Research & Development
En Masse low cost production of Consumer Electronics in the United States of America

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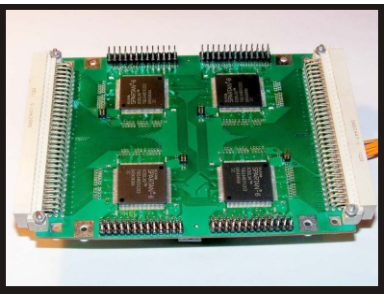
Instrument Quality



Infinite Continuous Numerical Analog Master

Instrument Quality is introducing the **Numerical Analog Converter (NAC)** at the Rocky Mountain Audio Fest in 2015. It generates two separate 100% guaranteed infinite continuous numerical analog output signals created with analog computers featuring no rails, infinite bit resolution and no compression. LEFT and RIGHT channels with separated volume output for each channel, eliminating the need for any **Digital Analog Converter (DAC)**. A 100% noise free Fibre Optic link from USB 3.0 connects any mainstream music format **(DIGITAL INPUT ONLY)** music, movie or computer music, including internet streaming from the computer. Input Quality ranges from 16 / 44.1khz CD quality up to the **NAC** 100% infinite continuous numerical analog input featuring infinite bit, and infinite sample rate. Digital 16, 24, and 32 bits, with 44.1 / 48 / 96 / 192 / 352.8 / 384 / 768 / 1536 / 3072 / 6144 / 12288 / 24576 PCM sample rate input. DSD64, DSD128, DSD256, DSD512+ mainstream inputs are also supported. Two separate internal and external Volume Controls included for Left and Right are 100% infinite continuous numerical analog. Realtime customer programmable music perception dynamics are possible for environment and amplifier speaker improvement including different tube sound combinations with 128 microphones on the Left channel, and 128 microphones on the Right channel. The actual Left and Right 100% infinite continuous numerical analog output signals with 100% infinite continuous numerical analog separated volume output signals are single ended, or balanced, appear at the two separate ends of the two 100 foot long 100% noise free Fibre Optic link outputs, for possible usage on separate preamplifiers or monoblock amplifiers located as close to the speaker systems as possible. The input to the **NAC** is also 100% noise free Fibre Optic link with the only electrical conductor being a power input. The 100% infinite continuous numerical analog signal is not improved by, and does not require any expensive power supply options, or exotic clocks because there are no discrete digital states involved that require perfected timing in any way, shape, or form. The Instrument Quality **NAC** sells for $4,999.99.

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Instrument Quality is also introducing the **Analog Numerical Analog Converter (ANA)** at the Rocky Mountain Audio Fest in 2015. The **ANA** converts 100% infinite analog input signals **(ANALOG INPUT ONLY)** into computer compatible numerical guaranteed 100% infinite numerical analog for digital storage, editing, processing, communication, and internet. Ranging from 2 input channels Left and Right, to thousands of separate input channels available for Master Recording Studios. Each individual input channel is guaranteed to be 100% infinite numerical analog created with analog computers featuring no rails, infinite bit resolution and no compression without expensive power supplies, massive filtering, or exotic clocking allowing microphone positions not currently possible. The **ANA** analog input is connected to a digital computer for digital processing, storage, and internet communication. The **NAC** then receives the **ANA** signals from the computer, storage, or internet and recreates the original 100% infinite analog input signals with analog computers. The output of the **NAC** can then be connected back to the **ANA** directly into an **infinite loop**, and never loose any of the original 100% infinite analog input signal detail. Vinyl LP's were produced cutting lacquers from Master tapes that eventually wore out, a copy replaced the discarded Master . The new cutting lacquers were made from the copies, until the copy was copied then the original copy was discarded. The cycle continued until the sound failed completely. Decades of music performances many decades ago are lost to the world forever, without Retro-Generation.

The Instrument Quality **Quad Floating Needle (QFN)** with floating turntable is designed for connection to the **ANA** and **NAC** for a guaranteed 100% infinite numerical analog signal for digital storage, editing, processing, communication, and internet of Vinyl disc recordings. The output is available any time from the **NAC** with a guaranteed 100% infinite numerical analog signal without the need of any turntable. It is designed with four independent floating needles that can be simultaneous run live, or a preferred ten to one hundred times below the rated RPM. This will reduce the twenty thousand cycles per second to two thousand cycles per second or two hundred cycles per second. Less wear and more signal detail are made clear for the computer storage of the guaranteed 100% infinite numerical analog signal. Repair of surface damage can be made with different copies replacing the damaged sections, or computer analysis can minimize transition differences. Multiple scans at different times, or from different sources can be added at any time without compromise of original scan. When the original scan is stored, infinite playback is possible with no loss of signal.

Instrument Quality is a "living" infinite continuous numerical analog signal designed for six dimensional Master Music Creation, not simply recording and playback. Existing music recordings can at best only be an accurate replication of original musicians and instruments limited with two dimensional planar wave signals from pickups, microphones or synthesizers, never to live again.

Bell Tower Home Theater is going to put a $125,000.00 concert hall grand piano into the home, along with the rest of the concert, for a small fraction of that cost. Instrument Quality master recording, with master generation signals are used to create a new live performance every time.

Bell Tower Home Theater is achieved without psychoacoustics of any kind, marketing analysis, or human brain scans, because the obviously **perceptible** 800 plus amperes of line current peak, hundreds of custom engineered atmospheric modulators with dynamic deflectors, and typical music song file sizes in the terabyte region creating the reality where you will not only hear the difference, you will feel the difference physically (without any harm from excessive amplitude).

Microphones and speakers of today work with two dimensional planar waves or multiple interfering two dimensional planar waves used in immersive sound, at best will ever achieve two and a half dimensions. Real music instruments exist in a three dimension reality that has **NOTHING** to do with the human ear, or speakers imitating the two dimensional planar waves recorded from a synthetic human ear microphone that is legacy based on the limited physics of 100 years ago. Instrument Quality uses **unlimited digital storage** for the numerical analog master signal to generate high performance living detail that is **currently** not addressed by any audio equipment.

Instrument Quality Realtime Analog Computer is used for the Analog To Numerical Analog converter to generate great high performance perceptible **input** detail. Numerical Analog To Analog converter generates an infinite analog **output** electrical signal with the Realtime Analog Computer**.**

Instrument Quality has all the advantages of digital computer storage and communication along with the advantages of **no rails** and **no compression** allowing microphone positions not previously possible, with **infinite bit resolution** analog signal quality designed for six dimensions creating three dimensional atmospheric modulation for music. **100%** look down compatibility to any existing standard music distribution model, **Instrument Quality Master** recording stores the individual instruments with environment effects, and can change any single instrument with another instrument in the same or different environment on higher consumer level equipment. Master 256 separate instruments including voice per channel composite and reverse separable.

Compatible with any existing music recording format in major distribution, the NAC is also forward compatible with any and all material recorded in the Instrument Quality signal format that will communicate a true 100% infinite analog signal from the microphone or instrument creation of master recording studios through the computer systems with disk, disc, tape and even internet communication where the original 100% infinite analog signal will be reconstructed in the home without dither, noise shaping, or any of the digital fill in the gap attempts to become more analog like.

The NAC is the 100% analog output signal, one component used for Instrument Quality. The ANA is the input component used for master recording studios and the Instrument Quality Recall product designed to convert the owner vinyl disc to computer storage of disk, disc, or tape for playback of 100% analog output without any turntable. The NAC, ANA, Recall, and IQ turntable QFN are four separate Instrument Quality components.

The NAC is usable with existing recorded mainstream distribution of music and movies connected to an existing 11.11 home theater system. The other three Instrument Quality products are used with the NAC for vinyl disc storage creating 100% analog recording and playback without any turntable. No discrete state digitization is ever used to create the 100% analog signal chain from beginning to end.

DIGITAL A digital system is a system where numerical quantities are represented by a device that shifts between discrete states, rather than varying continuously. For example, an abacus is an example of a digital device, because numbers are represented by beads that are either “up” or “down”; there is no meaning for a bead that is partway up or down. Pocket calculators and modern computers are also digital devices. A digital device can be more accurate than an analog device because the system only needs to distinguish between clearly separated states; it is not necessary to make fine measurements. Other examples of digital devices include clocks that display numbers to represent the time (rather than show hands moving around a circle) and music stored as a series of numbers in an MP3 file. For contrast, see **analog**.

ANALOG An analog system is a system in which numbers are represented by a device that can vary continuously. For example, a slide rule is an example of an analog calculating device, because numbers are represented by the distance along a scale. If you could measure the distances perfectly accurately, then a slide rule would be perfectly accurate; however, in practice the difficulty of making exact measurements severely limits the accuracy of analog devices. Other examples of analog devices include clocks with hands that move around a circle, thermometers in which the temperature is indicated by the height of the mercury, and traditional records in which the amplitude of the sound is represented by the height of a groove. For contrast, see **digital**.

NUMERICAL Pertaining to numbers.

NUMERICAL ANALYSIS The study of methods for approximation of solutions of various classes of mathematical problems including error analy*sis.*

In the cattle stampede of ULSI, WSI, SOC, and 3D-IC (Ultra-Large-Scale Integration, Wafer-Scale Integration, System-On-a-Chip, and Three-Dimensional Integrated Circuit) making computer architecture and electronic components smaller, with less cost, critical artistic and physical subtle music detail is sacrificed because it is ignored or never acknowledged, does not fit current economic models of minimum sales yield, and as long as no one else has anything better, we will have the best possible. The two dimensional composited planar wave captured from a microphone is a concept from over 100 years ago. Instrument Quality is a concept that is live and continuous.

This has created a status-quo of lowest common denominator to support and supply the demand for almost one billion cell phones manufactured world wide every year, including a compatible bit rate with existing low cost internet.. A false economy of low cost computer power available to almost everyone, however the intention for creation of this low cost computer power is explicitly for cell phones, with hand held mobile devices including the automotive market. Because a signal standard created almost 100 years ago is easily implemented into cell phones and portable electronics, it is heralded as the best possible signal format because it has been perfected for almost 100 years.

The existing signal standard for **ALL MUSIC** including master recordings is used in the lowest cost playback unit up to a full 2 million dollar stereo system where each single signal channel (Left or Right) is compromised into no less than five separate signal destinations, volume, tweeter, midrange, woofer, and sub-woofer. All immersive sound formats are simply a compounding compromise with more standard signal channels of the same existing standard. Immersive formats are the logical progression from experiments decades ago.

Infinite continuous numerical digital master analog signal resolution, means that we do supersede any, and all specifications for Hi-Res Audio, after MQ-A (From an analog master source). The digitization process has been so bad that some humans can hear the subtle differences of the minute missing signal detail from digitization, along with possible horrible distortion from Digital Signal Processing (DSP). Our Hatch Secure Processor works with the subtle missing signal detail in analog format from input to output, adding many of the advantages of digital, without the digitization loss. The Hatch Secure Processor works with the original analog signal, or Instrument Quality generated analog signal, and creates an analog sound signal improvement during live playback post processing, that the human can hear. Instrument Quality has the digital accuracy with the infinite replication of digital while still being a true analog signal. This is infinite continuous numerical digital master analog signal processing, not Digital Signal Processing (DSP).

