



# Quantum™

## A New Paradigm in Organ Building

### **Pipe Organs**

Historically, the organ has been both an icon of tradition and an instrument of cutting-edge of technology. Prior to the development of electronic instruments, pipe organs were technological marvels. In fact, the two most sophisticated devices in European communities during the 17<sup>th</sup> and 18<sup>th</sup> centuries were town clocks and organs. These organs used advanced mechanics to control thousands of pipes and create a myriad of sounds, thus gaining the title “King of Instruments”.

### **Analog Electronic Organs**

With the advent of electricity, the organ remained at the forefront of advanced technology for which Allen Organ Company played a pioneering role. In 1938, Jerome Markowitz, Allen’s founder, was granted a patent by the United States Patent Office titled *Radio Tube Oscillator* for the stable audio oscillator. While pipeless organ technology advanced from vacuum tubes to transistors, the basic technology included in this patent became the heart of electronic organs for nearly four decades. Tens of thousands of Allen analog organs served customers worldwide, with many still in use today.

By the late 1960’s Allen had taken analog organ technology to the pinnacle of its development. To improve further on sound quality required radically new technology.

### **Digital Organs**

In 1971, Allen Organ Company introduced the *Digital Computer Organ* with revolutionary technology that changed the entire world of sound production. The *Digital Computer Organ* was the first musical instrument to use digital sampling, a process by which recorded sounds are stored in digital memory for accurate sound reproduction.

The significance of this digital technology was immediately recognized with Allen receiving the *IR 100 Award* given by the Industrial Research, Inc. as one of the 100 most significant new products of that year, the first time this prestigious award was given to a musical instrument. In 2004, the world-renowned *Smithsonian Institution* recognized the significance of this technology by acquiring the first Allen digital organ for its collection.

In succeeding years, various musical instrument manufacturers licensed Allen’s digital patents. The fact that Allen’s nearest competitor did not begin using digital tone generation technology for nearly two decades after Allen testifies to the pioneering nature of this technology.

Since 1971, many advances have been made to digital technology with Allen being granted additional patents in the field. These advances were made possible as prices for memory decreased and more advanced integrated circuits became available. These advances have resulted in Allen’s Renaissance™, the first fully software-based organ.

Renaissance organs included many advances leading to more realistic tonal production. For example, some digital organs include the sampled *attack* and *steady state* portions of pipe sound. Allen's Renaissance organs also include the sampled *decay* sound of pipes, adding to the instruments' tonal realism. Another example of the evolution of sampling technology is increased voicing flexibility. Renaissance organs can be voiced on a note-by-note basis in order to respond to any artistic preference or installation challenge.

### **Quantum™ - A New Paradigm**

Until Renaissance, the goal of every digital organ was the faithful reproduction of pipe sound. The realism provided by Renaissance convinced Allen's development team that the most significant improvement to future organ development could be achieved by advancing a different, but equally crucial part of the organ's digital system; the instrument's mixing and acoustical enhancement. Allen embarked on a large development project that has resulted in Quantum™ technology for Renaissance organs.

Quantum™ Organs include two exclusive features that enable them to go beyond the goal of faithful pipe sound reproduction. *Acoustic Portrait™* and the *Allen Stoplist Library™* take Quantum Organs to a level of performance that no other instrument can match.

#### **1. Acoustic Portrait™**

It has often been said that the best stop on an organ is the room in which it is located, recognizing the importance that the acoustical environment plays in the success of an organ installation. Quantum instruments are the only digital organs that bring the science of sampling to acoustics. While other digital organs sample sound, Quantum instruments sample sound as well as space.

Electronic reverb found in other instruments is a synthetic imitation of acoustics "applied to" the sound and is not created as an integral part of it. Acoustic Portrait produces the real thing in exacting detail! Acoustic Portrait begins with a sampling process using impulse responses to measure a room's actual acoustic properties. These measurements are then stored in the organ's memory. Through an advanced real-time mathematical process called convolution, the acoustics of the sampled room become an integral part of the organ's sound, producing a noticeably smoother, more natural result than synthetic reverb.

