

# Low Down Power, Part 1

Reviewed by Thomas Perazella

Here's a roundup of four popular dedicated subwoofer amps: the Apex Junior, Marchand PM31, and the Parts Express SW250A and 300-794.

**D**o you remember that old phrase, "How are you going to keep them down on the farm after they've seen Poree"? The corollary in the audio world should be, "How are you going to listen to music with just your old speakers after you've heard a good subwoofer?"

There is no doubt that clean, deep bass is the foundation of music. Building a good subwoofer is one of the most satisfying segments of the speaker-building hobby. Unlike times past, you now have a wonderful selection of dri-

vers with parameters suited to building a good sub, and at prices that when corrected for inflation are real bargains.

The other three main components of a sub—the enclosure, crossover, and amplifier—have also been going through an evolutionary process. One of the most interesting areas of change has been in the amplification used for subs, and specifically the development of dedicated subwoofer amplifiers.

## SUB AMPS

The subwoofer amplifier can actually be defined with a range of parameters. There is no set list of functions for all amps. One common characteristic they all have is a design for mounting directly on

the sub enclosure through a hole that puts most of their workings inside the enclosure with connections and controls on the outside.

This is a great advantage, as no space external to the sub is needed for the amplification function. Wiring is easier as only a single line-level cable is necessary from the signal source, although most sub amps also have speaker-level inputs as a convenient function in case line-level outputs are not available. The only other thing needed is a near-by AC power outlet.

Power output from these sub amps ranges from a few watts to hundreds of watts. Most can drive loads to 4Ω, with some capable of going lower. Other common features that can greatly add to convenience include:

1. Input volume level control.
2. Signal feedthrough for line- and speaker-level signals.
3. Line-level low-pass filters with a wide range of adjustment.

4. Phase adjustment.
5. Speaker-level high-pass filters.
6. Standby mode with signal activated auto on.
7. Bass boost.

Some also feature remote controls, balanced inputs, energy-saving class-D circuitry, and defeatable low-pass filters. The best feature is often a very competitive price compared to standard amplification when you take all features into account.

## POWER REQUIREMENTS

How can you decide whether a sub amp is the solution to your problem? If convenience and ease of use are high on your list, this is the place to look. If very high power and flexibility are at the top, the decision may become harder. First you must dispel an old myth that says you need a huge amount of power to get deep bass.

The amount of power you need depends on several factors:



**PHOTO 1:**  
Apex Junior front.



**PHOTO 2:** Marchand PM31 front.

1. What SPLs are you trying to achieve (or, to put it another way, how understanding are your significant other and/or neighbors)?
2. How large is your room?
3. How low do you wish to go?
4. What tuning will you use—sealed box, vented box, passive radiator, transmission line, horn loaded (hope you have a big room or like to live inside a horn throat if you plan to go low with a horn), and so forth?
5. How efficient are the drivers you plan to use?
6. How transparent is your room to low bass; that is, how much room gain can you expect?
7. How big can the enclosure be?

The amount of power you can actually use, however, is primarily

dictated by how low you wish to go. How can this be? The traditional wisdom is that the lower you go, the more power you need. Unless you are working in a very small sealed box, the chances are quite good that with a typical driver, if you wish to go very low you will probably run out of excursion before you run out of power handling.

If you don't believe this, try a simple experiment. Using a variable DC supply, measure the cone excursion versus the DC voltage applied to the speaker terminals of a typical woofer. When you do this, be very careful to apply a DC voltage to the driver for only very short periods of time. It does not take much DC to burn out a driver, since the coil is not moving and there is no cooling air moving across it.

You will find that it doesn't take much voltage to drive the cone to the end of its linear travel range. The same is true at low music frequencies. Remember that if you are operating a linear driver above resonance, as you decrease the frequency being reproduced by one

octave, you increase the cone travel by a factor of four. It does not take much power at low frequencies to drive most woofers to their excursion limits.

Having heaps of power at very low frequencies, especially in ported designs, usually only results in driving the voice coil harder against the back plate (accompanied by a loud noise) or perhaps right out of the gap. From this, you can extrapolate that you will need a lot of volume displacement (excursion X moving area) to get a lot of clean low frequency bass. Because of linear excursion limits, this generally means multiple drivers. There are exceptions to this, but they are generally designs that are beyond the reach of most hobbyists.