Digital computers require analog signals to be converted to digital, because they can not work directly with analog in any way, shape, or form. Decades ago when computer memory, and cycle times were very precious because of the cost and electrical energy required, it was a reasonable trade-off to compromise the subtle analog detail for the high bit efficiency, digital replication, and ease of processing in the analog to digital conversion.

The compromise of the analog to digital conversion is accumulative, where sequential repetitive analog to digital, then back to analog with digital to analog and repeating without the original analog signal will degrade and take away from the original analog signal. Digital is famous for its wonderful infinite and accurate replication once digitized, however the signal degradation loss from the analog to digital process is much less well publicized. Ignoring the compromise, claiming the compromise does not exist, or trying to repair the damage after digitization does not work very well compared to the true analog signal. Different forms of filling in the gaps are applied to digitization such as interpolation, dithering with random number generators, slew, and other noise creation is used to convert or make the digital signal appear more analog like, ironically adding noise to improve the signal to noise ratio specifications.

Extreme digitization sampling frequencies, with increased bit resolutions do improve the end result, compared to lesser sampling frequencies and bit resolutions only, never quite reaching the true analog signal quality. Both the digitization process, and conventional analog recording systems where amplitude and signal are combined, harden the analog signal, freezing the analog signal forever in time and space with existing proportions, killing the living, breathing analog system forever. The original analog signal is always superior, it simply can not be stored without the distortions involved in the physics of the technology used.

Instrument Quality is designed for the master recording with master analog creation and generation in the recording studio to create a true six dimensional analog signal system with a minimum of hundreds to thousands of individual analog signal sources for each and every single one of the minimum 11.11 atmospheric modulators used in the Bell Tower Home Theater product, necessary for true Instrument Quality analog detail. Look down compatibility with conventional game based sound objects, multichannel audio, and immersive surround sound systems allows conventional playback without any claimed improvement when the Instrument Quality analog signals are not installed.

All current forms of digitization are by their very definition lossy because one hundred percent accuracy at the sampling point in space and time leaves out everything between the samples, including subtle intention. We call this loss.

Instrument Quality is about the practical implementation of new creations of true analog signal processing that are not possible with any true signal integrity from existing digital signal processing (DSP) system, or digital audio workstation (DAW). The self contained Hatch Secure Processor allows us to implement our original trade secrets into a high end consumer electronics product allowing us to maintain a mechanical advantage worldwide.

Over the past decades, vinyl recordings have proven to be the most practical economic delivery mechanism for a true analog music signal, and when the limitations of analog signal chain were observed, to this day remains a superior signal for subtle detail, even with the relatively high noise floor, and lesser dynamic range than high frequency with high bit resolution digital recordings.

In a true analog vinyl disc recording created with artistic effort, there remains decades later a treasure chest in hidden details of instrument quality that can be recovered, and rediscovered. The Instrument Quality Recall consumer electronics product offers the ability to send in your old scratched, and damaged vinyl recordings to us, and we will clean, repair the damaged and missing signals often using a database of previous experience, converting the true analog vinyl disc with our very original custom made vinyl groove signal transducer. The result is an infinite continuous numerical digital master signal, or numerical analog signal, lossless and superior analog to the recorded groove of vinyl recordings starting with the analog groove signal and supercharging the analog into a digital computer format, without any form of existing conventional digitization. The actual working mechanism is stored for use in future processing.

Resulting with almost the exact opposite intention of high bit efficiency, we explode the data storage requirements. The equivalent of four Linear Tape Open version six (LTO6) tape drives are currently used for storage and playback. Four LTO6 cartridges include 10 Trillion Bytes of native storage, with 640 megabytes per second throughput. The cost is approximately $35.00 for each cartridge, storing from 1-5 true analog LP vinyl discs raw. Four LTO6 tape drive cartridges are equivalent to 100 Blu-ray Disc's and will be reduced to two LTO7 tape drives with two LTO7 tape cartridges equivalent to 128 Blu-ray Disc's when physically available.

The Instrument Quality Recall is our product that our customers use to playback the vinyl disc LP recordings sent in, now on LTO6 tapes returned with the original vinyl LP discs. The LTO6 tapes are secured to be playback locked to the one single customer Instrument Quality Recall-Hatch Secure Processor only. Unlimited internet copies can be made, however they all can only be played on that one single customer Instrument Quality Recall unit. Unlimited lifetime data signal integrity is 100% guaranteed.

A 55 inch 4k monitor is used as the control panel to easily see the signal quality process the customer selects based on personal preferences, sound equipment used, and environment. Simple visual comparison of existing digital signals, and Instrument Quality signals become obvious. The onboard Hatch Secure Processor can not work with existing digital signals. No personal computer is required.

From the Instrument Quality Recall, multiple standard LC - LC fibre optic links up to 500 meters are used for the left and right channel where the true analog voltage output is connected to the possible monoblock power amplifier system. No mechanical turntable system is required.

The raw original repaired true analog vinyl disc signal is stored on the LTO6 tapes. The customer now has unlimited analog signal processing capability including removal of the noise floor, increase true dynamic range without the trade-off of distortion, or create an automatic dynamic fluid volume, create automatic dynamic fluid intensity of individual instruments without distortion or digital signal processing. Enhancement or even replacement of an individual instrument is now possible on some recordings.

Instrument Quality is now possible because of the signal detail available sometimes randomly discarded during the normal digitization process. The raw original repaired true analog vinyl disc signal can be fitted to compensate for less than perfect stereo playback equipment, and also environmental characteristics, without the horrible distortion of indiscriminate frequency based filter equalization achieved with digital signal processing. All the change in signal can occur during playback without changing the raw original repaired true analog vinyl disc signal. An unlimited dynamic range is now possible.

This is the first step toward our future Instrument Quality Retro-Generate that will recreate the instruments from the inside-out with atmospheric modulators, as opposed to the microphone view and planar speaker sound generation of outside-in, including the human voice, containing the original musician signatures from old recordings. Instrument Quality is not possible with current or future multichannel audio, and immersive surround sound systems, or object based gaming technology. The Bell Tower Home Theater will be required.

The Instrument Quality Recall infinite continuous numerical digital master signal on the LTO6 tapes does look down on any digital format, so if the customer decides to, it is easily possible to generate any standard digitization format for use in other equipment, from 44.1 x 16 CD quality up. The Instrument Quality Recall can connect to the internet for communication with our website where custom settings can be uploaded, or downloaded from the library. Different settings for different Albums can make dramatic changes for the better.

Bell Tower Home Theater

Bell Tower Home Theater will place Instrument Quality computer generated concert hall grand pianos, violins, flutes, trumpets, oboes, clarinets, bassoons, horns, trumpets, drums, and all traditional mechanical instruments of over a thousand years, including the human voice , into the home disguised as a home theater, for a small fraction of the $125,000.00 cost for one concert hall grand piano. Equal and new superior sound quality is achieved compared to the original mechanical instruments because of the unlimited computer generated configurations of true six dimensional animated motion controlled recombinant atmospheric modulators of Instrument Quality sound generation. An additional 400 to 800 amps are required to be installed for a typical home by the National Electrical Code with local state safety certified electricians. This represents peak load only, with very low average current requirements for two hour music concerts, or two hour movies.

Designed to be computer generated instrumentation without the horrible existing music synthesis, Instrument Quality will also emulate traditional speaker systems to be legacy compatible with all existing music, and movie distribution formats. Instrument Quality will modulate the atmosphere very differently from "speaker" voice coil driven cones. This is not possible with conventional "High Resolution" master recording signal formats including any or all existing master recording signal formats both analog, or digital driving any number of existing best quality speaker systems, can not, and never will create Instrument Quality.

The premise that recorded music should be stored and played back in a human referenced format is "Reductio Ad Absurdum". Single point time and space microphones are recorded by one single signal generated in a voltage rail bounded two dimensional format, with human scales of decibels in a volume unit format applied to the raw signals filtered for frequencies beyond both above and below "human hearing". This single signal now is amplified by the recorded logarithmic amplitude volume units possibly compressed, only then magically divided and individually separated by cross-over networks typically located in the speaker unit itself, into a separate tweeter driver signal, mid-range driver signal, woofer driver signal, and finally sub-woofer driver signal with logarithmic amplitude and volume units for each of the four derived signals from the **ONE-SINGLE** original signal. Stereo multiplies all these errors twice, and 5.1 = five times errors.

Entire dimension sets of data that have been ignored by the single point in space and time microphone position, are somehow magically reassembled by the recorded single point signal into a "sound stage" that now can only exist in the human imagination, because the "sound stage" that did exist in the recording studio, even a single voice or instrument, was never recorded. Multiple 2D planar sound images moved across multiple 2D planar speakers can not magically recreate 3D sound. The foundation to support real 3D sound into practical consumer electronic products does not exist in 2015. Thus began the Instrument Quality Bell Tower Home Theater.

Instrument Quality

Instrument refers to the traditional physical, mechanical, music creation made with wood, metal, animal parts, cloth, and fibers over the past hundreds to thousands of years. Flute, Trumpet, Drum, Clarinet, Bassoon, French Horn, Trombone, Violin, Acoustic Guitar just to name a few. It required over 200 years to advance from the harpsichord to the Concert Hall Grand Piano.

Instrument also refers to the complete replacement of the traditional physical, mechanical, music creation, and imitation of with "speakers" by unlimited computer generated configurations of true six dimensional animated motion controlled recombinant atmospheric modulators of Instrument Quality sound generation. The atmospheric modulators replace the traditional speakers and are true six dimensional animated motion controlled recombinant in different configurations for the creation of different simultaneous musical instrument groupings.

Six dimensional Instrument Quality animated motion refers to the many different individual physical magnetic field transducer core atmospheric modulators combined. Motion controlled recombinant refers to inflectors and deflectors of the combined dynamic reconfiguration with three dimensional arrays.

The configuration and location position of both the modules, and deflectors are dynamically active during the two hour concert, or movie. The wide range of physical motion can be visibly dramatic during playback.

Dynamic resonant cavities, and dynamic projection range deflectors are also included. The high speed high mass motion control system will consume large amounts of electrical current even though they are not directly responsible for music generation, and may not configure the same way twice in different physical locations with the same music.

Along with the three dimensions of X, Y, and Z are also included the three dimensions of rotate X, rotate Y, and rotate Z. Each and every module is a Six Dimension Instrument Quality Atmospheric Modulator. Many different modules of different physical dimensions and shapes are used to combine into one Six Dimension Instrument Quality Atmospheric Modulator. All the different moving cavities, inflectors, deflectors, recombinant shapes and sizes would be traditionally called one single speaker position, and or location.

Pulse Cannons are required for six dimensional animated motion controlled recombinant resonance cavity arrays of different dimensions and shapes to create the Instrument Quality atmospheric modulator. Pulse Cannons are used to create, shape, and project different resonance properties onto multiple atmospheric modulated sounds.

Pulse Cannons are extremely high energy devices with intermittent duty cycles, and practical where the normal distribution of music energy is consistent with existing two hour music concerts, and movies. Critical to unique signature atmospheric modulation, and live musical instrument interaction, the Pulse Cannon itself requires many more times the entire data bandwidth available to all the installed speakers in most entire existing movie theaters of 2015.

The number of different modules per position, and or location can vary depending on specific application, and or cubic footage of the performance area. Unlike traditional speaker systems with passive or active cross-over networks, there are no cross-over networks involved, and actually hundreds to thousands of live real-time signals are required for each speaker system. Where tweeter, mid-range, woofer, and sub-woofer have only **ONE SIGNAL** per speaker location.

