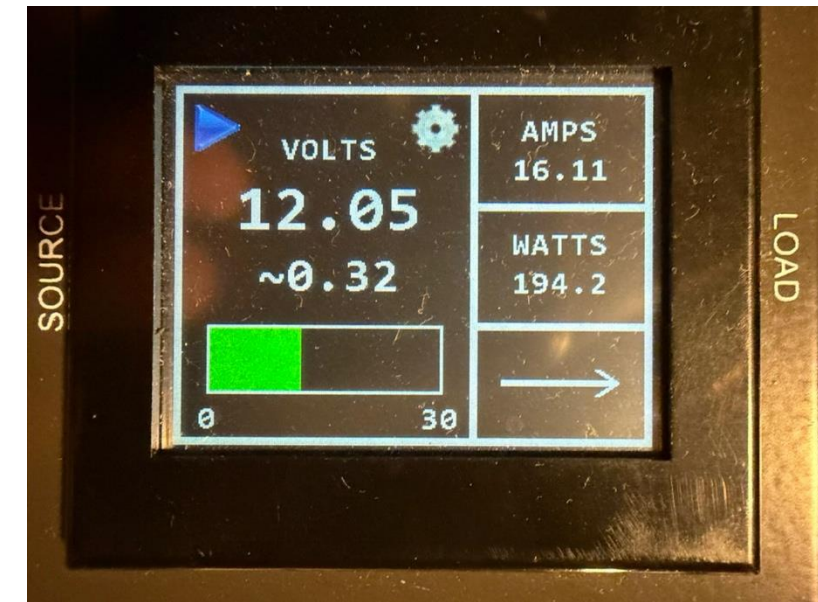
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Real World Test – Key Down

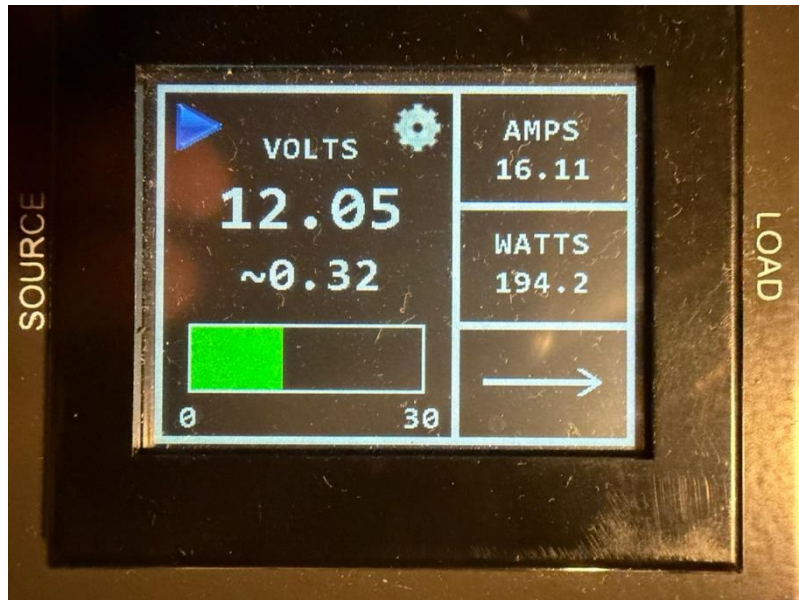


Real World Test – Key Down



Key Down – 100 watts

Real World Test – Low Voltage



Key Down – 100 watts



Real World Test – Success!