## FREQUENCY RANGE

This brings us to another crossroad. What is the definition of a subwoofer? Some would claim that a subwoofer should reproduce frequencies as high as 150Hz. In fact, you will find some of the sub amps

have crossovers that can go that high. The other school of thought is that a subwoofer is what its name implies, a device to work below a woofer, generally in the range below 60Hz.

My beliefs definitely fall into the latter category. I won't go into the pros and cons of those two philosophies here. However, you should be aware that if you venture into the over 50–60Hz range with a sub, the driver that bottomed with a loud "thunk" at 20Hz will probably be able to handle the same power at those higher frequencies without excursion becoming a factor. In those ranges, you can probably get higher SPLs without resorting to multiple drivers, but will need more power. That is where the big amps come in.

For this study, I chose four sub amps that—although by no means all-inclusive—give a good indication of what to expect in terms of features, price, and performance when you go shopping. Originally, one of the four I tested had remote-volume control, but it is not cur-

**TABLE 1**  
**SPECIFICATIONS**

	APEX JUNIOR	MARCHAND PM31	PARTS EXPRESS SWS250A	PARTS EXPRESS 300-794
Power—8Ω	100W	150W	Not specified	180W
Power—4Ω	130W	150W	250W	272W
Height	9 <sup>3</sup> / <sub>16</sub> "	11"	10"	10 <sup>7</sup> / <sub>16</sub> "
Width	9 <sup>3</sup> / <sub>16</sub> "	8 <sup>1</sup> / <sub>2</sub> "	10"	10 <sup>9</sup> / <sub>16</sub> "
Depth behind	3 <sup>1</sup> / <sub>8</sub> "	5 <sup>7</sup> / <sub>8</sub> "	2 <sup>1</sup> / <sub>2</sub> "	3 <sup>1</sup> / <sub>4</sub> "
Depth in front	1 <sup>1</sup> / <sub>2</sub> "	1 <sup>3</sup> / <sub>4</sub> "	1"	1"
Circuit type	Not specified	Class AB	Class D	Class AB
Power input	115V 60Hz	120V 60Hz	115V 60Hz	115/230V 50/60Hz
Power cord	Fixed 5 <sup>1</sup> / <sub>2</sub> ' cond	6' 3 cond IEC320	Fixed 5 <sup>1</sup> / <sub>2</sub> ' 2 cond	6' 2 cond removable
AC input filtering	Unknown	L/C filter network	Ferrite core choke	No
Fuse location/size	Front panel/4A	Front/4A breaker	Internal/4A	Front/4A
Exposed power	No/warning label	Yes/no warning	Yes/warning label	No/no warning
Auto power on	Yes	No	Yes	Yes
Line level input	L&R RCA jacks—left jack for mono	XLR socket w/RCA adapter cord	L&R RCA jacks—left jack for mono	L&R RCA jacks— not marked for mono
Line feed through	L&R RCA jacks	None	L&R RCA jacks	L&R RCA jacks
Speaker level input	L&R spring clips—left for mono	None	L&R binding posts <sup>3</sup> / <sub>4</sub> " spacing	L&R binding posts 1" spacing
Volume control	Rotary marked MIN to MAX	Rotary marked 1 to 10	Rotary marked MIN to MAX	Rotary marked MIN to MAX
Crossover	Continuous rotary marked at 60, 80, and 125Hz	None	Continuous rotary marked at 40 and 160Hz	Continuous marked at 40 and 160Hz
Bass boost	None	None	6dB fixed	6dB fixed
Line level output	Direct	None	None	High pass -13dB at 44Hz, 0dB at 88Hz, +8dB at 500Hz
Speaker level output	Spring clips direct	None	L&R binding w/220μF cap for 6dB/octave filter	L&R binding w/150μF cap for 6dB/ octave filter
Woofer output	Fixed wires 13.5" w/0.187 female quick disconnects	Fixed wires 26" non terminal	Fixed wires 22" w/0.187 female quick disconnects	Fixed wires 30" w/0.250 quick disconnects
Phase control	Push button switch 0 & 180°	Heavy duty toggle switch 0 to 180°	Rocker switch 0 & 180°	Continuous rotary 0–180°
Crossover range	60 to 125Hz	None	40–160Hz	40–160Hz
Panel indicators	Standby/on LED red—standby green—on	None	Signal tracking (auto on) green LED	Standby/on LED red—standby green—on
Remote control	None	None	None	None
Mounting method	12 holes with attached rubber gasket	8 holes with no gasket supplied	8 holes with no gasket supplied	8 holes with attached rubber gasket