The original and unique analog to digital converters are required to achieve an infinite continuous numerical digital master without digital sampling. A complementary original and unique digital to analog converter is also implemented in Instrument Quality.

Instrument Quality modules use multiple 10 Giga bits per second fibre optic cable links back to the Instrument Quality controller. USB 3.1 is a possible fit with a custom fibre optic converter that will reduce cost. The Bell Tower Home Theater system is designed for true mass production of consumer electronic products with almost no exotic materials, no ultra high performance semiconductors costing tens of thousands of dollars each, and will use extremely large steel metal castings that are cleaned and cut by CNC machines. It is designed to be affordable with time payments over years, and even improve the value of the home.

Quality refers to the fact that most musicians can perceive a difference between almost all live performances involving traditional mechanical music instruments, and recorded playback from even the most expensive electronic audio systems available. Ranging from $250,000.00 to $500,000.00 and up for just stereo audio. This simple observation is not the cause of all the change required, however it is just one small symptom of the many deficiencies accumulated over the past 100 years of traditional music recording, and playback. The continued strife of incremental performance increase, and then continued disappointment when bandwidth limitations force quality sacrifice ends now.

Quality also refers to the complete system integrity of music reproduction with repeatability that is equal or greater than the original. This is possible because almost all live performances use some form of electronic amplification. Instrument Quality will also improve the live performance while creating the music recording of the live performance. The Box seats in a concert hall can now be located in the home live, where the Box seats are actually on the stage with the musical instruments and singers. Retro-generation of live performances from artist of long ago, without the dry two dimensional multiple planar sound we have today in 2015.

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Hatch Secure Processor

The Hatch Secure Processor is located at **www.hatchsecureprocessor.com**. Similar to a submarine hatch that is secured for water tight integrity, the Hatch Secure Processor can not be reverse engineered by all the supercomputers in the world working together to defeat the secure data integrity once the hatch is secured.

The Hatch Secure Processor can be secured and numerically become a unique identity unto itself while being mass produced on a consumer electronics product scale. The internet can easily handle the management of each and every two hour music concert, and or movie of each and every single performance sold so that a copy of any Hatch Secure Processor title could be stolen and placed on the internet for random free distribution world wide, and the millions of copies made can and will only be able to playback on the one single customer Instrument Quality controller.

For decades and decades musicians would invest great amounts of money to be published by a record manufacturer, with printing cost of jackets and pictures, creating pallets of music ready for distribution. Because of the profit margins created from all the distribution stages, it became profitable to pirate the original vinyl recording, and bootleg manufacture illegal copies with no profit margin returning to the original investment of time, money, and talent.

Now decades later in a warehouse, those original recordings sit on the same pallet awaiting distribution, and the pirate copies are found on eBay selling at hundreds of dollars each. It is still devastating to the musician all these years later that no income was ever generated. Of course it is much easier than ever to pirate recordings even at home, now that digital has only an excuse of an attempt at data security especially on Blu-ray discs, just enough to say that they did their best, and no one has anything better.

It is the Recording Industry Association of America (RIAA) policy to go after and "lawsuit to death" a Native American mother of four, after turning down a settlement offer of $5,000.00 charges, in 2007 was found liable for $222,000.00 or $9,250.00 per song. In 2009 another jury charged $1,920,000.00 or $80,000.00 per song. Final damages returned to $222,000.00 or $9,250.00 per song in 2012 with no further review in 2013.

Simple due diligence with a small engineering effort will keep the victims from being not only blamed, but turned into criminals. It is not possible to get on the internet and steal anything with your fingers, it is only possible to download what is possible to download. It is very difficult for me to know what is legally free now, and what is not. I do know that all this confusion is only possible with big money political support, and in the year 2015 it is again "Reductio Ad Absurdum", not necessary, and not even possible without an engineered conspiracy of terror caused by Fraud Upon The Court. The claim that no one has had a solution has been a lie for many, many years now

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We are now living in the "Irish Potato Famine" of computer architecture caused from the Intel-Microsoft Monopoly. A few different competing monopoly's simply offer their different versions of the same "Irish Potato Famine". The entire world has become a willing victim of low cost consumer electronic products, even to the point where supercomputers use the same processor architectures by the hundreds of thousands at a time. Again "Reductio Ad Absurdum".

In a numerical world where infinity is everywhere, we are bounded by 1960's to 1980's computer architecture foundations only because of the "Irish Potato Famine" Intel-Microsoft Monopoly with posers, and it will end beginning with the Hatch Secure Processor.

The Hatch Secure Processor is not simple data encryption. The entire Hatch Secure Processor computer architecture is dynamic, computer generated so no two computers are ever the same, and never made available to the public. The "Irish Potato Famine" comes from only a few different versions of instruction sets, and all available to the public. Even encrypted instruction sets can be reverse engineered because economically they are cookie cutter stamped in silicon, have a fixed methodology and therefore are not dynamic, so everyone on planet earth shares only a very few different versions. A computer virus can not exist without knowledge of the computer instruction set it is infecting. It will be identified as a virus and destroyed before it can do any damage. The cost of Hatch Secure Processor is a minimal increase in electronics, with 100% physical secured success, compared to a current human terrorism campaign.

In the year 2015 it is only possible to manufacture and mass produce data constructions such as music, movies, computer programs, money, or art, that can be stolen in any way, shape, or form if and only if you allow them, or want them to be stolen.

Bell Tower Master Recording VS Discrete Digital Recording

Instrument Quality is designed by computers, for computers, and only interface with humans at the very last moment. Existing two dimensional master recording formats can, and do generate artifacts from discrete digital sampling while mixing different digital recorded sources in the hundreds at a time for movie production. Instrument Quality is designed to integrate thousands of different recorded sources into one instrument at a time, with thousands of instruments integrating thousands of sources each possible per sound channel without discrete digital sampling artifacts.

No repair or fix is possible, or will be attempted to existing music recording, and generation systems by Instrument Quality. Instrument Quality is a brand new music recording, and generation system from beginning to end. While two dimensional sound, and music does exist, and is appropriate at times, it is almost never correct all the time.

No claim is made at this time to magically repair the missing details and failures of all existing recording formats because that missing detail is lost forever. Instrument Quality can use existing legacy recordings to "Retro-Generate" new Instrument Quality performances from almost any recording format. The original signature and detail content of any and all artist, singers, instruments, and locations, can be used to create new, and original music with Instrument Quality.

All human perception is removed from Instrument Quality including multiple planar source formats for three dimensional positioning of multiple simultaneous two dimensional sources found in modern surround sound systems. No psychoacoustics analysis of what humans can, or can not hear is ever involved in Instrument Quality. Human perception is engineered out of Instrument Quality, however Instrument Quality can and always will be look down compatible with any and all existing music, movie, and generation systems from master recordings to all consumer distributions including movies.

Instrument Quality is the answer to existing music recording, and generation systems that are beyond redemption in 2015, and have no intention of improving audio, only further compressing existing audio data for the internet. Two dimensional and planar from beginning to end, over a century of attempted correction has only improved the sound quality when compared to itself. Music synthesis by electronic instruments is a complete horrible failure when compared to the mechanical instruments they are trying to emulate or playback from a microphone recording.

Current trends of quantity over quality include multiple two dimensional speaker systems where the perceived quality increase by simple quantity multiplication of existing compromised sound channels that require more and more bandwidth, are typically even more compromised to make room for the more channels, or raw signal quantity. Music quality is even further removed by claiming the subtle signal detail was never necessary, or not going to be heard in the first place. We are then offered the cheap thrill of sound objects moving in apparent three dimensional space, that are actually multiple two dimensional planar signals panned across multiple two dimensional speaker systems.

Live Conspiracy of the Status In Quo

In 2012 Steve Wozniak said "I really worry about everything going on to the cloud, I think it is going to be horrendous. I think there are going to be a lot of horrible problems in the next five years." I do agree with the exception of any possible time limit involving five years.

In 2013 at CES, a Sony representative said "If you look at the Blu-ray format and the density of a 4K native content movie, you can't fit it on a Blu-ray disc. It is 120Gigabytes depending on the length of the movie ...We've got to find the other way, which is downloading." Please pay attention to uncompressed "4K native content movie".

In 2015 at CES the UHD Blu-ray is announced. The HEVC codec, also called H.265 used by Netflix and many other streaming services who recommend at least 20 - 50 Million bits per second download speed over the internet, is used for compression. "In addition to higher 4K resolution, UHD Blu-ray will be able to support better color, both a wider color gamut and 10-bit up to 16-bit color, which allows for smoother transitions between colors, without banding. It will also include support for high dynamic range, which is the difference between the brightest and darkest images. There's also built-in optional support for 3D, should a manufacturer want to include this. To fit the extra detail and improvements, new dual-(66GB) and triple-layer (100GB) discs are being developed. That is why older Blu-ray players won't be able to play the new UHD discs."

The UHD Blu-ray disc reportedly have transfer rates up to 100 Million bits per second, which is compared to the average home download speed of 10 Million bits per second, and Netflix recommends at least 20 - 50 Million bits per second. A 300GB Blu-ray format is being developed now for the movie industry at this time, and not for any consumer electronics product. More and more lossy compression, or simple discards of data signal quality are required to fit more and more content over the existing internet.

The best available distribution medium for a two hour music concert, and or two hour movie is currently the 4K Blu-ray optical disc. The approximate 120Gigabytes of digital movie data depending on the length of the movie will not fit on a 100Gigabyte 4K Blu-ray optical disc without compression now. This is all for both video and audio.

The live conspiracy of the status quo is that audio is not even seen as a problem now because almost all of the consumer electronic product energies are being applied to the 4K UHD picture distribution over the internet, and no one wants to improve sound quality when the picture is what everyone sees. Even at the cost of downgrading existing low level quality sound into lossy sound compression schemes to give the video a higher priority with more bandwidth.

Instrument Quality works by generating hundreds to thousands of more digital data audio signals than any existing consumer electronic product music recording, and generation system in 2015. Not only the quantity is superior, also the quality of each and every signal is infinite digital analog. The current trend is to dismiss the need for more digital data, and to even reduce the quality of existing discrete digital sampled signals, claiming humans can not hear the difference. Computers need superior quality analog signals for atmospheric modulation of Instrument Quality.

The Codex Grandeur X-100 is a lossless audio signal compression system that achieves a 100 times lossless compression, or only one percent of the original digital storage requirement compared to existing lossless audio discrete digital sampled signals. No lossy components are used in any way, shape, or form.

The existing 4K Blu-ray disc of 100 Gigabytes, can be compressed to 10 Terabyte's of discrete digital sampled audio signals with lossless quality. This compression system allows Instrument Quality to exist in 2015 with consumer electronics product discrete digital sampled audio signals with lossless quality.

The Codex Grandeur X-100 makes Instrument Quality practical for two hour concerts, and or two hour movies to be stored on Blu-ray discs, computer hard drives, flash drives, memory cards, or distributed over the internet .

Inside Looking Out

Every existing music and recording system up to 2015 has been based on the perspective of outside-microphone-looking-in toward the instrument. The microphone to the waveform, amplifier, and then speaker system that attempts to recreate the microphone position at recording time, is of course not possible to do because the atmosphere before and after the microphone position at recording time are missing, and gone forever.

