



# CROSSFIRE

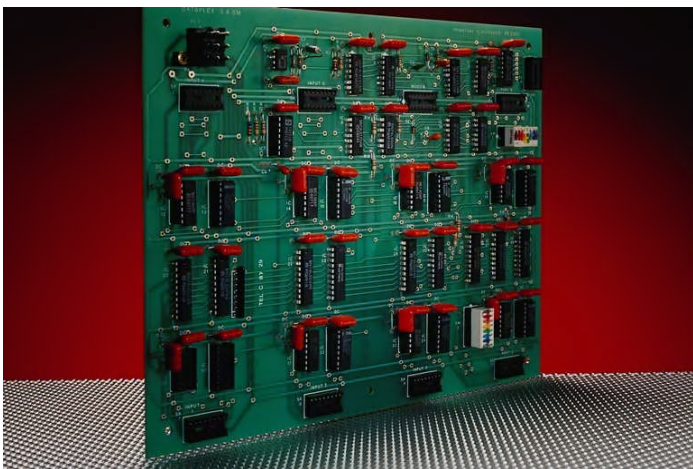
## Multiple Ultrasonic Frequencies with *SIMULTANEOUS* Operation

Zenith Ultrasonics, the recognized industry leader in producing the most revolutionary ultrasonic cleaning products, has once again developed a product sure to revolutionize the ultrasonic cleaning industry. The development is known as **CROSSFIRE** Multiple Frequency Ultrasonics, and is so superior, it will make every other ultrasonic cleaning system obsolete by comparison.

Ultrasonic systems are customarily delivered with only a single operating frequency. Purchasers are forced to determine which single frequency best addresses their cleaning applications. In many cases, however, a single frequency ultrasonic system cannot address all of the cleaning requirements. For example, what if your application has both small blind holes, typically cleaned with high frequency ultrasonics, but also heavy industrial contamination, cleaned most commonly with low frequency ultrasonics? Luckily, there is now a solution to these multi-faceted cleaning applications. It is known as **CROSSFIRE** Multiple Frequency Ultrasonics.

**CROSSFIRE** ultrasonic systems incorporate fully sweeping multiple frequencies of transducers into the same cleaning tank or immersible pack and ALL TRANSDUCERS OPERATE SIMULTANEOUSLY to produce cleaning effects not obtainable by any single-frequency system. For the first time in history, purchaser's of ultrasonic systems can choose more-than-one operational frequency rather than being forced to choose a single frequency which simply can not remove all of the contaminant in question. This is not simply mounting of differing frequencies onto adjacent tank walls, but rather multiple frequency transducers mounted to the same radiating diaphragm, a design previously thought impossible!!!!

Ultra-critical industries, such as manufacturer's of hard disk drives, silicon wafers, optical instruments, and others, typically purchase Zenith's **CROSSFIRE** 80/120, a combination of 80Khz and 120Khz transducers specifically designed for ultra-gentle submicron cleaning applications. In fact, one of the very first 80Khz/120Khz **CROSSFIRE** systems was tested at the largest hard disk manufacturer against virtually every competitive "highest technology" system on the market. The **CROSSFIRE** system outperformed every other system, and was proven significantly more reliable.



CROSSFIRE was first developed to address critical cleaning applications.  
Today, it is used to address virtually EVERY application more efficiently.

high-density material in an attempt to improve transducer output, but rather a completely new technology

Heavy duty industrial applications, such as automotive component manufacturing, metal parts washing, degreasing, service applications, or other industries which require heavy gross contaminant removal typically purchase **CROSSFIRE** 40/80, a combination of both 40Khz and 80Khz transducers. A 25/40Khz system is used for the most aggressive cleaning action available. Other choices of frequencies is are also available based only upon your cleaning application.

**CROSSFIRE** technology is not an "enhanced" transducer which utilizes ceramic disks or other

which allows transducers of differing frequencies to be mounted next to one-another, firing randomly and simultaneously. As with all Zenith systems, transducers used in CROSSFIRE are Natural Frequency Transducers which vibrate at their natural frequency rate, rather than the typical competitive Modified Frequency Transducers, which literally force transducers to operate outside of their natural operational frequencies. Parts receive absolute, true multiple frequency cleaning action, with all frequencies operating simultaneously.



Critical valve assemblies on NASA's space shuttles are cleaned using Zenith ultrasonic cleaning equipment.

Not only do the parts receive multiple-frequency cleaning action with many harmonic frequencies adding to the cleaning effect, the great number of frequencies present virtually **ELIMINATES** any dead space or level sensitivity. Ultrasonic cleaners are similar to microwave ovens in the fact that both produce areas of intense activity, and areas of significantly less activity, leading to inconsistent cleaning results in some cases. The lower the operating frequency of the ultrasonic system, the greater the number of dead spots in the ultrasonic cleaning tank. **CROSSFIRE** greatly reduces or eliminates these deadspot by combining the activity of more than 1 frequency. Waveforms continuously overlap each other, producing a cleaning action

that is uniform at every tank depth or location.

The cleaning action produced by the **CROSSFIRE** system can not be compared with any single frequency system, or any competitive multiple frequency system. Transducers in the **CROSSFIRE** system are evenly distributed to ensure that all parts receive multi-frequency activity regardless of position in the tank. **CROSSFIRE** cleans faster, removes contamination from the smallest detailed part areas, while simultaneously having the power to remove the heavy contamination of industrial applications. The frequency combinations selected can be perfectly matched to the expected contaminant particle sizes, bond strengths, and part designs, to produce a cleaning action second to none.

**CROSSFIRE** ultrasonic systems are available from small table-top models to the largest fully-automated cleaning systems. And all Zenith ultrasonic equipment is available with Multiple Frequency **CROSSFIRE** Inside! **DEMAND** that your ultrasonic equipment vendor include **CROSSFIRE** ultrasonics for the very best cleaning action possible in any ultrasonic cleaning system.

**PATENT #5,865,199**

**PATENT #6,019,852**



**ZENITH MFG & CHEMICAL CORP.**

**85 OAK ST. P.O. BOX 412  
NORWOOD, NJ 07648-0412**

**800-4432-SONIC  
FAX: 201-768-6999**

**WWW.ZENITH-ULTRASONICS.COM**



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