rently being distributed in the US, so I replaced that amp with the new Parts Express 300-794. As a comparison, I tested a standard, high-quality, stereo separate amp using the same procedures, including listening tests. This may help you decide the best route to take. [Two vendors did not choose to participate in this review.—Editor.]

## THE CONTENDERS

I chose the following four amps, in alphabetical sequence by manufac-

turer/distributor: the Apex Junior, the Marchand PM31, the Parts Express SWS250A, and the Parts Express 300-794. As a comparison, I included a “standard” stereo amp, the excellent-value Audiosource Amp Three, to give a reference as to what to expect in terms of performance when taking the “classical” route. Manufacturer specifications are shown in *Table 1*.

### APEX JUNIOR

The Apex Junior is the smallest,

lowest powered, and least expensive amp of this group. When I first saw it I thought to myself, “Well, what can you expect for less than \$90.” What I discovered during testing and listening is that the Apex gives a lot more than you would expect. But, more on that later.

It is actually quite nicely featured, with a built-in continuously adjustable crossover, phase reversal switch, level control, both line- and speaker-level inputs, auto on, and both line- and speaker-level outputs. Cost-saving measures are apparent in the spring-loaded speaker-level connections and the fixed AC power cord. To be honest, I’m not dismayed by the speaker-level connections, which appeared to be functional, and you are better off using line-level inputs if possible.

My first impression was, “Not too shabby, especially considering the price.” The back is sealed on this unit, so I was unable to photograph the innards. A problem for me, but a definite safety plus for anyone using the amp. Street price at the time of the article was \$89.95. *Photo 1* shows the front-panel layout.

### MARCHAND PM31

This piece just screams out “industrial solid.” Fancy-schmancy gewgaws are not the province of this amp. From the removable three-conductor power cord to the metal XLR connector and through all the toggle switches and circuit breakers, the design and construction of this amp says “no shortcuts.” *Photo 2* shows the front-panel layout.

A look at the back of the panel is equally impressive (*Photo 3*). The design and layout of the circuit boards seem first rate. The power transformer is a huge toroidal design and is followed by a large bank of filter capacitors. The money spent in supply design shows up in the later measurements.

The PM31 is also different from all the others in that it includes no crossover. This is not surprising because Marchand is in the business of making very high quality, very flexible external crossovers, and the unit is designed to complement those crossovers. As such, it is real-

ly a full bandwidth amp, making it not only suitable as a sub amp, but also as an internal amp for a self-powered full-range speaker utilizing passive crossovers.

The one caveat immediately evident is that line power is available to the touch at several points on the back of the amp. This is no problem once the amp is safely snuggled up inside the speaker enclosure, but can be the source of a nasty, if not lethal, shock if you plug the unit in before the rear is covered up. In addition, there is not even a warning label to that effect, which is quite surprising in today’s world where major lawsuits routinely arise over spilled hot coffee, if not yet over spilled milk. Price at the time of this article is \$295 in kit form and \$595 assembled.

### PARTS EXPRESS SWS250A

What’s different about this amp? Well, both the power-supply and amplifier output sections are operated in a switched mode. This results in lighter weight (important in a portable design, but probably not in a sub that sits in a corner), higher efficiency, and lower power dissipation.

Features include a built-in adjustable crossover, volume control, phase reversal switch, and binding posts for the speaker-level connections. Power is provided by a fixed two-conductor cord, and the amp has an auto-on provision. Noticeably absent are line-level pass-through jacks. *Photo 4* shows the front-panel layout.

A view of the back (*Photo 5*) shows a circuit layout more reminiscent of a computer motherboard than a traditional amp. There are no big transformers or large banks of capacitors. The size of those components for a given power capability are proportional to the line frequency.