Allen engineers have recorded the acoustics of cathedrals and other acoustically desirable buildings throughout the world. With advanced processors (DSP's) and patented low-latency convolution algorithms, Acoustic Portrait reproduces the true acoustic response of each original room with stunning realism. Quantum organs feature 10 different Acoustic Portraits™, ranging from intimate rooms to cavernous cathedrals. While not all of the recorded locations' names can be published, one of the acoustics included in Quantum organs is from the well-known *Saint Denis Cathedral* in Paris, France. Listening to a Quantum organ with this Acoustic Portrait setting is like traveling to France to hear the organ live!

#### **2. The Allen Stoplist Library™**

At the touch of a control, organists can change the entire specification of a Quantum Organ. Each specification includes unique pipe samples (sounds) from the world's finest examples of organ-building styles with completely independent scalings, offering the

flexibility of multiple organs in one console! After the installation of the instrument the voices in each specification are perfected to conform to the specific acoustics of the room.

### **Stoplist Library™**

Larger three- and four-manual Quantum organs feature six Stoplist Library™ voices: *American Classic*, *English Cathedral*, *Orchestral*, *Cavaillé-Coll*, *Schlicker* and *Arp Schnitger*. The *Orchestral* specification, perfect for blended worship, complements traditional organ voices with sounds typically found in MIDI modules, such as Strings, Piano, Brass, woodwinds and Percussion..

### **Quad Suite™**

Smaller Quantum Organs feature four QuadSuite™ voices from the Allen Stoplist Library™: *American Classic*, *French Romantic*, *Neo Baroque* and *English Cathedral* (or an *Orchestral* specification in lieu of *English Cathedral*).

Quantum Organs are perfect for today's blended worship. Many churches require instruments with greater versatility to serve more diversified musical needs. Although Allen organs are renowned for their pipe organ sound, their non-traditional benefits make them much more. An Allen organ can be "Music Central" for your church, no matter what style of music you prefer.

## **Quantum™ Technology –Basic Facts**

Hearing a Quantum organ, one quickly recognizes a tonal clarity that sounds live, rather than recorded. This unmatched clarity is a direct result of unique technological advancements.

- Superior Digital Audio Processing - Allen starts with advanced digital mixing that is more precise than analog-based mixing. Allen's system includes 96 digital audio channels.
- Superior Resolution - Quantum's DAC's include 24-bits of output with 128X over sampling and a signal-to-noise ration of 120 db's.
- Superior Processing Power & Patented Technology - Supplying real-time convolution (Acoustic Portrait) requires enormous processing power. An 8-second stereo convolution reverb requires about 35 billion calculations per second, currently unobtainable for any musical instrument. With exclusive patented technology, Allen Quantum organs process this eight-second convolution reverb with about 400 million calculations per second. While still a huge number, Allen dedicates multiple SHARC® DSP's to offer this advanced capability.

*How does Allen offer so much processing power?* The SHARC® DSP's include internal **floating-point** capabilities, rather than the *fixed-point* systems supplied with most consumer products. Floating-point processing means that a much greater range of computational numbers is available for Quantum organs, offering substantially more computing power, less distortion and a higher quality sound; i.e. low-latency convolution and tonal clarity.

*How advanced is Allen's Quantum technology?* Here is an interesting comparison. A digital organ that produces CD quality sound without convolution requires only about 100,000 calculations per second for each sound. Quantum organs include about 4,000 times that capacity to create convolution alone! Combine this with high-speed circuitry, and an eight-

layer printed circuit board, and you have the most advanced computer processing power ever placed in a musical instrument.

While Quantum's technological statistics are amazing, it is the musical result provided by this technology that is truly fantastic. Just as with the earliest Allen digital organs, Quantum is the new benchmark of design and performance that will chart the course for the future of organ building!