Review: The Samlex SEC-1235M Switching Power Supply
By Phil Salas – AD5X

Introduction

I've owned a Samlex SEC-1223 switching power supply for many years, using it as my primary power supply in my shack for powering my accessories (digital power meter, remote antenna switch, auto antenna tuner) and occasionally my IC-706MKIIG. My main transceiver has been a Yaesu MKV which has its own power supply, so the 23-amp rating of the SEC-1223 has been fine. Recently, however, I've changed my main transceiver to an Elecraft K3. Because now everything in my shack needs to run from 13.8VDC, I wanted a power supply with more headroom. Because I've had such good luck with the SEC-1223, I decided to stay with Samlex and move up to the heftier SEC-1235M switching power supply for use in my shack. The "M" indicates that the power supply includes voltage and current meters, which I also wanted on my main station power supply.

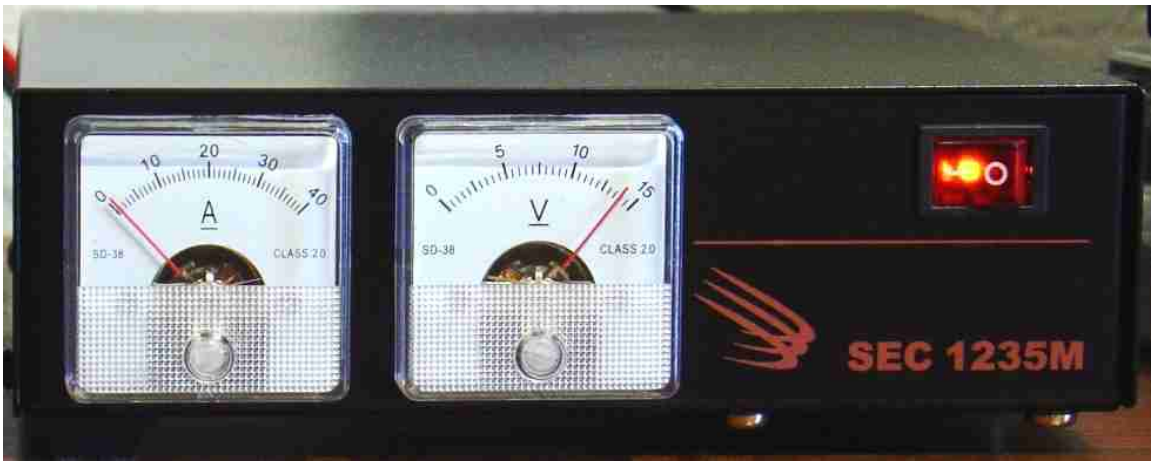

Photo A: The new Samlex SEC-1235M Compact 30-amp Switching Power Supply

First of all, why a Switcher?

A lot of folks tend to stick with the traditional linear power supply for their fixed location ham station. At least part of the reason for this is due to the fear of switching power supply tones causing problems with your transceiver. This was a problem several years ago with earlier switching power supplies. However, it seems that manufacturers today have managed to minimize these RFI problems. And if the RFI noise problems are not evident, then I prefer the much smaller size and significantly lighter weight of a switching power supply.

Samlex SEC-1235M

Besides my excellent past experience with the SEC-1223, the SEC-1235M was of interest to me for several other reasons. First, Samlex products are heavily used in the land/mobile industry. Samlex also gives a 3-year warranty on their products. And finally, the SEC-1235M is very reasonably priced for a metered power supply. While the MSRP is $170, the street prices through the various ham radio distributors range from $130-140. I purchased my SEC-1235M from www.radiodan.com, since I was in the process of ordering some ferrite chokes from him. So - let's begin by looking at the SEC-1235M specifications:

Specifications

Nominal Input Voltage:	120 VAC, 60 Hz (100 VAC to 130 VAC) – Default
	230 VAC, 50 Hz / 60 Hz (200 VAC to 260 VAC) – Internal strap change
Input current:	7.5 A at 120 VAC, 60 Hz, 3.5 A at 230 VAC 50 / 60 Hz.
Output Voltage:	13.8 VDC, adjustable 11.5 V to 15.5 V with internal potentiometer
Output current:	30 amps continuous, 35 amps peak
Current limit:	35 amps, constant current limiting, auto recovery

