



**MACRO-TECH**

*Anniversary*  
E D I T I O N



 **CROWN**  
MACRO-TECH 2402

 **CROWN**  
MACRO-TECH 3600VZ

 **CROWN**  
MACRO-TECH 5002VZ



## Celebrating the Crown Macro-Tech Series



our Macro-Tech® Signature Series amplifier is the culmination of a long heritage of Crown® products and design ideas that began in the early 1970s.

In these pages you can explore how the Macro-Tech Series came to be, understand its advanced features, and enjoy stories and sales literature from its colorful past.



MACRO-TECH

## Crown Macro-Tech Series

**S**ometimes a product fits an application so well, it is deemed a classic. The term is synonymous with the Crown® Macro-Tech Series of power amplifiers. That product line, and its predecessor Micro-Tech®, sparked innovative technologies that provided lower distortion, less thermal stress, higher output power, greater reliability, more power density and superior audio quality.

No compromises, no gimmicks. Just brilliant engineering backed by superior manufacturing, support and an unsurpassed commitment to quality.

Like all Crown amps, the defining characteristic of the Macro-Tech Series is sonic accuracy. A tight, rock-solid low end, with smooth, detailed highs and a well-defined midrange. In short,

the most accurate reproduction of an audio signal you've ever heard. And because we put the quality of sound above all else, Crown amplifiers are the most coveted in the business.

When it comes to manufacturing amps, our work is based on one simple fact: there are no shortcuts to quality. And our Macro-Techs have proven this time and time again in some of the most demanding applications in the world.

For this special, limited Macro-Tech release, we wanted to bring you more than just the typical operation manual. This brochure goes much further, delving into the Macro-Tech's development, design philosophy, and advanced technical features. We've also included some brochures from the past, a bio of Crown's chief R&D engineer Gerald Stanley, customer statistics, anecdotes and more.



**Since 1984, Crown has shipped approximately 272,625 MT and MA amplifiers to date. That's approximately 54 million watts into 4 ohms or 65 million watts into 2 ohms!**

*Enjoy!*



Crown Macro-Tech amplifiers were used at the 64,640-seat Sangam Stadium in Seoul, South Korea, during the 2002 World Cup.



## A Sampling of Crown Macro-Tech Users

### STADIUM / ARENA

American Airlines Arena  
 American Airlines Center  
 Ralph Engelstad Arena  
 Key Arena  
 Xcel Energy Arena  
 Conseco Field House  
 Coors Field  
 Volkswagen Stadium  
 Hong Kong Stadium

### THEME PARK

Universal Studios  
 Everland (Korea)  
 Six Flags of America

### FIXED INSTALL

Club Capitale  
 Sydney 2000 Olympics  
 Crystal Cathedral  
 Official All Star Cafe  
 Hard Rock Live  
 Experience Music Project  
 Spirit, Roxy  
 Deep night clubs

### TOUR

Neil Diamond tour  
 Pro Show, SPL Sound, XFL  
 Seoul World Cup 2002  
 Audio Analysts  
 Morgan Sound  
 Clair Brothers  
 Disturbed (band)  
 Art Garfunkel Tour  
 Maryland Sound  
 Gemini Sound  
 On Stage Audio  
 Enterprise Live

Racks of Crown Macro-Tech amplifiers power this 2001 extravaganza staged in Salt Lake City's Salt Palace for the Annual Gala held by Utah Governor Mike Leavitt. Rocky Mountain Audio Visual chose Crown Macro-Tech along with JBL Vertec speakers to provide concert-quality sound for the event. (Find out more at [http://www.jblpro.com/pressroom/rmav\\_utah.htm](http://www.jblpro.com/pressroom/rmav_utah.htm).)



Crown Macro-Tech amplifiers power the premium sound system employing JBL PD Series speakers in the 400,000 sq. ft. Ralph Engelstad Arena in Grand Forks, North Dakota.



## The Macro-Tech Design Philosophy

The Macro-Tech product line, and its precursor Micro-Tech®, owed the audio industry with new technologies that reduced distortion and thermal stress — while increasing reliability, audio quality, power density and power output.

How about taking our two best technologies and putting them in the same product?"

Three patented technologies invented by Crown's Gerald Stanley led to those benefits:

- Grounded Bridge™ topology provided 4 times the power of existing power transistors without sacrificing reliability.
- Junction Temperature Simulation (JTS), otherwise known as Output Device Emulator Protection (ODEP®), protected the power transistors from overheating and maximized their potential power output by keeping them at the optimum temperature.
- Variable Impedance or VZ® power supply, also called bi-level power-supply switching, was used in the MA-3600VZ and MA-5000VZ Series. The supply changes its impedance to adapt to the signal voltage and current. This technology permits large amounts of power in a compact package while achieving ultra-low distortion and without generating excess heat.