This microphone perspective is limited in its generation and playback ability because of what exact sound combination ends up appearing to the outside-microphone-looking-in at any given point source location in time. The speaker can only attempt to recreate what sound appeared at the microphone at that time. Both the cause and effects continuing before and after the microphone of that recorded sound were not recorded. A large part of music synthesis is also based on the microphone perspective of outside-looking-in, as to music instrument emulation, and the lack of quality sound is horrible.

Instrument Quality is designed from the beginning to work from the inside-out of atmospheric modulation. Even as two dimensional microphones are still required in 2015, the enhanced signal quality of different frequency spectrums combined with hundreds of lower quality microphones per single audio channel are literally combined, and reverse engineered into the root cause, or material positions involved in the modulated atmosphere. This reverse engineered data is then applied to the true six dimensional animated motion controlled recombinant atmospheric modulators of Instrument Quality sound generation with Pulse Cannons in a non direct, and not obvious method to recreate the very instrument itself. If we were working with any of the existing speaker systems in 2015, there would be only minor improvements possible.

MANUFACTURING

Instrument Quality is the result of a puzzle picture from literally thousands of different physical components, and hundreds of different concepts, designed with many thousands of specific different engineering disciplines. Research and Development, Electronics, Physics, Mechanical Engineering, Robotics, Material Science, Metal Cutting, Tooling, Metal Casting, Plastic Injection Molding, Mold Making, Painting, Powder Coating, Electronics Manufacturing Services, Manufacturing Sciences just to name a few, each one can each be broken down into many different categories.

The current typical United States of America solution to manufacturing this type of product, is to raise investment money, then find a Tier 1 electronics manufacturing services company such as Foxconn/HonHai rated at 100 thousand million dollars each year, and try to fit into their schedule. You are typically sent to a smaller 1 thousand million dollar each year competitor, or even smaller Tier 2, or even smaller Tier 3, then Mexico if you can afford no where else. We are still being told there is no money in manufacturing. The cost in time and effort of just getting in that line if even possible is not practical, when I am the manufacturer.

The Research and Development of all these solutions to Instrument Quality has been achieved as the result of investments over thirty five years of time from our manufacturing, for our manufacturing, because of all the monetary profits to be made with our manufacturing from our unique products. As in the story "The Little Red Hen", we do not do all the hard work necessary to plant seeds, toil the land, then bake the bread, and then hand it to them to eat, after they refused to help.

Manufacturing of the Bell Tower Home Theater will occur in the United States of America. The manufacturing is being manufactured by us. This is necessary to compete once again in the United States of America at a consumer electronic product level, without low wage jobs being used as an excuse to purchase millions, and millions of dollars worth of manufacturing equipment placed in foreign countries where the humans fill the gaps of robotic manufacturing.

It is no longer possible to economically mass produce consumer electronic products with human hands, because the physical dimensions of the components used are well below human scale. Most consumer electronic products are based on printed circuit boards that use Surface Mount Components that are Mounted on top of the printed circuit board Surface.

www.smtrobotics.com = Surface Mount Technology Robotics
www.belltowerhometheater.com = Bell Tower Home Theater consumer electronic product
www.belltowermasterrecording.com = Bell Tower Master Recording studio professional product
www.hatchsecureprocessor.com = Hatch Secure Processor consumer electronic product
www.codexgrandeurx100.com = Codex Grandeur X-100 lossless music compression system

SMT Robotics began four and one half years ago with independent Research and Development into mass production for consumer electronic products we create from the ground up, without contract manufacturing (Foxconn), EMS and ECM (Electronic Manufacturing Services, Electronic Contract Manufacturing), or multiple two - three million dollar plus printed circuit board assembly lines (Located in many countries around the world, except USA). Realizing that we are in direct competition with those technologies, SMT Robotics begins at the prototype stage, and is designed to eliminate the need for, while exceeding the performance of two - three million dollar plus printed circuit board assembly lines.

When I first started working in the electronics manufacturing industry about 1974, human assembly of printed circuit boards was possible, and economically practical. Human printed circuit board assembly is no longer economically practical, or possible in 2014, because of the below human scale electronic component dimensions, with increased system complexity. Human labor cost is insignificant compared to the minimum true cost of all the manufacturing technology required.

Where it was possible to start small scale electronic printed circuit board prototyping with some manufacturing twenty years ago, it ranges from very difficult to impossible today. Existing full capability prototype level solutions with solder paste printing, and reflow oven, begin at a true cost of $15,000.00 to 25,000.00. Also all the needed accessories must be purchased, then maybe a performance of up to 7,200 CPH (components per hour) can be achieved. It is usually less.

This will allow the engineer to assemble the prototype boards, demonstrate the performance, and sell hundreds or thousands of products. The components must now be ordered from the semiconductor manufacture with anywhere from a four to eight month delay in arrival after payment is made. During the four to eight month delay, thousands of more sales are made at trade shows, and through advertisements. More four to eight month delay cycles are begun. Meanwhile the original customers are becoming very upset, still waiting for their parts to arrive.

The number of small components can easily exceed thousands of semiconductor components per board, with many boards in one single product. This will result with many weeks, to many months of further delay in manufacturing complexity, just for the printed circuit board assembly. Meanwhile more thousands of orders are pouring in, and it will be almost impossible to retrieve any significant portion of the original equipment cost by selling it used. There is no way to increase the performance.

It is almost a fixed linear hard rail road of price/performance from the desktop prototype stage through the two - three million dollar printed circuit board assembly line. From there it is typically multiple two - three million dollar printed circuit board assembly lines. The major upheaval from changing manufacturing equipment along the way is devastating, and time consuming by itself.

SMT Robotics assembly line begins with a solder paste machine that eliminates the need for laser cut stainless steel stencils. This also eliminates all the requirements for storage, and cleaning of different stencils. Automatic optical inspection is included, as is an epoxy glue dot dispenser.

Board sizes from single component area, up to 48 inch by 96 inch are supported. Up to four separate and independent assembly lines 12 inches wide are possible, with any combination from four, three, two, or one board carriers. Multiple routing is possible to support epoxy catalyst.

Prototype level SMT Robotics assembly lines well exceed the price/performance of existing technologies, are available at $25,000.00 and 36,000 CPH, and unlike any other complete assembly line this one will easily build to the very real price/performance of a two - three million dollar assembly line for about $150,000.00 and 576,000 CPH with all needed accessories included, and no hidden fees. Existing cost of only a quantity of one hundred, 8mm feeders on high performance machines around the world will easily cost over $150,000.00, and it is not unusual to have hundreds of feeders on a cart that rolls up to the pick and place machine.

Designed to be a true consumer electronics mass production printed circuit board assembly line, the SMT Robotics pick and place machine has a theoretical maximum performance of 576,000 CPH (components per hour) with up to 640 8mm component reel feeders installed per pick and place machine. Different combinations of larger component reels installed will affect total numbers of smaller reels possible. All feeders are included with the $150,000.00 mass production assembly line price.

The reflow oven is one single machine with multiple dynamic staged zones for the prototype level, and expands with two machines with multiple dynamic staged zones for mass production capability.

SMT Robotics has many of the printed circuit boards completed for the custom computer architectures required, and is now building the metal cutting manufacturing facility in Tennessee for mass production of the SMT Robotics consumer electronics mass production assembly lines.

James Lee McDaniel
CEO / President / Director
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smtrobotics@gmail.com

Codex Grandeur

Codex Grandeur X-100 is a lossless music compression system at one percent of original file size lossless binary digits, or one hundred times compression lossless binary digits. Data storage and data transmission systems available to consumer electronic products in 2015 can now be used to support Instrument Quality.

The extra storage space and transmission efficiency is used for the hundreds of times increase in Instrument Quality infinite continuous numerical digital master analog signals necessary for the true six dimensional animated motion controlled recombinant atmospheric modulators of Instrument Quality sound generation with Pulse Cannons.

Increased quantity with analog quality of signals for the master recording also creates a complete dimensional separation with signal volume, or signal amplitude separated from the signal itself, creating twelve channels for each and every single six dimensional waveform. All separate twelve channels are without rails and each one is an infinite continuous numerical digital master, making each separate signal digitized analog in every sense of any application. Discrete digital sampling frequency, and the digital bit depth of dynamic range have been completely eliminated The always possible threat of rail clipping has been completely eliminated and is not possible anymore.

All signal storage is now designed to maximize the signal to noise ratio, where previously the signal to noise ratio was a victim of the logarithmic volume, hard rail dynamic bit range clipping of the human perspective scale. No attempt to capture volume is even necessary with Instrument Quality, making microphone placement as close as possible to music sources to record detail never possible before with no problem. On playback the Instrument Quality controller calculates recorded energy positions and creates the desired human perspective scaled volume outputs. Any and all volume data can be changed with infinite resolution, and no noise consequence.

With the correct Instrument Quality master recording, any individual note of any individual orchestra instrument or groups of instruments can be isolated and controlled separately without consequence in a seating total of hundreds, without individual separate tracks or microphones.

Infinite numbers of signals can now be combined without digital sampling artifacts, or minute insignificant accumulated errors that can and do grow into large significant errors. This is important for music creation from the inside-out without ever involving microphones where simple positioning guidance possibly involving infrasonic and ultrasonic frequencies may be hundreds to thousands of layers before the actual sound signal is even applied.

To this date in 2015, there has never existed any lossless recording format, first with analog and then especially with current discrete digital sampling. Analog recording has always been a lossy signal storage from wire recordings, magnetic tapes, vinyl records, and lossy by the very name discrete digital sampling.

Instrument Quality with Codex Grandeur X-100 is a practical analog signal storage infinite continuous numerical digital master. All the advantages of both analog and digital are available.

For over one hundred years each and every single master recorded audio signal for playback has typically been filtered out for low, and high frequencies sometimes by design, and sometimes by the physical limitations of the microphones with electronics. This is before the signal ever reaches any recording format system. The root problem with any and all existing electronic recording systems is the microphone. The microphone is a lossy signal generation component. The fact that no two microphones of different manufactures sound the same is a symptom of signal loss. This has nothing to do with flat frequency response of recorded signals. This root problem refers to the signals that are not captured by the microphone.

Even if the root problem had been addressed in the past, the recording format to capture the lost signals did not exist before Instrument Quality. All the dramatic differences in audio system playback performances of any and all existing audio systems only begin at the lossy two dimensional microphone, and it is a long series of cascading failures to the final speaker output. The second problem with microphones is demonstrated by their critical position requirement. Any and all existing recording format systems now have voltage rails high, and low where the signal must strictly stay in-between. Also logarithmic volume is included to match the human amplitude hearing scale. If the microphone is placed too close to the recording instruments, the signal will clip or saturate the voltage rails losing all recording information, and if the microphone is placed too far away from the recorded instruments, insufficient subtle detail is recorded, and too much background noise results in a low signal to noise ratio with poor sound quality.

This creates a sweet spot for the microphone position that is actually a horrible compromise of signal to noise ratio. Automatic gain control as involved with signal compression is often used to move the microphone closer without clipping the rails, however with horrible signal distortion that is often masked as an improvement because it is a louder recording, often enhancing low quality audio playback equipment, at the complete failure of Instrument Quality.