That’s why large airplanes use 440Hz AC instead of 50 or 60Hz. The transformers and filter capacitors would add quite a bit of excess weight to the airplane if the AC frequency were lower. Computer supplies and this amp take that concept a step further and convert the AC line power to DC with no transformer, then use a very high frequency switch to convert it



PHOTO 3: Marchand PM31 rear.



PHOTO 4: Parts Express SWS 250 front.

back to AC where a much smaller transformer, rectifiers, and capacitors can re-convert it to DC. Sounds ideal.

What are the drawbacks? High frequency noise. Although the size decreases with frequency, the radiated noise increases. Good circuit layout and shielding are a must to prevent producing an unwanted RF noise generator.

The output section of the amp also operates in a switching fashion. A normal amp has output devices that vary the voltage to the speaker by acting as variable resistors, dividing the supply voltage across themselves and the speaker in proportion to the input signal.

That results in a lot of power dissipation across the devices, be they transistors or tubes. In a switching amp, the transistors are either on or off.

How can you get a smooth waveform from a switching device? Switch at very high frequencies, and vary the time on versus off. Then put a filter on the output to smooth out the switching transients and, *voilà*, an analog waveform appears. Since the transistors spend most of their time fully on or off where power dissipation is minimal, the efficiency can be much higher. Less power going to heat means less power used.

Drawbacks? Noise and stability.

Again, good circuit design and filtering are in order. Like the Marchand, this amp also had exposed line voltage on the back but did have a warning label. You still need to exercise care until the amp is sealed in the cabinet. Street price was \$249.80.

### PARTS EXPRESS 300-794

What's with this 300-794? No, it's not the name or model number. Neither of those is evident on this amp. Actually, it is the ordering code, but since I couldn't find another identifier, I'll use the code. Like the SWS250A from Parts Express, this amp is advertised as putting out 250W into a 4Ω load. The specification sheets claims 272W into 4Ω.

This amp has many features (Photo 6). RCA jacks are provided for both line and line out signals. Binding posts on 3/4" centers do the same duty for speaker-level signals. There are also continuously variable controls for volume, crossover frequency, and phase. More about the pros and cons of the continuous phase adjustment later.

AC power is connected through a removable three-wire power cord into a standard IEC320 socket with internal fuse and spare fuse. A switch is provided for 120V or 240V operation.

The back of the amp shows a large, standard EI-core-type power transformer, two relatively large filter capacitor boards. The AC power connections are all covered by shrink tubing to prevent a shock hazard.

When you plug the amp in, the power transformer is always energized, even if the power switch is in the off position. The switch only controls the power out section of the amp. Unlike other amps that have a passive line-level pass-through, input line signals in this amp go through a circuit that provides a high-pass function on their journey to the output jacks as long as it is plugged in. Street price was \$225.80.

### AUDIOSOURCE AMP THREE

This amp has become one of my favorites for best bang for the buck in a basic stereo power amp. It features a rating of 150W/ch into 8Ω

and 400W in bridged mono. It is small, rugged, and performs well. In an upcoming project, I will be using three of them instead of a single super amp. The front panel has two volume controls, an illuminated pushbutton power switch, and two illuminated push-button switches for selection of two sets of speakers.

The rear has a switch for manual or auto on, two sets of line jacks for line in and out, a stereo/bridged mono switch, and two sets of binding posts on 3/4" spacing for two sets of stereo speakers. Power is provided by a detachable three-wire AC cord. A fuse holder is provided for input power, but four fuses are located inside the unit for DC power bus protection.

Inside, it has a large toroidal power transformer, four large filter caps, and relay switching of the speaker outputs which doubles as speaker protection against faults or DC offset. Street price was \$350.

Next month, Part 2 covers system performance of the four units and includes listening tests. ❖



PHOTO 5: Parts Express SWS 250 rear.



PHOTO 6: Parts Express 300-794.

### SUPPLIER LIST

**Apex Junior**  
3045 Orange Ave.  
La Crescenta, CA 91214  
Phone 818-248-0416  
FAX 818-248-0490  
URL [www.apexjr.com](http://www.apexjr.com)

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