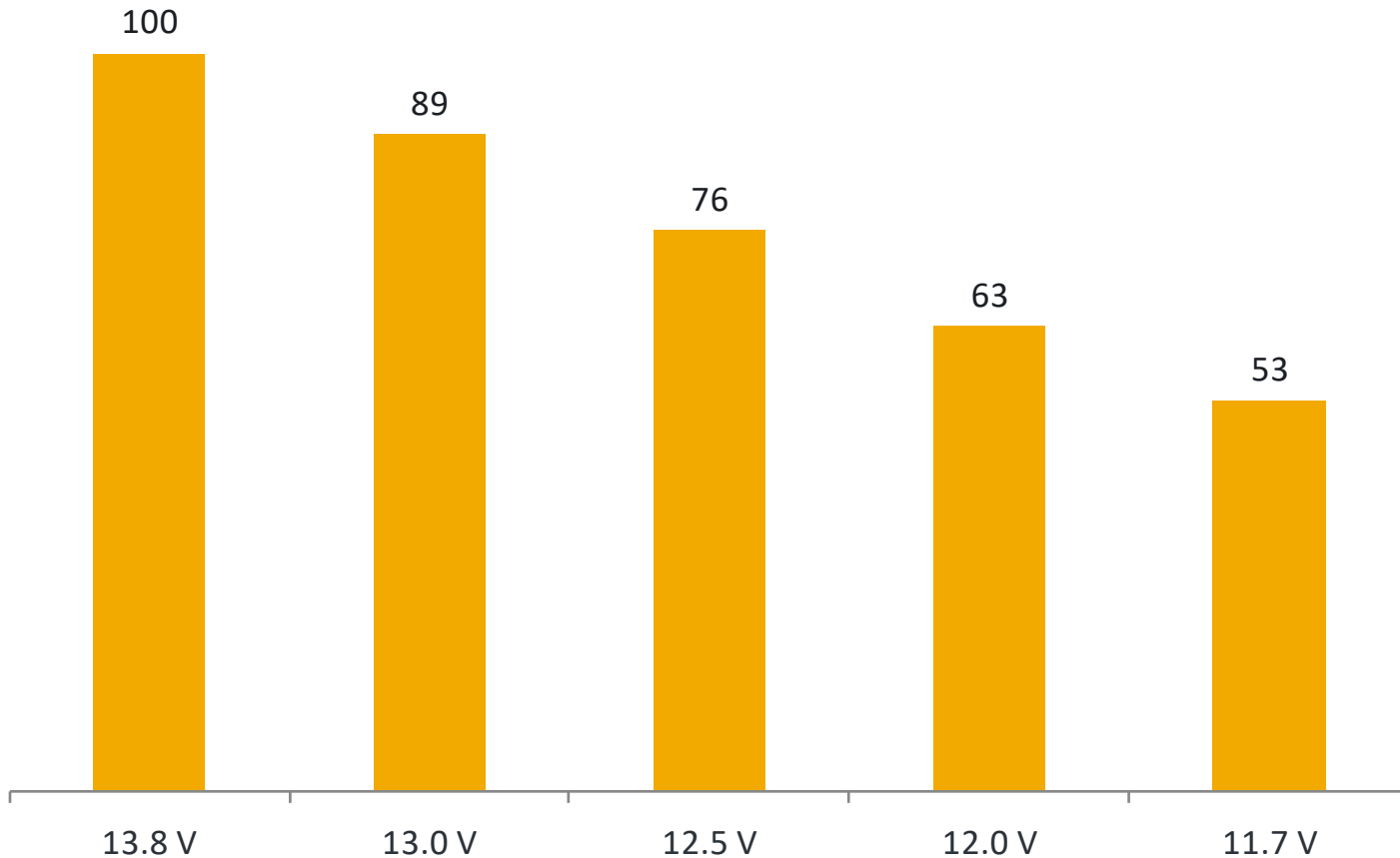


Key Down – 100 watts



When voltage sags, output power follows

Approximate max clean output, 100 W radio (watts)



Rule of thumb

Output scales with roughly the square of the supply voltage.

Losing 1.8 V costs about a quarter of your power, and pushing a starved final drives splatter.

The source must hold 13.8 V under load



Bench power supplies

- Buy on the continuous rating, not the peak rating
- Size 25–50% above total load: 25–30 A for a 100 W radio
- Overvoltage (crowbar) protection and current limiting
- Quiet switcher or linear: listen for added receiver noise

