Product Review: Battery Boosters by W4RRY and MFJ Enterprises
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Introduction

Today's compact 100-watt HF transceivers are designed to operate from 13.8V$\pm$ 15%. This means about 12 to 16 volts. The low voltage end is very critical in that output signal distortion, output power problems, and transceiver reset can all occur when the voltage gets much below 12 volts. In the mobile environment, there are two problems that you often run into that can cause these low voltage issues:

First – there can be noticeable voltage drop on the DC input lines due to the high current drawn. Typical current requirements for a 100-watt rig are about 20-amps for 100-watts output power. If you just have $1/10^{th}$ of an ohm resistance in your cable and connectors, you'll lose 2 volts! And second – When you turn your car off, the battery voltage drops from around 13.8 volts to close to 12 volts after a short period of time. Couple this with any voltage drop in the cables, and you have a problem.

Battery Boosters to the Rescue

There are several battery boosters on the market that have been designed to alleviate the low input voltage problem. I obtained the W4RRY 23A Battery Booster about a year ago, and it has served me well. Recently I had the need for a second battery booster (for a second car), and I chose the new MFJ-4416 Super Battery Booster.

W4RRY 23A Battery Booster

The W4RRY 23A, shown in Photo A, has been on the market for several years. This unit takes any voltage from 11 volts to 13.8 volts and makes it 13.8 volts. The specs are pretty simple:

Size: 5.5" x 3.25" x 1.5"
Weight: 14 ounces
Peak Output Current: 23 amps
Regulated output voltage: 13.5 volts at 11-13.8 volts input

As supplied, there are just three leads on the23A: Battery input (+), Battery Input (-), and Regulated Output. Photo A shows an outside photo of the unit as it was received. The positive battery input is fused with a 30-amp fuse, and both inputs have large spade lugs attached to them. The regulated output is unterminated, and requires that you attach your own connector to match whatever your radio's DC input requires. Your radio's negative ground input must be connected to the Battery Input (-). Photo B is a look inside the unit.

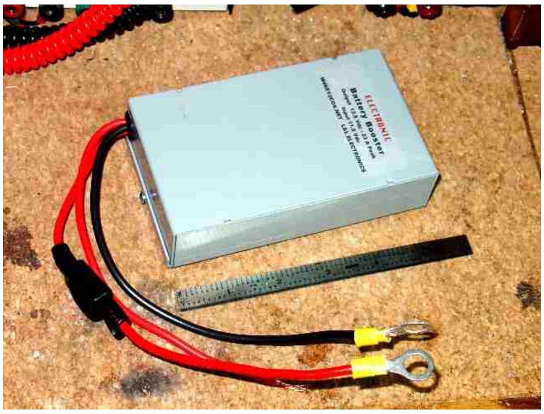

Photo A: W4RRY 23A External View

Photo B: W4RRY 23A Internal View

Since the W4RRY 23A is connected in series between my normal Powerpole DC runs in my car and my Icom IC-706MKIIG, I put Anderson Powerpole connectors on both the inputs and outputs of my 23A Battery Booster. Since the Battery Input (-) is common with both the battery input and booster output, I included a negative (black) 12-gauge wire from the input Powerpole to the regulated output Powerpole. I used a 45-amp PowerPole terminal in order to crimp the two black 12-gauge wires together. I wrote "BATT" and "RIG" on the appropriate connectors with a permanent marking pen. Photo C shows my Powerpole-connectorized 23A, and Photo D is a close-up of the Powerpole connectors showing how I marked them.

Photo C: W4RRY with Powerpoles

Photo D: Close-up of added Powerpoles

I ran some tests on my IC-706MKIIG and found that it works fine down to 12-volts. Below 12-volts, output power begins to drop off. At just under 11-volts, the radio shuts itself off when I transmit. My IC-706MKIIG typically draws 17-amps at 100-watts output, so I tested the 23A at 17- and 21-amps.

I ran tests at 12.5V, 11.5V and 10.5V input with output current set at 17- and 21-amps. The power supply I used for these tests is the MFJ-4245. My DC load is a homebrew high current resistive load. I monitored the input voltage and current with an AstroFlight (www.astroflight.com) Model 101 Super Whattmeter. The output voltage was measured with a Radio Shack digital voltmeter, and the output current was determined by the high power resistors used in my homebrew DC load. My measurements were as shown below:

Table 1: W4RRY 23A DC Test Results

Vin	Iin	Vout	Iout	Eff
12.5V	20.3A	13.7V	17A	91%
12.5V	25.3A	13.7V	21A	90%
11.5V	22.7A	13.7V	17A	88%
11.5V	30A	13.7V	21A	82%
10.5V	24.2A	13.4V	17A	88%
10.5V	28A	12.5V	19A	81%

The key to the above numbers is that you can't exceed the 30-amp rating of the input fuse. So based on your output current requirements, you can see that there are input voltage limits that must be observed.