No load current:	120 mA at 120 VAC
Ripple:	50 mV peak to peak
Noise:	150 mV peak to peak
Peak Efficiency:	85%
Cooling:	Temperature controlled fan
Output indications:	Voltmeter and Ammeter
Protection:	Overload, short circuit, over voltage, over temperature
Operating temperature:	0° to 40° C
Dimensions:	8.4”L x 7.1”W x 2.4”H
Weight:	3.4 lbs

I didn’t realize it until I actually received the new SEC-1235M, but the SEC-1235 is exactly the same size as my SEC-1223, and it weighs the same! This is obviously due to improved design techniques and components used over the last several years. Actually, the SEC-1223 is 0.2” deeper than the SEC-1235M due to the length of the rear power connectors on the SEC-1223. Photo B shows the SEC-1223 and SEC-1235M together for comparison purposes.

Photo B: The SEC-1223 vs the SEC-1235M

The first thing I do with any new product is look at the internal design. As seen in Photo C, the design is very compact, with many SMD components used on the printed circuit board. Notice the large ferrite core around the DC output wires in the lower left, and the fan in the upper right side of the photo.

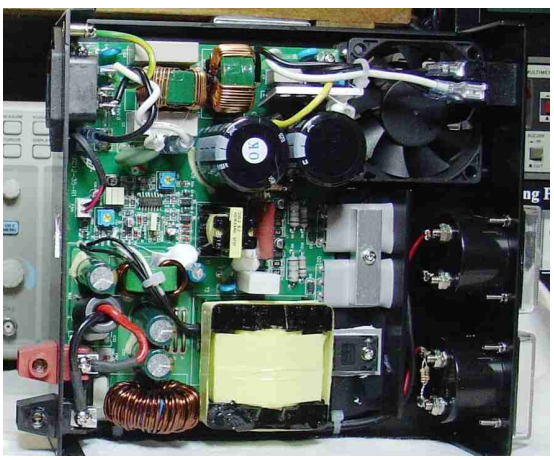
Photo C: Internal view of the SEC-1235M


Photo D: Close-up of cooling fan

The temperature-controlled fan (Photo D: fan close-up) only switches on when the internal temperature sensor reads a temperature of 60 degrees C. The fan then turns off when the temperature is reduced to +50 degrees C. Normally the fan doesn't come on. However, I've found that under heavy use (long QSOs), the fan will come on, and when it does you will know it as it moves a lot of air. Also, in case the fan fails, the air intake is blocked, or the ambient temperature is very high, there is also a temperature sensor on the transformer that turns the power supply off if it senses a temperature of 105 degrees C. The power supply will turn back on when the temperature drops to 95 degrees C.

Performance Measurements & Testing

Before connecting the SEC-1235M into my station, I ran it through a battery of tests. I have a DC load that permits me to switch in fixed loads of 1-, 3-, 7-, 10-, 14-, 17-, 21-, and 24-amps at 14VDC. I currently don't have the ability to easily load the power supply any heavier than 24-amps. I first looked at the ripple and noise on the 13.8VDC output as a function of load. Photo E shows the worst case noise spikes on the DC output, which occurs with no-loading of the +13.8VDC output. As you can see, the output noise does meet the 150mv p-p spec of the power supply. However with even light loading of the output, the noise spikes are significantly reduced. Photos F-, G-, and H show the output noise and ripple at 1-, 3-, and 24-amps respectively.