### How It All Began...

The brainstorming for this whole family began with collaboration between engineers Gerald Stanley and Jim Wordinger. In considering the drawbacks of current power amplifiers, they were looking for ways to:

- pack more power into a smaller rack space
- improve reliability by preventing overheating
- lower the cost per watt.

Gerald's Grounded-Bridge design and Junction Temperature Simulation were already in his toolkit. In 1975, JTS was employed in the SA-2 and PSA-2 amplifiers, while Grounded Bridge was used in the M-600.

Gerald and Jim thought, "How about taking our two best technologies and putting them in the same product?" The Micro-Tech Series was born. The original name of this series was to be HVA for High Value Amplifier.

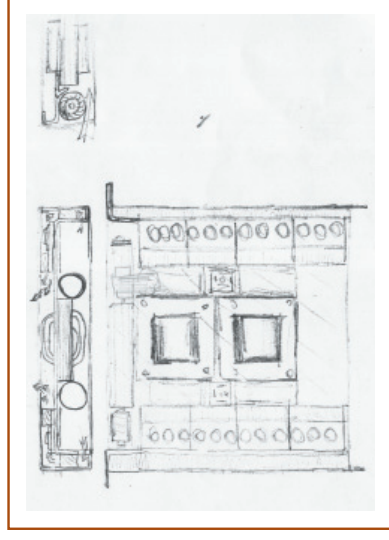




### Micro-Tech

Jim and Clay used to share ideas over lunch, where Jim told Clay about the concept. Clay came up with the name "Micro-Tech" because the goal was to put high technology into a micro-sized amp. It was a new packaging paradigm as well as a new market.

In the early 1980s, Jim Wordinger went to Showco, one of the major touring sound companies. At that time they were doing sound for David Bowie using PSA power amps. According to Jim, "We asked them what they would like to see in an amplifier."



An early sketch by Jim Wordinger showing a proposed chassis layout of a pre-Micro-Tech power amplifier.



"They said, 'We'd like them smaller and lower-cost.' I couldn't say anything about what we were working on, but their comment certainly vindicated our design goals. Showco was one of our first customers; they used a lot of Micro-Techs. We had a relationship with them. They would find any problems first and then we'd fix them."

Eventually Clair Brothers bought Showco. Now they are using over 2000 MA-3600VZs.

The MT-700 (never released) was the first Micro-Tech amp. Then came the MT-1000 which provided 1000 watts into 2 ohms. Next was the MT-1200 which produced 1200 watts, thanks to bigger power transformers.

The technology in Micro-Tech products helped Crown develop amps for Magnetic Resonance Imaging (MRI). General Electric asked Crown to make amplifiers with more voltage and current than what was available. We created bigger amps for GE, such as the 7780, using JTS and Grounded Bridge.

## Macro-Tech

Building on our experience with the MT series, Gerald and Jim developed the Macro-Tech Series in 1987. It added Plug-In-Processors (PIP™ cards) and offered a better appearance. Jim Wordinger remembers, “In the early days we’d compare MA amplifiers side-by-side with competitive amps. Ours had more punch and deeper bass, which I attributed to more output voltage and current.”

The huge Macro-Tech 10,000 amplifier was basically an MRI amp modified for audio use with a new audio interface and front panel.

“...they weren’t used to seeing that kind of power.”



Crown Macro-Tech 10,000.



It was developed for John Royer and Tom Allebrandi who did sound for the Indianapolis 500. Three of these amps were modified to drive the race track’s 240V distributed-speaker system — replacing two huge war-surplus amplifiers from a battleship.

“We supplied the first Macro-Tech prototypes to John McBride of MD Systems, doing a tour for Garth Brooks. At one gig, the FOH engineer noted that he had to keep pushing the level up in the midrange. The problem wasn’t with the amps. Actually, MD had burned up

two-thirds of the midrange drivers because they weren’t used to seeing that kind of power. Crown shipped in 24 drivers, installed them, and wired them differently. Problem solved. That’s the kind of support Crown would do.”



## MA-5000s are used on destroyers and aircraft carriers.”

In 1992, Crown engineer Andy Archias worked on the MA-5000. Crown’s upper management was delighted that the amp had such a positive impact on the company, the music industry, and the audio world. MA-5000s were even used on destroyers and aircraft carriers (and still are today).