Too far away and the microphone loses significant detail of sound, and the background noise, or environmental characteristics become prominent. The ideal microphone position is currently a compromised position being neither too close, or too far away. The fine critical details are lost by the microphone not being close enough, and the signal bit depth, or signal voltage range in analog recordings is lost by the microphone being far away.

Signal processing that is not possible with existing discrete digital sampling, is now possible even at the consumer electronics product level with the Instrument Quality controller in Bell Tower Home Theater. The Bell Tower Master Recording is an accessory that will allow musicians to have their own Master Recording Studios at home, or Master Recording Studios to have their own Bell Tower Home Theater.


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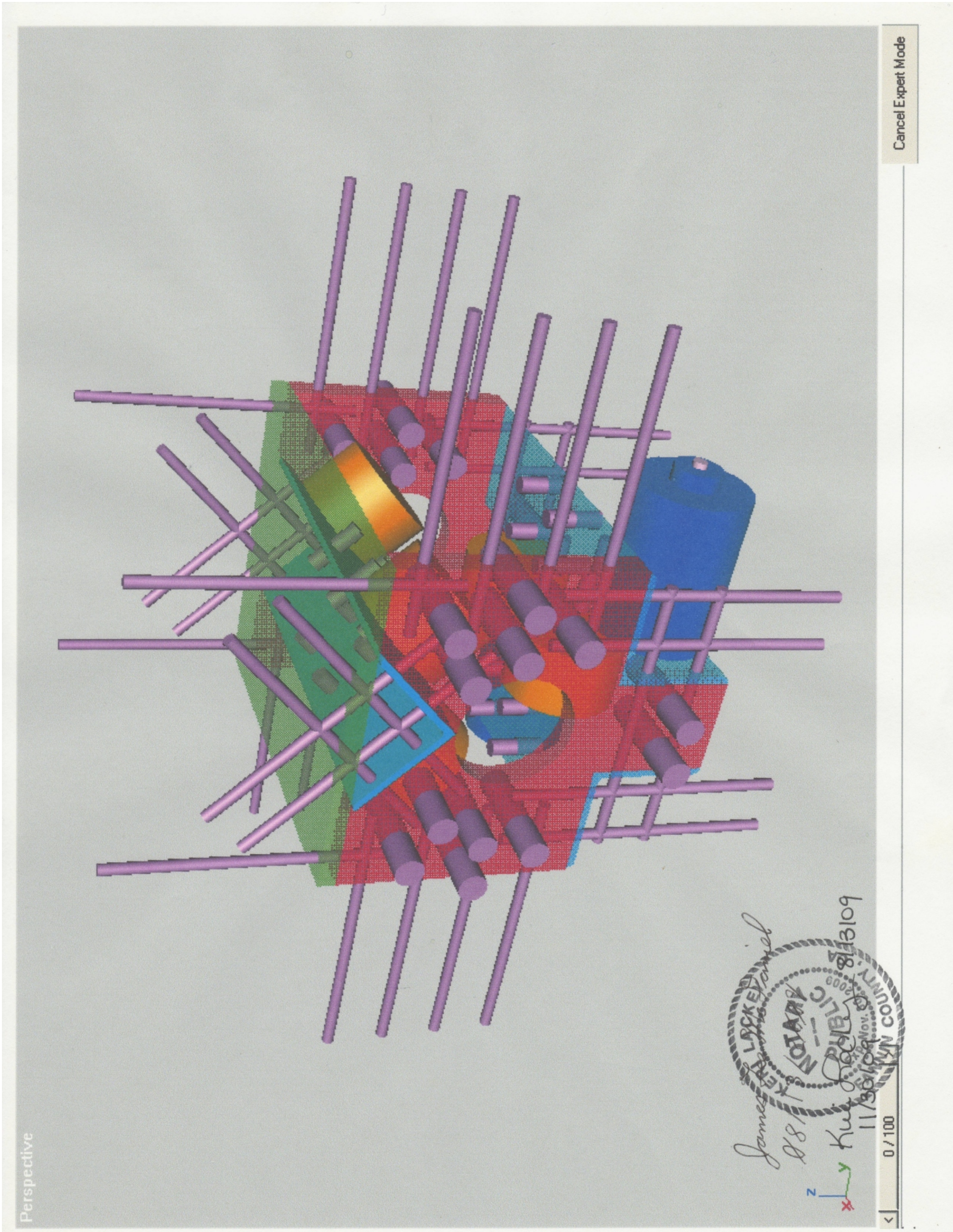
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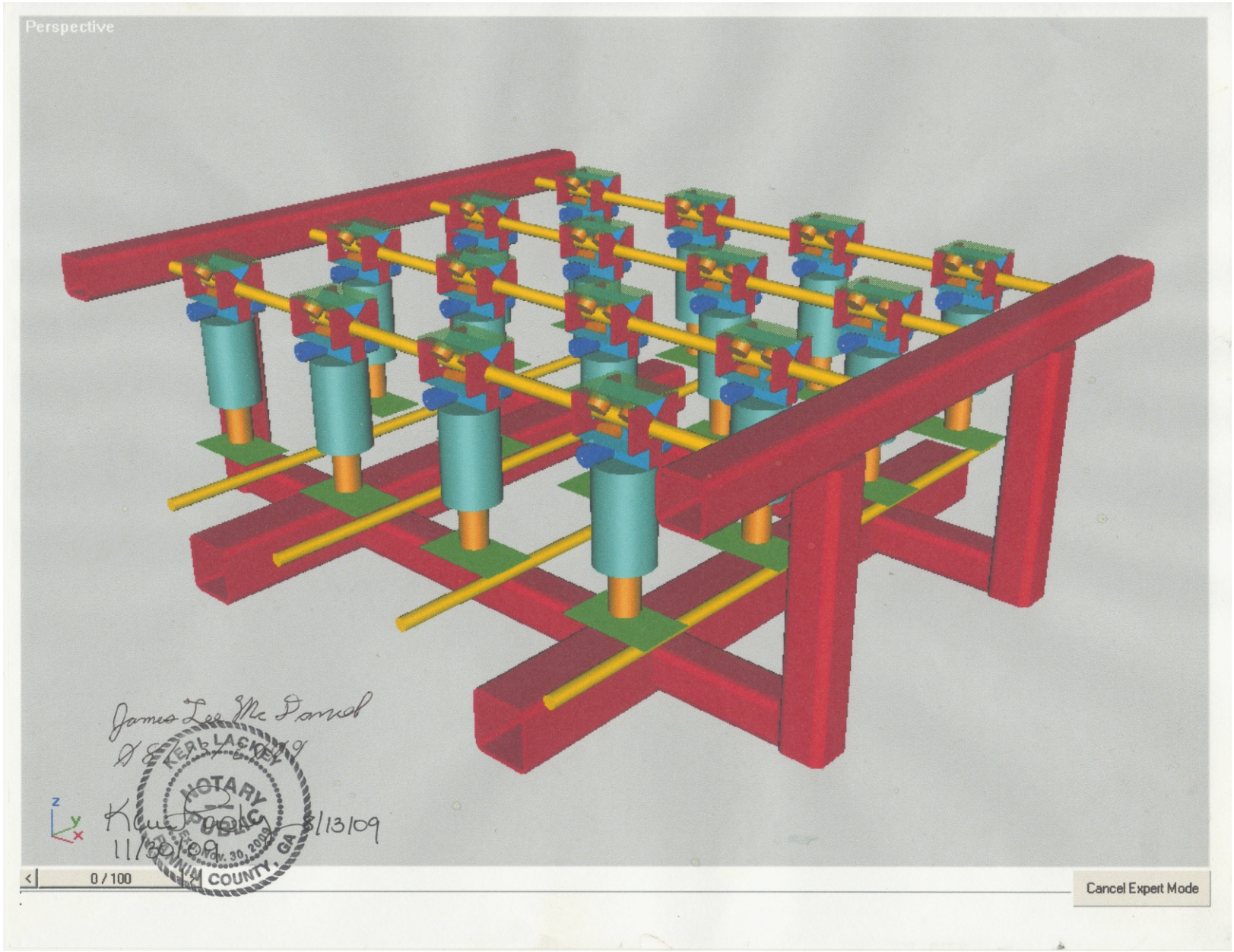
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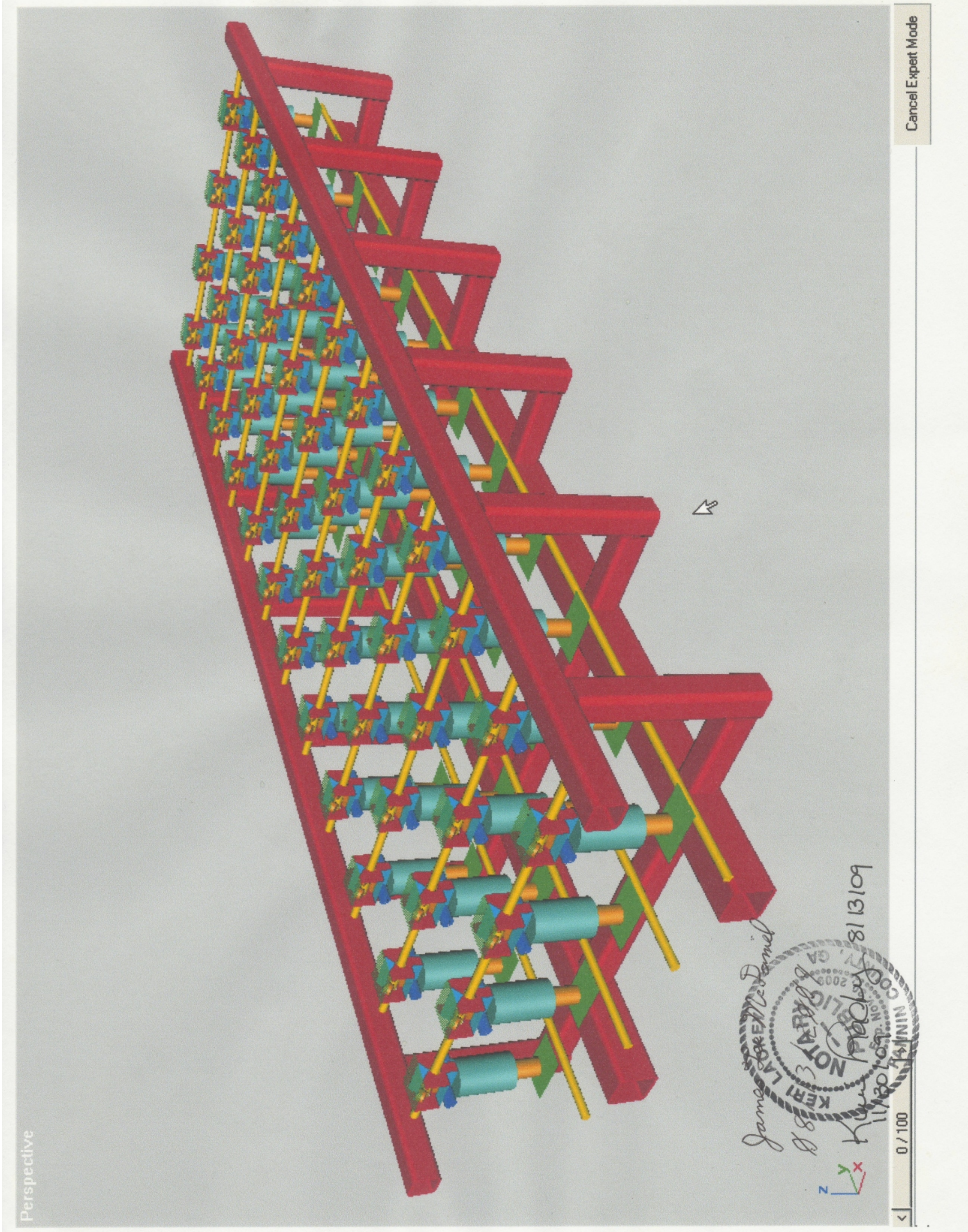
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ELECTRONIC ANALOG COMPUTING MODULES