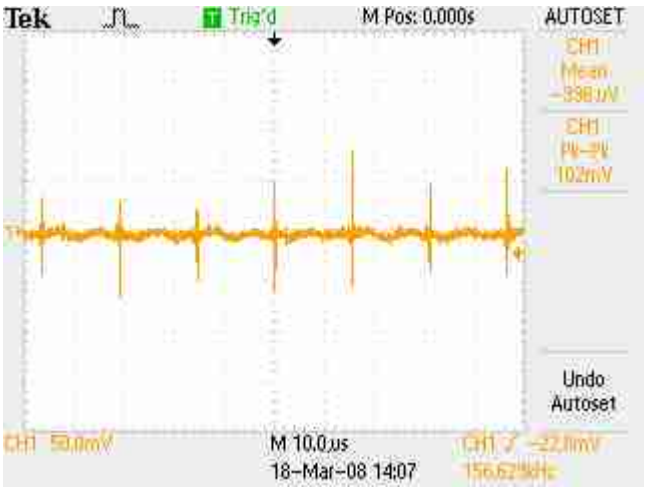

Photo E: No load ripple and noise

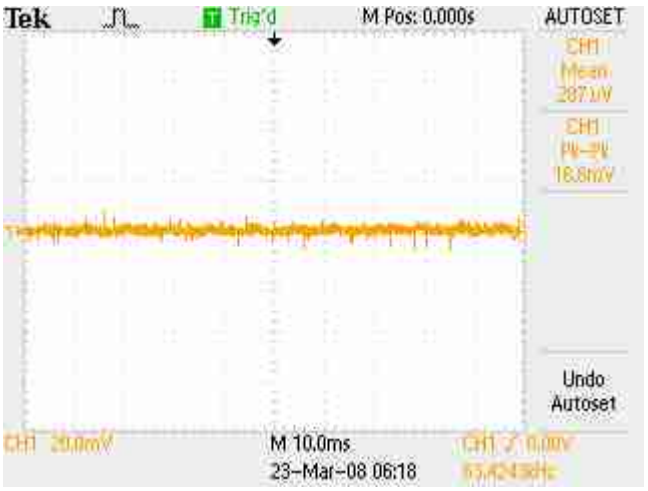

Photo F: Ripple and noise at 1-amp current drain

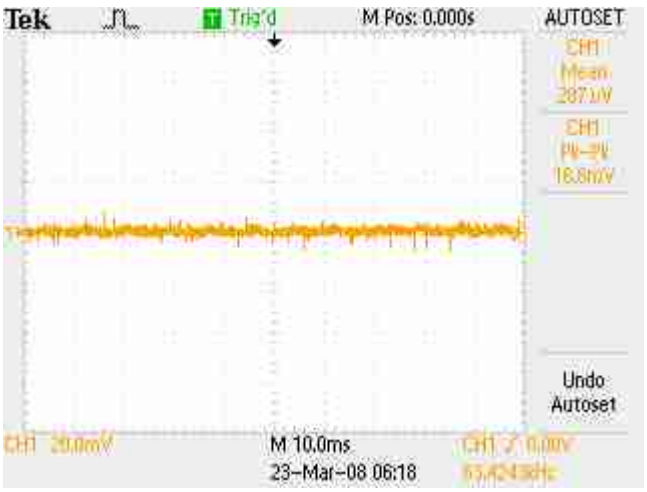

Photo G: Ripple and noise at 3-amp current drain

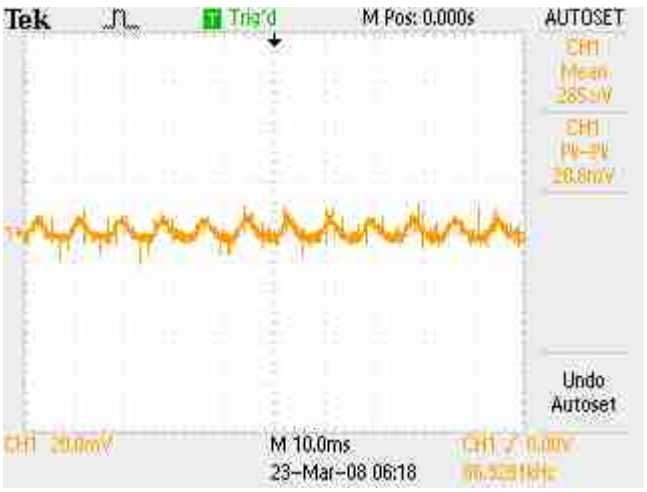

Photo H: Ripple and noise at 24-amp current drain

Next I checked the DC output voltage as a function of load, and the accuracy of the ammeter. The voltage was measured with a separate digital voltmeter. The results are shown below. As you can see the output voltage

regulation is very good, dropping just 90 millivolts when going form no-load to 24-amps. And the ammeter reading is very accurate, within my ability to read the analog ammeter on the SEC-1235M.