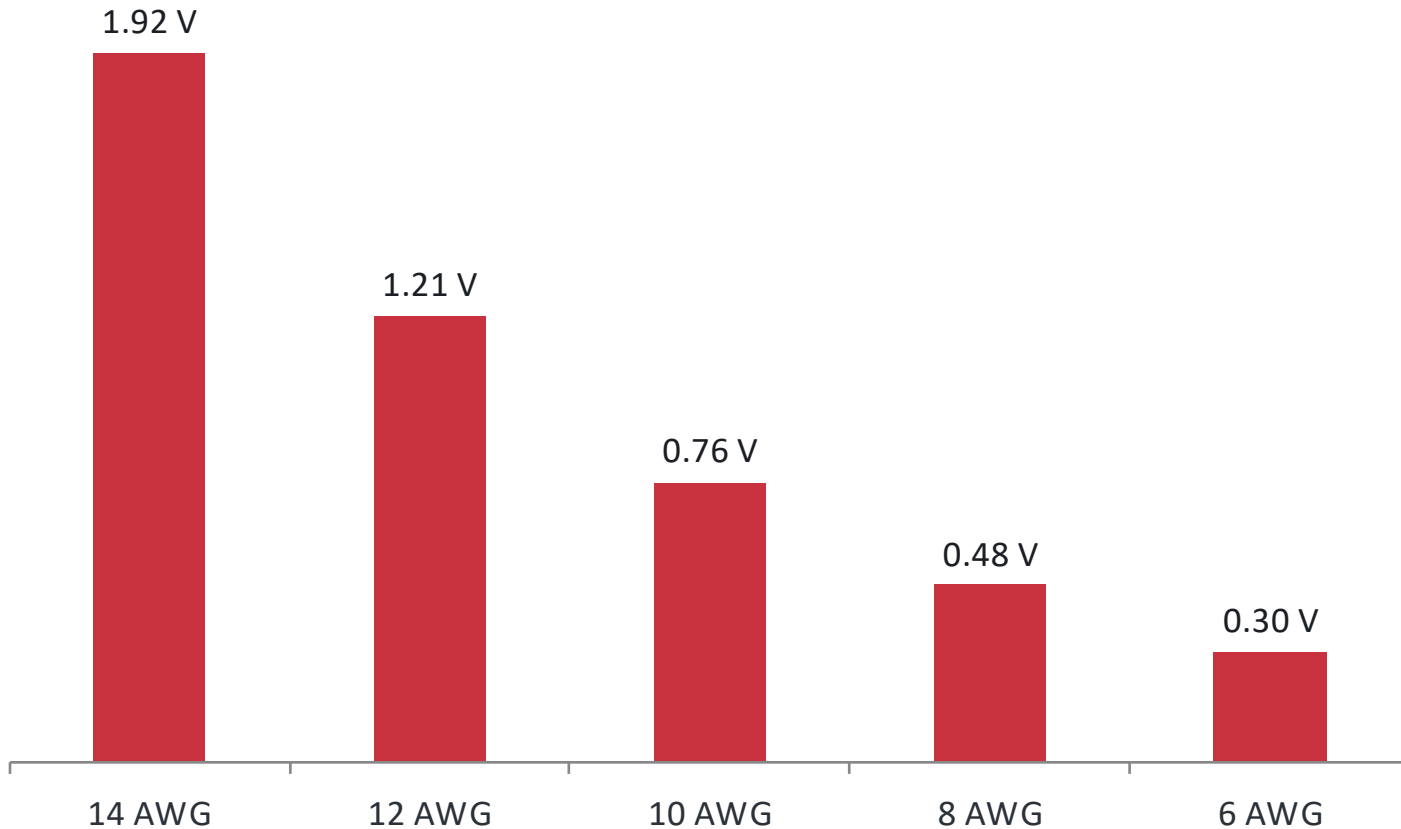


Batteries

- Voltage drops under load and as charge falls
- Lead-acid rests at 12.6–12.8 V, can sag to 12 V or less at 19 A
- LiFePO₄ rests near 13.3 V and stays flat much longer
- A regulated booster can hold 13.8 V as the battery drops

Wire gauge and length set your voltage drop

Voltage drop, 20 ft run (40 ft round trip) at 19 A



Count the round trip

A radio 10 ft away has 20 ft of wire in circuit.

Target: under 0.5 V total drop at full current.

20 ft of 14 AWG delivers only 11.9 V to the radio and burns 36 W as heat.

Not all wire is what the label says



Copper-clad aluminum (CCA)

About 60% more resistance than copper: 10 AWG CCA behaves like 12 AWG copper, and it crimps poorly.



Undersized "gauge" wire

Fewer or thinner strands than the label claims. Buy from reputable sources.



100% copper, finely stranded

Look for "OFC" or "100% copper." Flexible, crimps well, and performs to its gauge.

Three ways to make a connection



Crimped ring terminals

~0.0002 Ω per joint

Lowest loss. Best for permanent joints at supplies, bus bars, and batteries. Crimp with a ratcheting tool; add a lock washer.



Anderson Powerpoles

0.000525–0.000875 Ω

The ham standard for plug-and-unplug. Genderless, self-wiping contacts. Use 45 A contacts on 10 AWG.



