Impedance, Sensitivity, Phase Angles, Watts

There are certain questions that we are often asked, and to answer these questions we need to discuss certain fundamental characteristics of loudspeakers, namely Phase, Sensitivity, Phase Angle and Watts.

Let's start with *Impedance*. For many years many customers have asked us about the impedance of our speakers and their importance. The reason for these questions, and justifiably so, is that they are concerned whether the wrong impedance could damage their amplifier. Many amplifier manufacturers stipulate that their speakers should not be used with a speaker of certain impedance (they may do this to protect themselves more than anything else).

Generally most loudspeakers use Mid-Bass drivers that are rated at 8 Ohm and when used with an 8 Ohm Tweeter, the speaker would nominally be rated at 8 Ohm. However if the speaker is a floor standing model, it would likely use *two* Mid-Bass drivers wired in parallel and now nominally 4 Ohm. Also, if the drivers were connected in series, the speakers would be rated at 16 Ohm, but this a rare thing to do.

No doubt these questions are also raised with other manufacturers, but let us focus on the explanations we use here at Orpheus Loudspeakers. As explained, most of the speaker drivers are each rated at 8 Ohm. When, as we do in most cases, we use them in pairs and in parallel, our speakers are almost always nominally 4 Ohm. However at this point we have to make a point that NOT all 4 Ohm speakers are the same. This is where the subject about the loudspeaker's electrical *Phase Angle* needs to be considered. Without getting too technical, let us accept certain basic rules. If the electrical phase angle is near zero degrees or has a positive phase angle, it is accepted that the load on the amplifier is benign. But if the electrical phase angle goes significantly negative, this places excess demands on the amplifier. But ALL Orpheus loudspeakers designs are carefully optimised to prevent this from happening and all our speakers, even the ones rated at 4 Ohm, are very easy to drive. This makes them compatible with most, if not all, amplifiers on the market. Even most tube or valve amplifiers have 4 Ohm terminals that can be used. It is very unlikely that your amplifier will not be compatible with any speaker from the Orpheus stable, as this is exactly what we strive for.

Another consideration is *Sensitivity*. A loudspeaker's sensitivity is rated in decibels, or dB, of Sound Pressure Level (SPL). Hence we use "dB SPL" to rate sensitivity. We follow the convention and measure sensitivity at 1 Metre distance and with 1 Watt input power. Generally if speakers are capable of 90dB SPL or more for 1 watt input, it is classed as high in sensitivity and gets loud quite quickly. A side issue to sensitivity is *efficiency*. This is a very complex rating that most users need not be too concerned about, but in a general sense, speakers with high sensitivity are usually also very efficient. For the technically minded, efficiency is calculated on the basis of sensitivity times the current required to achieve a rated sensitivity. Many believe they are the same thing, but sensitivity is rated as dB SPL and efficiency is rated as a percentage. But this is rarely an issue and certainly not so with Orpheus Loudspeakers.

Perhaps now is the time to discuss the issue that may confuse the most. Many consumers ask how many *Watts* our speakers can handle or put out. That is actually two questions as an acoustic Watt is very different from an electrical Watt. But basically, they want to know how much *power* the speaker needs or what *power* is too much and may damage the speaker. There is no simple answer here. Our speakers can handle quite high power during short term peaks, and this is what you would like to see as most music has short only term peaks rather than long term peaks. It also comes down to what kind of sounds you are playing or how loud you want or need to play them and the kind of program to you are intending to play.

To help us understand that better, please examine the following list:

Sounds	dB SPL
Rocket Launching	180
Jet Engine	140
Thunderclap, Air Raid Siren 1 Meter	130
Jet takeoff (200 ft)	120
Rock Concert, Discotheque	110
Firecrackers, Subway Train	100
Heavy Truck (15 Meter), City Traffic	90
Alarm Clock (1 Meter), Hair Dryer	80
Noisy Restaurant, Business Office	70
Air Conditioning Unit, Conversational Speech	60
Light Traffic (50 Meter), Average Home	50
Living Room, Quiet Office	40
Library, Soft Whisper (5 Meter)	30
Broadcasting Studio, Rustling Leaves	20
Hearing Threshold	0

From the above listing, it is apparent that trying to play certain kinds of sounds at *real* levels as listed above, is going to place more demands on both loudspeaker and amplifier.

But it is clear that common sense is also your best guide. Clearly, none of us would ever want to produce the sound level of a Saturn 5 Rocket Launch right inside our listening room – think about, it could literally damage your house if it was possible. We would clearly be satisfied with something less. But how *loud* does it need to be, especially *if* you want to listen to that kind of *non*-music event as rockets or jets taking off? Only you know.

There is also the danger that an amplifier rated too *low* in Watts is more likely to damage a loudspeaker than one that has sufficient headroom. An amplifier that runs out of power runs into a condition that is called *clipping* – basically the top and bottom of a musical waveform gets chopped off – and you will clearly hear this gross distortion. This is important: It is NOT the loudspeaker that is distorting, it is the *amplifier*. And now the amplifier will produce distortion that is damaging to your loudspeaker. If you hear this kind of distortion, lower the volume, otherwise damage will occur, and it will usually happen first to your Tweeter.

Does this mean that the Orpheus Loudspeaker can handle more power? In a sense, the answer is yes. With musical sounds and an adequately powered amplifier, they will go loud enough to satisfy discerning ears who want realistic sound levels. Sounds that are short in duration can be played very loud indeed. But non-musical sounds or long constant tones produced electronically, these will create greater demands. Whereas, when sounds are created by normal musical events and instruments, then Orpheus Loudspeakers can handle very high levels, if the amplifier supplies the power cleanly. Indeed, even the most powerful amplifiers can be used when common sense applied.

So the bottom line is this: Determine for yourself what levels and what kinds of sounds you will need to produce, let your wishes and needs be known to your reputable dealer, and he, or ourselves, will be happy to help choosing the right combination of speaker and amplifier. But we do point out that Orpheus Loudspeakers are compatible with the vast needs of most music listeners and also the vast number of amplifiers ever made.