Actual Current	Voltage	SEC-1235M Ammeter Reading
No Load	13.85VDC	0 amps
3 amps	13.82 VDC	3 amps
7 amps	13.80 VDC	7 amps
10 amps	13.78 VDC	10 amps
13.8 amps	13.76 VDC	13.5 amps
16.8 amps	13.74 VDC	16.5 amps
20.6 amps	13.72 VDC	20.5 amps
23.6	13.70 VDC	23.5 amps

My last performance test involved looking for switching power supply tones. First, I listened on my outdoor vertical antenna using the K3 receiver – once when the K3 was powered by the SEC-1235M, and once with the K3 on battery power. In both cases the SEC-1235M was delivering minimal current to my accessories (digital power meter, auto antenna tuner, and remote control antenna switch) – approximately 500 ma total. I could find no power supply tones.

Next I moved the SEC-1235M to my workbench and looked for switching noise with a battery-powered IC-706MKIIG receiver with a 2-foot wire connected to the antenna port. I moved the antenna lead along a 2-foot DC output wire connected to the SEC-1235M while searching the bands for tones. I did this at no-load and my maximum load capability of 24 amps. In no case could I hear any power supply switching tones – meaning that any radiated power supply noise is below the noise floor of the receiver. This power supply is VERY RF quiet!! Incidentally, I did find a lot of in-house RF noise when doing this!

SEC-1235M Modifications

I don't know why I can never leave things well enough alone! Maybe it is just because I want things a little more perfect. I made two modifications to my SEC-1235M: The first modification keeps the fan running continuously at low speed. The second modification adds Anderson Powerpole™ connectors to the SEC-1235.

As I mentioned earlier, the fan only comes on during heavy use. But when the fan does turn on it is very noticeable, especially if the power supply is mounted close to your operating position. A simple modification keeps the fan running quietly at low speed all the time, yet still permits the fan to go to full speed if the temperature exceeds 60 degrees C. With the fan running continuously at low speed, the SEC-1235 stays cool enough that it only goes to full speed under heavy, high current use. The modification is simple, requiring just connecting a 100 ohm 1-watt resistor between the black fan lead and the negative DC output port. I simply cut the black fan wire going to the fan connector (back center of the pc board) and spliced the wires back together along with one resistor lead and then connected the other resistor lead to the negative DC output. See Figure 1.

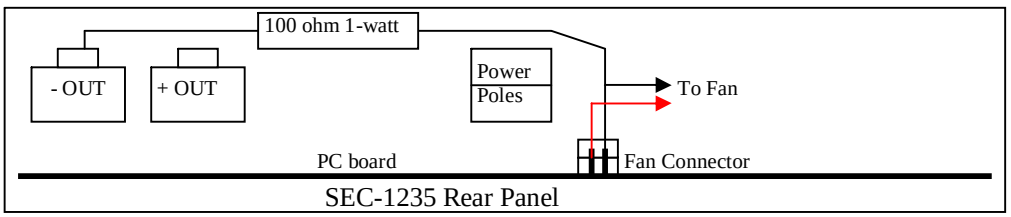

Figure 1: Fan modification

The SEC-1235M, like many other power supplies, uses a screw-clamping output power connector. While this connector easily takes a 10-gauge wire, I've never been real comfortable with screw-clamping connectors as it

seems to me that the connection could become loose over time. Also, like many hams I've converted everything in my shack to the "standard" Anderson Powerpole™ connectors. Therefore, I decided to add a Powerpole™ interface to the SEC-1235M.

For my implementation, I chose to mount a pair of Powerpole™ connectors using a Connex (www.connex-electronics.com) 1462G1 mounting clamp set. Make sure you position the connector hole so that the Powerpole™ connectors do not interfere with anything inside the power supply when they are mounted. You'll need to cut a 0.65" x 0.65" hole in the desired location on the back panel of the SEC-1235. I marked the square hole pattern, and then drilled a 3.8" diameter hole in the center of the marked pattern. An inexpensive nibbling tool and a small file took care of the rest of the cutting work. Figure 2 shows the mounting location I chose.