Wago 221 lever connectors

up to ~0.002 Ω per splice

Fast, tool-free permanent splices. Not a plug. 221-4xx: 12 AWG, 20 A; 221-6xx: 10 AWG, 30 A.

Voltage drop per connection (volts)

Connector	Ohms	1 A	5 A	10 A	15 A	30 A
Ring terminal	0.0002	0.0002	0.0010	0.0020	0.0030	0.0060
Powerpole, 45 A contacts	0.000525	0.0005	0.0026	0.0053	0.0079	0.0158
Powerpole, 30 A contacts	0.0006	0.0006	0.0030	0.0060	0.0090	0.0180
Powerpole, 15 A contacts	0.000875	0.0009	0.0044	0.0088	0.0131	over rating
Wago 221 lever connector	0.002	0.0020	0.0100	0.0200	0.0300	0.0600*
Lighter plug (comparison)	0.025	0.0250	0.1250	0.2500	0.3750	over rating

Volts = amps × ohms · Per conductor; every lead has two. *Wago 221-6xx only (30 A rating).

Heat lost per connection (watts)

Connector	Ohms	1 A	5 A	10 A	15 A	30 A
Ring terminal	0.0002	0.0002	0.005	0.02	0.05	0.18
Powerpole, 45 A contacts	0.000525	0.0005	0.013	0.05	0.12	0.47
Powerpole, 30 A contacts	0.0006	0.0006	0.015	0.06	0.14	0.54
Powerpole, 15 A contacts	0.000875	0.0009	0.022	0.09	0.20	over rating
Wago 221 lever connector	0.002	0.002	0.050	0.20	0.45	1.80*
Lighter plug (comparison)	0.025	0.025	0.625	2.50	5.63	over rating

Watts = amps² × ohms · Going from 1 A to 30 A multiplies heat by 900. *Wago 221-6xx only.

Add it up: two stations, same radio, same supply



Careful station

13.05 V

at the radio, transmitting at 19 A

- 6 ft of 10 AWG, ring terminals, 45 A Powerpoles
- 0.75 V total drop, 14 W of heat
- About 89 W maximum clean output



"Junk box" station

11.76 V

at the radio, transmitting at 19 A

- 15 ft of 14 AWG, a Wago splice, 30 A Powerpoles
- 2.04 V total drop, 39 W of heat
- About 73 W, at the bottom of the window

Other Solutions

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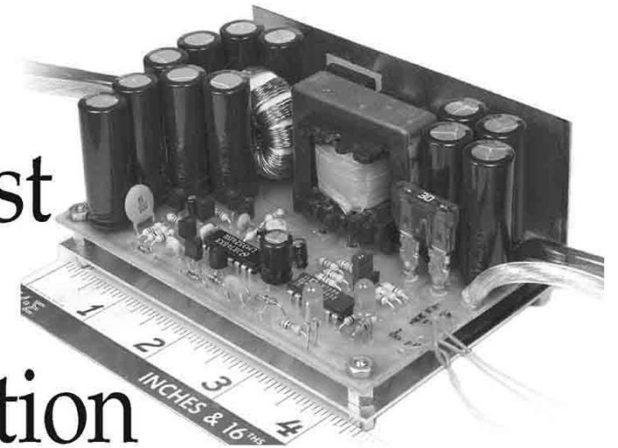


**West Mountain Radion
N8XJK Super Booster
\$325**

**Originally Published in the November
2004 QST Magazine**

By Daniel R. Kemppainen, N8XJK

A 12 V dc Boost Regulator for Battery Operation



A dc-dc boost switching converter is the answer to low voltage battery problems for mobile, portable or emergency-power operation.

Battery low charge state conditions, combined with voltage drops in wiring, can cause reduction in switch for manual operation. The other input is an RF detector. The RF detector can be used to monitor the RF output of MOSFET transistors Q5 and Q6¹ alternately switch the legs of the primary winding of T1 to ground, creating an ac

Design it, then measure it

- ✓ Know your radio's current draw and voltage range
- ✓ Size the source 25–50% above the load; test it under load
- ✓ Use 100% copper; keep total drop under 0.5 V
- ✓ Ring terminals for permanent joints, Powerpoles for plugs
- ✓ Crimp with the right tool; fuse both leads
- ✓ Measure at the radio jack, keyed into a dummy load