Model FF Arbitrary Function Component

GAP/R MODEL FF

GENERAL CHARACTERISTICS

Electrical Characteristics

Output:
Voltage: −50/0/+50 volts
Minimum Load Impedance: 10K
Number of Segments:
Ten in two non-interacting groups of five each
Range of Slope Adjustment:
0 to ±10 volts per volt per segment
Range of Adjustment between Adjacent Break Points:
0 to ±20 volts
Range of Adjustment of Curvature from Break Point:
0 to ±15 volts referred to the input
Input:
Voltage: Maximum Range −50/0/+50 volts
Impedance: 1 Megohm

Physical Characteristics

Power Requirements:
100 ma at +300 vdc 100 ma at −300 vdc
0.75 amp at 115 vac, 50-60 cps
Plug-in Elements:
1 K2-G2 2 K2-X 9 K2-W
2 K2-P 1 K2-X1
Tubes and Diodes:
Exclusive of those contained in the plug-in elements
1 6SN7GTB 20 Semiconductor Diodes
Mounting:
Standard — 10½ in. panel for rack mounting
Dimensions:
19 w x 10½ h x 11½ deep behind the front panel
Not including clearance for connections
Weight:
Installed: 18½ lb. Packed: 26 lb.

GENERAL INFORMATION

(See figures 1, 2.)

The new Philbrick Model FF Arbitrary Function Component is a self-contained, rack-mounted analog computing component for the simulation of arbitrary functions of the input voltage. For excitation, an external power supply is required, having characteristics comparable to Philbrick Model R-100B.

Model FF's applications include curve fitting, linearization, generation of waveforms (when used with an external linear sweep generator), and simulation of nonlinear elements in analog computor studies. When used with analog Multipliers, such as Philbrick Model K5-M, the FF may be used in vector resolution. Typical systems to which FF may be advantageously applied include computing, data reduction, control, test, and programing.

The FF features 10 straight line segments, in two non-interacting groups of 5 each, with adjustable precision rounding of their intersections, and adjustable incremental slopes, break points, and offset. The rounding is a segment of a true parabola exactly tangent, at each extremity, to the straight line segments which otherwise would intersect.

Its unique properties include the following:

1. The tangent parabolic rounding permits close simulation of smooth functions without introducing discontinuities.

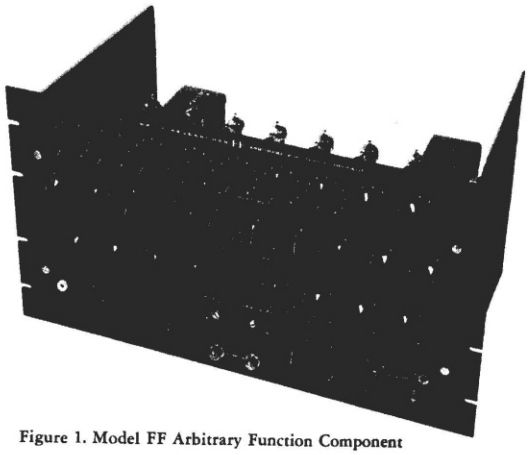

Figure 1. Model FF Arbitrary Function Component

2. The break points are adjustable to permit an accurate fit in regions of large slope change.
3. The incremental slopes are adjustable over a range of at least ±10 volts per volt, and accumulate.
4. The spacing between adjacent break points can be adjusted within the range of 0 to 20 volts.
5. The unit contains its own operational amplifiers, which results in high input impedance, low output impedance, wide band operation, and independence of the characteristics of the associated computor circuitry.
6. The input and also the output voltage, each independently of the other, can have added to it an offset voltage adjustable over the entire input and output ranges.

Physically, the unit is mounted on a 10½" rack panel. It draws approximately 100 milliamperes at plus and minus 300 volts, and about 80 watts at 115 vac.

The FF simulates nonlinear continuous functions of one variable by a segmental approximation or envelope derived by adding together linear segments of the form:

$$e = a_j S^{\pm}(\Delta e_j, 0)$$
$$\Delta e_j = e_i - X \pm E_j$$

where e_i = input voltage
X = input offset voltage
E_j = input voltage at the breakpoint ($X = 0$)

(See figure 3.)

A triangular wave generator (K2-G2), coupled to the diode selector circuits, adds at each breakpoint a parabolic section, tangent to the intersecting segments. (See figure 4.) This circuit functions according to the equation:

$$e_j = S^{+}(\Delta e_j, e_G)$$

(assuming perfect diodes)

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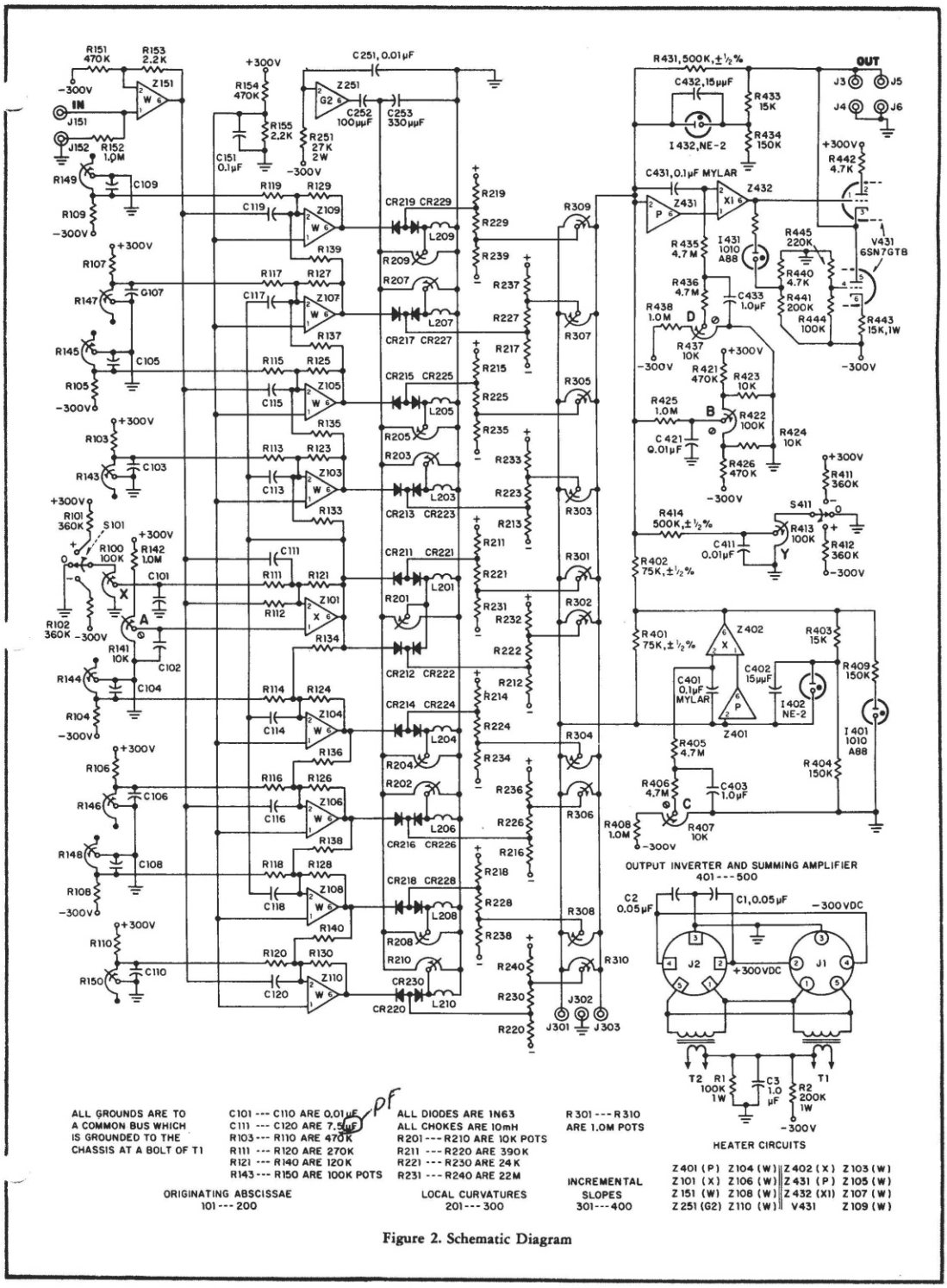


Figure 2. Schematic Diagram

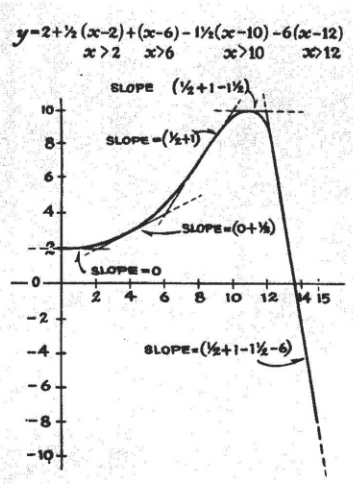


Figure 3. Construction of a Segmented Envelope

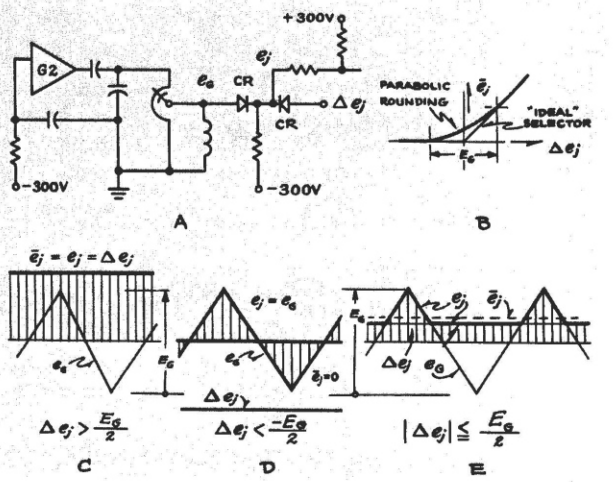


Figure 4. Operation of the K2-G2

In most applications, Δe_j varies very slowly as compared to e_G which has a frequency of 1.5 Mcps. Therefore, Δe_j can be considered to be a constant over one cycle of e_G.

Consider the case where the average value of e_G is zero.