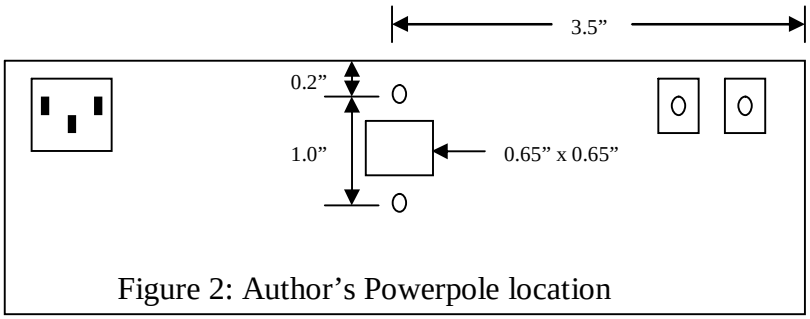

Figure 2: Author's Powerpole location

I also cut out a small piece of single-sided pc board so I could mount some bypass capacitors on it (see Figure 3, and watch the polarity of the electrolytics!). I scribed the copper on the pc board material with a Dremel™ tool. This extra bypassing is probably unnecessary, but I decided to do this just in case some switching noise is picked up by the internal wiring for this new connector. I mounted the small pc board using 0.625" #4 standoffs. For flexible wiring between the Powerpole™ connectors and the pc board, I used pieces of braid from a scrap piece of RG-58 coax. Stranded 12-gauge wires are soldered to the pc board and braid, and then connect to the main DC output lugs using #6 crimp-on lugs. Photo I shows the parts used, Photo J shows the internal view with the connector assembly mounted, and Photo K shows the back of the power supply with the Powerpole™ assembly mounted in place. I painted the Powerpole™ mounting brackets black to match the case.

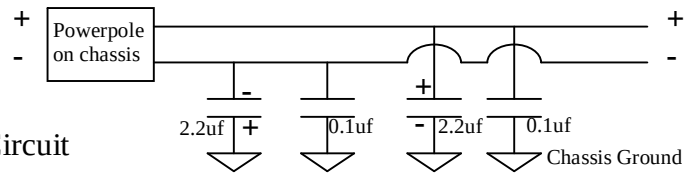

Figure 3: PCB Bypass Circuit

Photo I: Parts and back panel cut-out

Photo J: Connector assembly mounted in place.

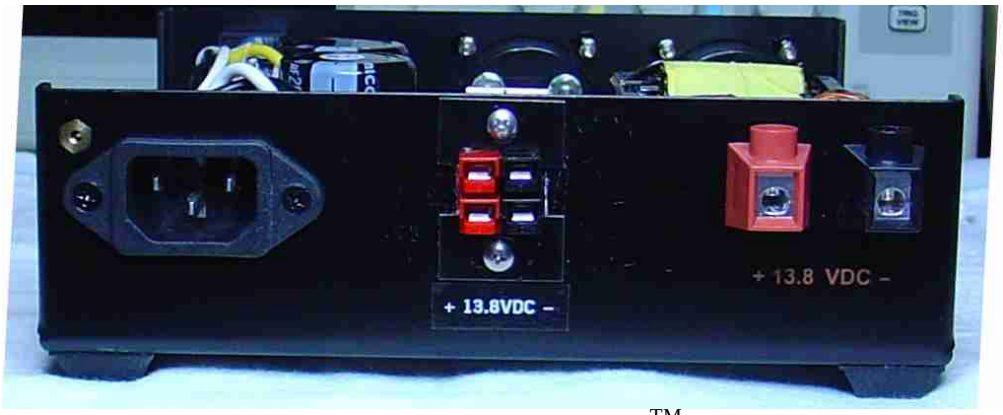

Photo K: SEC-1235M back panel with Powerpole™ connectors mounted

The addition of the Anderson Powerpole™ connectors really made the SEC-1235M perfect for my set-up. One output powers my K3, and the other output goes to an inexpensive MFJ-1106 1x6 power distribution strip for powering all my accessories. And then, of course, I also have the heavy-duty screw-terminal output should I ever need it.

Conclusion

With a 30-amp continuous output current capacity, RF noise-free operation, compact size, 3.5 pound weight, and voltage and current metering, the Samlex SEC-1235M switching power supply can be considered as a strong contender as the main power supply for your shack.