

Distributed Sound Systems Using Plitron Toroidal 70 Volt Line Transformers

By Menno Vanderveen

Introduction

Plitron has introduced a series of high performance, wide bandwidth, low distortion 70 volt toroidal transformers for distributed sound applications.

Distributed sound systems, using long loudspeaker cable run, utilize 70 V line transformers. These transformers convert the output voltage of an amplifier to a standardized secondary level of 70 V. Transported through the long loudspeaker cables, the 70 V is transformed down to the voltage required at the loudspeaker. Because of the low current in a 70 V system, the heat loss produced by the audio signals in the long loudspeaker cables is attenuated, while the damping factor at the loudspeaker stays unaffected large.

The requirements for high end performance in 70 V line system places large demands on the transformer. The bandwidth should exceed the amplifier bandwidth, the distortions should be extremely low, the losses inside the transformer should stay small, and the stability of the transformer should be excellent. The transformer should not have any negative influence on the driving amplifier. In summary, the transformer should act as an invisible neutral element.

Menno van der Veen designed a new PAT range of 70 V line transformers with several power levels ranging from 60 to 250 Watts, See the specifications for more details.

These new high-end transformers can be distinguished into two groups: non isolating (auto) transformers and isolating transformers.

Isolating or non-isolating?

In the case of the non-isolating designs the secondary winding uses a part of the primary winding for the voltage step-up from the amplifiers output to the 70 V line. In this design the grounding of the amplifier is part of the 70 V line. For almost all applications this is no problem.

However, for very special situations, where the 70 V line should be totally floating, an isolating type line transformers should be used, like for instance the PAT-4154-02. There totally separated primary and secondary windings are used to ensure perfect primary to secondary isolation under any condition.

About Bandwidth and Distortion

The high-end character of these designs is found in the extremely wide frequency bandwidth, when measured at 1 W, ranging from at least 0.1 Hz to a mere 500 kHz, therefore largely exceeding any amplifiers frequency range. The -3dB power bandwidth starts at 14 Hz up to the same high frequency limit at 500 kHz.

Measurement of the total harmonic distortion (THD) at full power at 20 Hz, shows an amazing 0.007 % THD. This 20 Hz full power frequency is the most difficult frequency for the transformer, since the core is then loaded to its limits. The extremely small THD at 20 Hz shows that indeed we have produced neutral 70 V line transformers, largely exceeding the qualities of almost any high end audio amplifier. When we tried to measure the THD at 20 kHz as well, the line transformer distorted less than the driving amplifier (with a THD of 0.003 % at 20 kHz). Therefore we claim for our transformers a smaller distortion than 0.003% at 20 kHz.

DC-offset creates problems!

Under normal conditions an amplifier is loaded by a loudspeaker with an impedance in the environment of 4 Ohms. At DC-level and at very small frequencies, such a loudspeaker will have an impedance close to 3 Ohms.

However, what happens when a PAT line level transformer is placed between the amplifier and the loudspeaker? At DC-level, the

amplifier now sees the small DC-resistance of the primary winding of the transformer, equals to 0.5 Ohms or less. (The internal resistances of our transformers are very small for a small Insertion Loss inside the transformer).

DC-offset voltages at the amplifiers output will create rather large currents in this small 0.5 Ohms internal resistance. These currents will tend to partly saturate the core of the transformer. This means that a 70V-line transformer will be very sensitive to any DC-offset voltage at the amplifiers output, unless special precautions are taken, as we did.

In general a good quality amplifier should show a DC-offset voltage smaller than 0.1 mV at its output, but in reality offset voltages up to 10 mV (and even larger up to 50 mV) are found. Without any precautions any 70 V line transformer will be DC-saturated by this small 10 mV offset voltage. This will cause severe low frequency distortion inside the driving power amplifier and in the 70-V line transformer.

However, our new 70V-line transformers are designed to withstand such DC-offset voltages without getting saturated. They can handle up to 10 mV DC-offset of the amplifier and then show a small THD of 0.03 % at 20 Hz full power! This smart design prevents the use of expensive DC-blocking capacitors (10,000 μ F at least, bipolar) in series with the primary winding, as found in many standard 70V-line transformer designs. However, when amplifiers are used where the DC-offset can not be guaranteed to be less than 10 mV, the application of DC-blocking series capacitors is strongly advised to take full advantage of the low distortion capabilities of our new 70V-line transformers.

Specifications

The table shows the specifications of standard PAT line transformers. Custom OEM designs can easily be manufactured by Plitron with the application of our new computer design program for high-end audio 70V-line transformers. Step down transformers from 70V to loudspeaker voltage levels with any power level and or power tapping points are part of our OEM design program as well. Contact us for more information.

	PAT-4139-02	PAT-4131-02	PAT-4138-02	PAT-4154-02
Type	non-isolating	non-isolating	non-isolating	isolating
Power	60 W / 8 W	120 W / 8 W	250 W / 8 W	120 W / 8 W
-3dB freq. range at 1 W level	.1 Hz - 500 kHz	.1 Hz - 500 kHz	.1 Hz - 500 kHz	.1 Hz - 500 kHz
-3dB power bandwidth	14Hz - 500 kHz	14Hz - 500 kHz	14Hz - 500 kHz	14Hz - 500 kHz
THD at full power at 20 Hz; no DC-offset	.007%	.007%	.007%	.007%
THD at full power at 20 Hz; 10mV DC-offset			0.03 %	
THD at 20kHz			< 0.003 %	

These specifications tell our current level of design and manufacturing, however are subject to further improvement due to our continuing research.