Let: E_G = peak to peak voltage of e_G

$\bar{e}_j$ = e_j averaged over one period of e_G

When: $\Delta e_j \geqq \frac{E_G}{2}$, then $\bar{e}_j = \Delta e_j$ (1)

its slope = 1

When: $\Delta e_j \leqq \frac{-E_G}{2}$, then $\bar{e}_j = 0$ (2)

its slope = 0

$|\Delta e_j| < \frac{E_G}{2}$

Then: $\bar{e}_j = \frac{1}{2E_G}(\frac{E_G}{2} - \Delta e_j)^2 + \Delta e_j$ (3)

Equation (3) describes a parabola which has a slope of 0 when $\Delta e_j = \frac{-E_G}{2}$

and a slope of 1 when $\Delta e_j = \frac{+E_G}{2}$

Therefore, the parabola is tangent to $e_j = S^{\pm}(\Delta e_j, 0)$ at these two points.

How the FF component works is exemplified in figure 3 and is further discussed in the section on OPERATION.

INSTALLATION

Mounting and Connections

If the FF Component is mounted on an open rack, natural ventilation is generally adequate. If the Component is mounted in an enclosed rack, forced ventilation may be needed. Ventilation must be such that the hot spot temperature of the K2-G2 plug-in does not exceed 65°C (149°F).

The unit is powered via a 5-pin standard RETMA connector mounted on the rear of the chassis to mate with the standard Philbrick power cables (Model PC or similar).

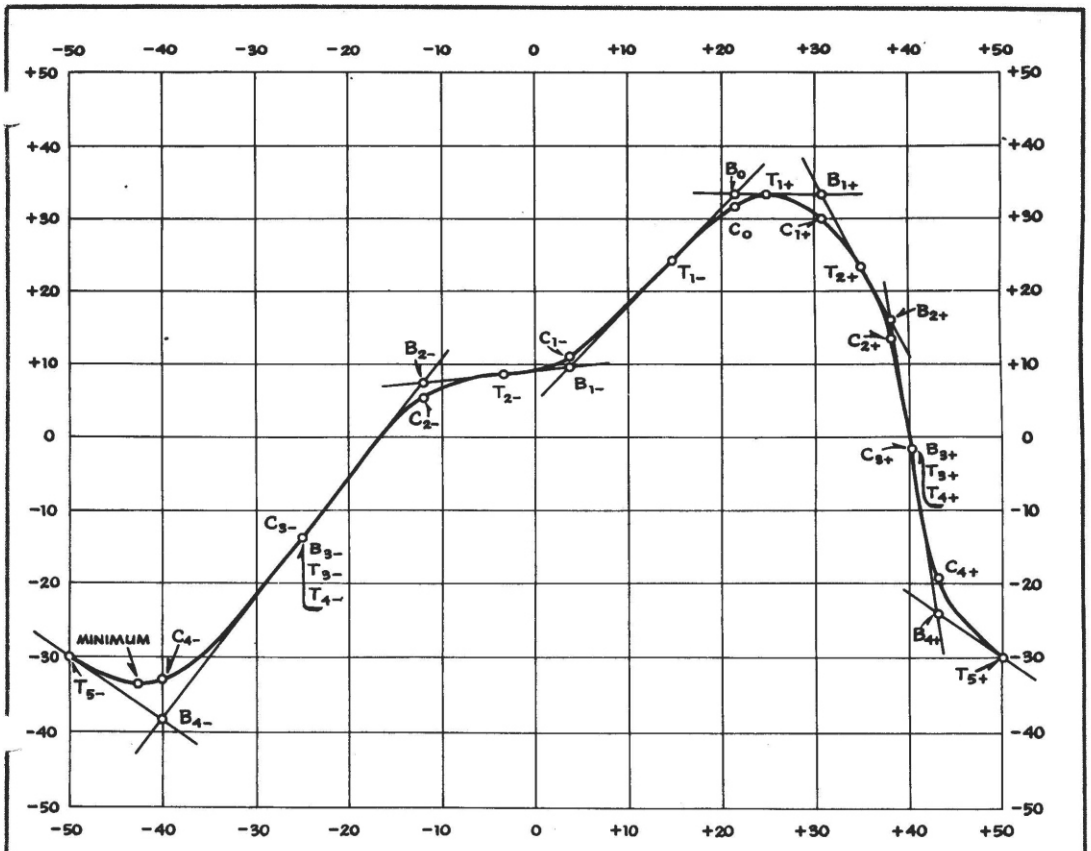
Input signal voltage is supplied via a pair of banana jacks mounted on the front panel at the left as you face it.

Output is available via two paralleled pairs of banana jacks on the right of the front panel. (See figures 1 and 7.)

Zeroing Procedure

(See figures 1, 2, 7, 8.)

1. Apply ac power.
2. After 1 minute apply dc power.
3. Apply a −50 to +50 volt sine wave or sweep to the X input of an oscilloscope.
4. Apply the same sweep to the input of the FF.
5. Connect the output of the FF to the Y input of the oscilloscope.
6. Set all knobs at zero except the two central INCREMENTAL SLOPE knobs. Set these knobs to produce a ∨ at the output.
7. Adjust potentiometer A so that the vertex of the ∨ occurs where the sweep crosses the Y axis ($x = 0$).
8. Remove the sweep input.
9. Return the two central INCREMENTAL SLOPE knobs to zero.
10. Connect a 100Ω resistor between jacks J301 and J302.
11. Adjust potentiometer C for minimum noise and ac hum (this may not occur at zero) at the output.
12. Remove the 100Ω resistor.
13. Connect a 100Ω resistor between jacks J302 and J303.
14. Adjust potentiometer D for minimum noise and ac hum (this may not occur at zero) at the output.
15. Remove the 100Ω resistor.
16. Set potentiometer B for zero output.
17. Check noise which now should amount to no more than 20 mv peak to peak.



TABULATED DATA FOR ARBITRARY FUNCTION

MINUS					PLUS				
B,C	T	x	y_B	y_C, y_T	B,C	T	x	y_B	y_C, y_T
0		+21.5	+33.4	+31.5	0		+21.5	+33.4	+31.5
	1-	+14.7		+24.2		1+	+24.7		+33.4
1-		+3.7	+9.6	+11.0	1+		+31.0	+33.4	+30.0
	2-	-3.6		+8.6		2+	+35.0		+23.3
2-		-12.0	+7.5	+5.2	2+		+38.0	+16.0	+13.5
	3-	-25.0		-13.7		3+	+40.3		-1.6
3-		-25.0	-13.7	-13.7	3+		+40.3	-1.6	-1.6
	4-	-25.0		-13.7		4+	+40.3		-1.6
4-		-40.0	-38.3	-33.1	4+		+43.0	-24.0	-19.2
MINIMUM		-42.7		-33.7		5+	+50.0		-30.0
	5-	-50.0	-30.0	-30.0					

Figure 5. Illustrative Arbitrary Function

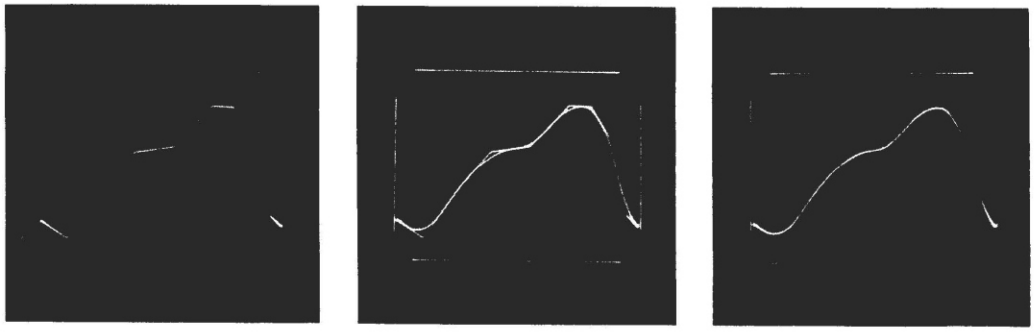


Figure 6. Oscillogram of Illustrative Arbitrary Function as Produced by the Model FF

OPERATION

(See figures 5, 7, 8.)

The objective of operation is, of course, to produce an output that fits the desired arbitrary function as accurately as possible. The basic limitations are:

a. A maximum overall voltage excursion of −50 volts to +50 volts.

b. A maximum segmental slope of ±10 volts per volt added algebraically to the next inner (towards the center) slope.

c. A maximum of 20 volts between break points. (See par. 1.c. following.)

Careful preparation of data and adjustment of the FF should produce the best fit. (See figure 6.)

Procedure A

To set up the FF with a sine wave or sweep source and an oscilloscope:

1. *Prepare the Data*

(See figure 5.)

a. Plot the arbitrary function to a convenient scale on a square or a rectangular chart, according to the screen of the oscilloscope to be used. It is suggested that the scale be such that the curve of the function substantially fill a 10 × 10 chart but with allowance for the segmented envelope to be developed in step 1.c. following. If the center lines of the chart are the X and Y axes, the 10 × 10 chart will provide a range of −50/0/+50 in each direction. The origin of the X and Y axes can be shifted to any convenient point on the chart.

b. Draw a tangent to the curve at each point of inflection, at each end of the curve, and at each maximum and minimum point.

c. Distribute the remaining available tangents (a total of 10 tangents can be used) and extend all tangents so that adjacent tangents intersect. These intersections constitute break points (B) and locate the ORIGINATING ABSCISSAE.

(1) If the voltage between any pair of break points exceeds 20 volts, the tangent between them should be replaced by two or more tangents to the curve. (If necessary, a tangent at a maximum or a minimum may be omitted.)

(2) Then apply any remaining available tangents to points of greatest curvature.

(3) Label the "break points" from left to right B_{4-}, B_{3-}, B_{2-}, B_{1-}, B_{0}, B_{1+}, B_{2+}, B_{3+}, B_{4+}. The central break point is B_{0}.

(4) Label the tangents from left to right T_{5-}, T_{4-}, — T_{1-}, T_{1+}, —T_{5+}. These correspond to the INCREMENTAL SLOPES on the FF and, between break points, to the segments of the envelope.

(5) Tabulate the x and y coordinates of each break point and the end points.

(6) Tabulate the y coordinates (C) of the arbitrary function of each x coordinate tabulated in (5) above.

d. The resulting segmented envelope should closely approximate the curve of the desired arbitrary function.

2. *Prepare the FF Component*

(See figure 7.)

a. Check the zeroing (See INSTALLATION).

b. Designate the LOCAL CURVATURE knobs from left to right as C_{4-}, — C_{0}, — C_{4+}. These will be used to adjust the break points (B) of the segmented envelope to the corresponding values of the arbitrary function. (See par. 1. c. (6) above.)

c. Designate the INCREMENTAL SLOPE knobs from left to right as S_{5-} — S_{1-}, S_{1+} — S_{5+}. These designations correspond to the segments of the envelope. (See par. 1.c. (4).)

d. Designate the ORIGINATING ABSCISSAE knobs from left to right as A_{4-} — A_{1-}, A_{1+} — A_{4+}. These correspond to the break points (B) of the segmented envelope except for B_{0} which is fixed by the initial setting of the FF. (See par. 4.a. following.)

e. Set all C knobs at 0 (fully CCW).

f. Set all S knobs at 0 (top center).

g. Set all A knobs at 5 (halfway).

h. Connect a ±50 volt sweep or a sine wave signal of appropriate amplitude to the input.

3. *Prepare the Oscilloscope*

a. Connect the sweep (or sine wave) signal to both the X and the Y inputs of the oscilloscope.

b. Adjust the oscilloscope so that the sweep is displayed as the diagonal of a square or a rectangle according to the shape of the screen. The markings on the screen (if any) should be such as to produce a 10 × 10 grid over the range of the sweep. The X and Y axes will be those coordinates that divide the grid into 4 equal quadrants. Note that if operation is within a restricted area, the X and Y axes and the scale of the display can be adjusted accordingly. (See par. 1.a. above.)