I also measured a typical output ripple at 17-amps of 300 millivolts peak-peak. And finally, I listened for switching regulator tones by draping a short clip-lead from the antenna input of my IC-706MKIIG across the 23A. I could hear low level tones through 14 MHz when listening this way, however I could hear no tones when the IC-706MKIIG was connected to my mobile antenna as the normal band noise exceeded the level of the tones.

MFJ-4416 Super Battery Booster

MFJ just recently introduced their MFJ-4416 Super Battery Booster. The specs on the MFJ-4416 are as follows:

Size: 7-3/4"W x 4"H x 2-1/8"D
Weight: 1.3 pounds
Peak Output Current: 25 amps (based on 30-amp maximum input current)
Regulated output voltage: 13.8 volts at 9-13.8 volts input

As you can see from the specs and Photo E, the MFJ-4416 is a little larger and a little heavier than the W4RRY 23A. However, the MFJ-4416 has a few more features. It includes both Anderson Powerpole connectors and high-current 5-way binding posts for both the DC input and regulated output. The input fuse is internally located, and there are also selectable limits on the minimum voltage that the unit will accept: 9-volts, 10-volts (default), and 11-volts. This feature protects you from over-discharging a battery, and possibly damaging it. The MFJ-4416 also includes output over-voltage crow-bar protection in case regulation is lost. Finally, the MFJ-4416 maintains +13.8 volts output over its full input voltage range, whereas the W4RRY 23A output drops off at lower input voltages. Photo F is an internal view of the MFJ-4416. Table 2 shows the results of my testing of the MFJ-4416.

Photo E: MFJ-4416 External View

Photo F: MFJ-4416 Internal View

Table 2: MFJ-4416 DC Test Results

Vin	Iin	Vout	Iout	Eff
12.5V	20A	13.8V	17A	94%
12.5V	25A	13.8V	21A	91%
11.5V	23A	13.8	17A	91%
11.5V	28A	13.8	21A	87%
*11.2V	30A	13.8V	21A	86%
10.5V	26.5A	13.8V	17A	84%

*Due to the 30-amp fuse limitation at 13.8V/21A output power

Two additional features are included in the MFJ -4416. First, an RF sampling port can be connected to the transmission line with a UHF -T connector. When enabled, the MFJ - 4416 is bypassed unless RF is sensed. Therefore, no regu lator switching efficiency penalties are incurred during receive. Additionally, there can be no switching tones since the unit is powered off when it is bypassed. A switch enables or disables this feature.

The second additional feature is a user -adjustable output voltage control which lets you set the output voltage anywhere between 12- and 13.8-volts. When setting the output at 12-volts, input voltages greater than 12V will pass through, but the efficiency of the regulator is higher. Also, when the vo ltage sags, your transceiver will run cooler ! 20 amps at 1.8V less drop is a 36 watt savings in heat dissipation in your transceiver during transmit, and even 3-4 watts savings during receive. Additionally, higher output current is available at the lower output voltage (not as much limitation due to the input fuse). So it can be good to let the voltage sag to 12 volts, then have the regulator protect you from lower voltages. Below is data I measured with the output voltage set to 12-volts.

Table 2: MFJ-4416 DC Test Results

Vin	Iin	Vout	Iout	Eff
14V	21.5A	12.9V	22.5A	96%
13V	22.5V	12.1V	21A	87%
12V	24.5	12V	21A	86%
11V	27.9A	12V	21A	82%
10V	24.9A	12V	18A	87%

The output ripple of the MFJ-4416 varied from 5-55mv p-p depending on the input and output voltage and current requirements. During my listening tests, I could hear some low level tones up to 20 meters when employing the clip-lead test. But, just like the W4RRY unit, no tones were heard when my transceiver was connected to my mobile antenna.

Conclusion

Battery boosters can be an effective means of ensuring that you can compensate for voltage drops in your mobile or portable wiring. In my case, both the W4RRY 23A and the MFJ-4416 let me suffer some pretty significant voltage drops while permitting normal operation of my mobile 100-watt HF transceiver. For more information, check out the W4RRY unit at http://members.cox.net/w4rry/index.html, and the MFJ-4416 at www.mfjenterprises.com.