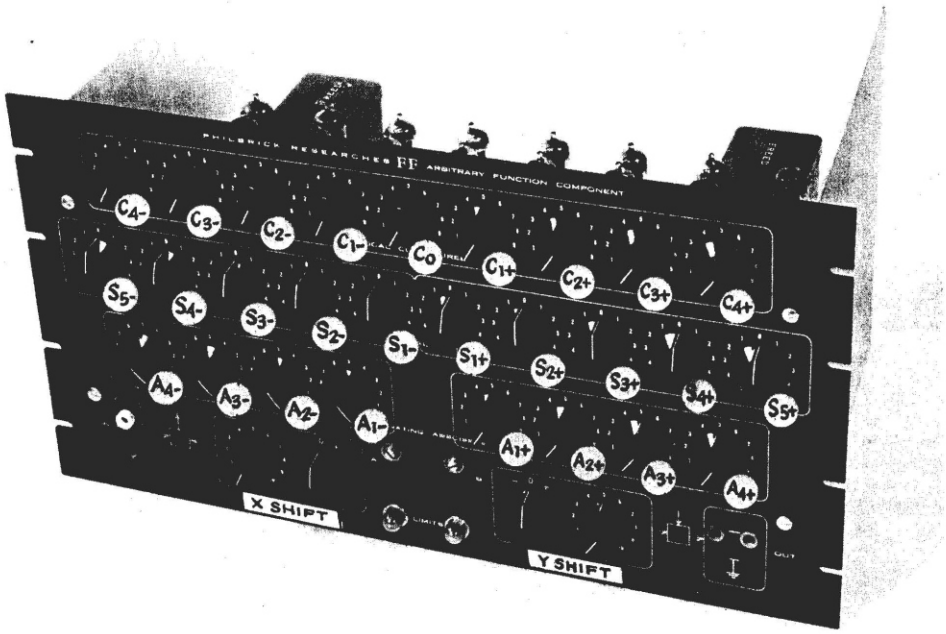


Figure 7. Front Panel, Identification of Knobs

4. *Set the FF Component*
(See figure 5, 7.)

a. Set S_{1-} at 3 CCW and S_{1+} at 3 CW, thus forming a ∨ display, (or S_{1-} at 3 CW and S_{1+} at 3 CCW if a ∧ display is better suited to the arbitrary function.) Manipulate the X and Y shifts so as to locate the vertex of the ∨ or ∧ at the point corresponding to break point B_{0}. (See par. 1.c. (3).)

b. Adjust S_{1+} so that the segment it controls passes through the coordinates of the break point B_{1+}. Set S_{2+} at right angles to S_{1+} so as to produce a sharp break point. Then adjust A_{1+} so that the break point appears at B_{1+}. (It may be necessary to trim S_{1+}.)

c. Similarly adjust S_{2+} so that the segment it controls passes through B_{2+}, set S_{3+} at some value of opposite polarity to S_{2+}, then adjust A_{2+}. (Trim S_{2+} if necessary.)

d. Then adjust S_{3+} and A_{3+}.

e. Next adjust S_{4+} and A_{4+}.

f. Now adjust S_{5+} so that the trace of the last segment passes through the positive terminal point of the function.

g. In like manner adjust S_{1-}, A_{1-}, through S_{4-}, A_{4-}, and S_{5-}.

h. Finally, adjust C_{0} — C_{4+}, and then C_{1-} — C_{4-} until the displayed curve approximates the desired function.

i. If desired, trim the settings of the FF as follows:

(1) Determine from the plot of the arbitrary function (See par. 1.a., 1.c. (5), and figure 5.) the *x* and *y* coordinates of each point of local curvature, each point of tangency, and other key points.

(2) Disconnect the FF from the sweep (or sine) source and the oscilloscope.

(3) Connect an accurately adjustable voltage source to the input of the FF. A Philbrick Model K5-U Universal Linear Operator is recommended.

(4) Connect a voltmeter of the desired accuracy to the output of the FF.

(5) Start at the center (corresponding to the point set by C_{0}) and set the voltage source at the input *(x)* voltage of each positive check point in turn as selected by step (1) above, and measure the output *(y)* voltage. If any measured voltage differs significantly from the desired voltage as shown on the plot and the tabulation of the arbitrary function, trim the curve using the appropriate S_{+}, A_{+}, and C_{+} knobs.

(6) Return to the center point and proceed similarly towards the negative side.

5. *Use the FF Component*

a. Note and record all switch and potentiometer settings. The function can be duplicated to a first approximation at some future date by resetting the FF Component to these readings.

b. Connect the FF input and output in their planned system locations.

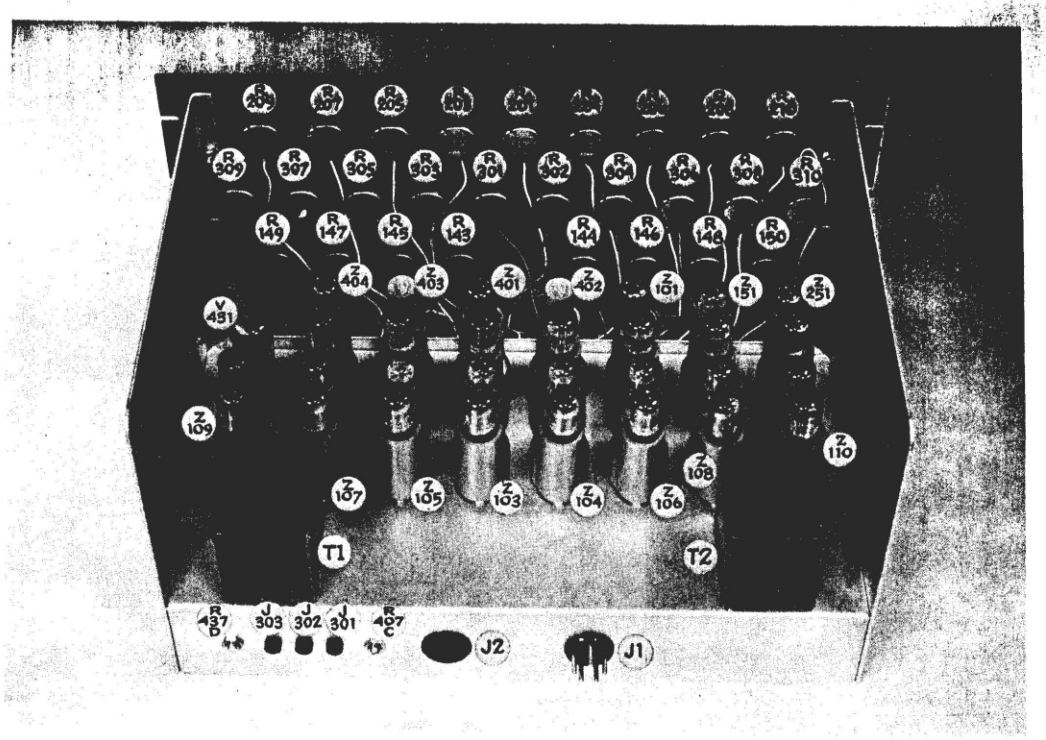


Figure 8. Rear View, Identification of Tubes, etc.

Procedure B

The oscilloscope and sweep generator procedure is the preferred method. If they are not available, Procedure B can be used.

To set up the FF with a calibrated adjustable dc voltage source and a dc voltmeter of the desired accuracy:

1. *Prepare the Data*
   (See figures 3, 5, 7.)
   a-d. Prepare the data as outlined in Procedure A.

2. *Prepare the FF Component*
   a-g. Prepare the FF to step g as outlined in Procedure A.
   h. Connect a calibrated, adjustable dc voltage source to the input of the FF. A K5-U Universal Linear Operator is recommended.
   i. Connect a voltmeter of the desired accuracy to the output of the FF.

3. *Set the FF Component*
   a. Set S_{1-} at about 3 CCW and S_{1+} at about 3 CW or vice versa to get a usable $\bigvee$ or $\bigwedge$ in the FF.
   b. Set B_0 into the FF.
   (1) Set the input at the voltage of the x component of B_0.
   (2) Set the polarity of the X shift at $-$ (if x of B_0 is positive) and adjust the X shift until the change in the output (y) voltage starts to reverse, thus indicating a minimum or a maximum value.
   (3) Set the polarity of the Y shift at $+$ (if y of B_0 is positive) and adjust the Y shift until the output (y) equals the y component of B_0.
   c. Set B_{1+} into the FF.
   (1) Set the input voltage at the x value of B_{1+}.
   (2) Adjust S_{1+} until the output (y) voltage equals the y value of B_{1+}.
   (3) Set S_{2+} about $\frac{1}{4}$ turn from S_{1+} in the reverse direction. (If S_{1+} is CW, turn S_{2+} $\frac{1}{4}$ turn CCW.)
   (4) Adjust A_{1+} until the output (y) just starts to change.
   (5) If necessary, trim S_{1+} so that the output (y) equals the y coordinate of B_{1+}.
   d. Similarly set points B_{2+}, B_{3+}, and B_{4+}.
   e. Set the positive terminus of the function.
   (1) Set the input voltage at the x value of the positive terminus (usually $+50.0$v).
   (2) Adjust S_{5+} until the output (y) voltage equals the y value of the terminus.
   f. Similarly set point B_{1-} — B_{4-} and the negative terminus of the function.
   g. Return the input voltage to the x value of B_0 and adjust C_0 until the output (y) is at the desired value y_c of the arbitrary function at that point.
   h. Similarly adjust C_{1+} — C_{4+}, then C_{1-} — C_{4-}.
   i. Finally recheck all tabulated outputs against their respective inputs and trim as indicated.

4. *Use the FF Component*
   a. Note and record all switch and potentiometer settings. The function can be duplicated to a first approximation at some future date by resetting the FF Component to these readings.
   b. Connect the FF input and output in their planned system locations.

MAINTENANCE

(See figure 8.)

Normal "good housekeeping" is always in order.

Periodically inspect the chassis for evidence (if any) of overheating, loose joints, etc. Check the seating of all tubes and plug-ins.

After each 100 hours of operation (or each month) check the zeroing (See INSTALLATION, *Zeroing Procedure.)*

Trouble Shooting

Should any malfunctioning develop, set up a test function like ΛΛΛ and localize the trouble in one of the five major subcircuits — INPUT, ORIGINATING ABSCISSAE, INCREMENTAL SLOPES, LOCAL CURVATURES, OUTPUT.

1. Check the input operating power.
2. Check the heating of all tube filaments.
3. Check operation on an oscilloscope.
4. Inspect (visually) the chassis wiring.
5. If a plug-in or the 6SN7 output tube is suspected, check by substitution. (Note: Be sure that the substitute is O.K.)

Corrective Maintenance

Replace any parts found to be defective. Do not open any sealed unit (K2-P, K2-W, K2-X, K2-X1, or K2-G2). To do so will void their guarantee. Any defective sealed unit should be replaced and returned to Philbrick for repair.

USERS' NOTES

Philbrick will welcome your comments and suggestions about the application and servicing of this equipment.