A major supporter of MA amps was Sam Helms, manager of Sigmat, a premier pro audio representative in New Jersey. Sam put Crown amps through all sorts of torture tests. As he says, “We put low-frequency square waves into the amp and drove a subwoofer with that signal. This was to show how the MA’s damping factor controlled speaker-cone motion compared to the competition. It was no contest.”

“Using a signal generator, we put 60 Hz in the front end of the amp, ran the level controls up, got high-power out of the amp and welded pieces of metal with it! Or we’d take an AC cord, cut off the end of it, put on a banana jack, plug it in the back of the amplifier, and run a drill off it. The competition would shut off and the Crown amp would just keep going. You could drill through a 4x4 with no problem at all.”

Crown’s elite studio amplifier, the Macro-Reference™, used the same main board as the MA-3600VZ, but with remote load sensing for higher damping factor. It was the best-measuring

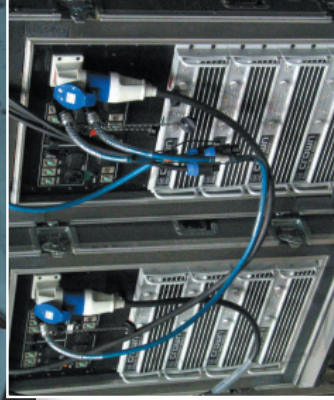
amp Crown ever made. Around 1992, Crown introduced the MA-24x6 and MA-36x12 amps with a different power rating in each channel for bi-amping woofers and horn drivers.

VZ technology (with bi-level power supply switching) was first prototyped in an MA-1200. It was feared that the switching would affect the audio, but that did not happen. The first bi-level amps were MRI units custom-made for Picker International, a medical imaging company.

Jim Stembel, Crown’s International Business Development Manager, recalls: “At the trade show in which we introduced the MA-3600VZ, it was the first amp with that much power in two rack spaces. One of our biggest competitors asked, ‘Why put all that power in two rack units?’ We replied, ‘Because we could.’ That power density was unheard of at the time. It was quite a significant landmark.”

“When we introduced the MA-5000, one of our major customers asked, ‘Why does anybody need that much power?’ Again it was an amplifier ahead of its time — it was so large compared to anything else on the market. At the time, nobody appreciated the power of the MA-5000. Of course, the MA-5000 has gone on to become a wildly successful amp in touring sound — a standard. They really were trend-setting amplifiers.”

10 years ago in Pro Sound News, a poll reported that 9 out of 10 of the major tours used Crown, mostly MA amps. We still have die-hard customers who refuse to use anything else. So, starting with Grounded Bridge, invented in 1971, and JTS, invented in 1974, those two key pieces of technology enabled the Micro-Tech and Macro-Tech family. After a long lifetime, most of those products are still running. That’s what we think they should do.



## About Gerald Stanley

**T**he mastermind behind the Macro-Tech Series, and all Crown solid-state electronics for over 40 years, is our senior vice president of R&D Gerald Stanley.

Gerald recalls, "When I was a kid I used to go around to neighbors to get old radios. I liked to get parts out of them, and I liked to soup them up." This early interest in electronics led to an amazing career.

This brilliant engineer joined Crown part-time in 1964, first working as a tape-recorder tech, draftsman and engineer, when he designed the SA-20-20 and SA-60-60 — the first solid-state Crown amplifiers. In 1965 he received a BSE from Michigan State (Honors College) and MSE from the University of Michigan in 1966 (State College Fellowship).

Gerald has this to say about the SA-60-60: "It was a dual 60W 8-ohm amplifier. Only a few were made. They were unreliable, using only high-speed fuses for protection. The SA-20-20 was a 1-rack-space amp that soon became the SA-30-30. The SA-20-20 used smaller versions of the SA-60-60 output devices. The 60-60 was DC coupled throughout and the 20-20 was AC coupled at the input. The DC-300 was not the first DC audio amp, but it was the first that was reliable."

Gerald went on to invent the technology behind all of Crown's power amp series. He holds a huge number of patents: 31 in the U.S. alone, and many more in other countries.

Gerald comments on Crown's success over the years:

**“**In an era of cookbook designs and buggy software, it would seem that the most basic lessons of history have been forgotten. Crown's recipe is simple: design, build and service each product as if you were the customer. This approach not only drives the product to excellence, it drives the people to be the best that they can be.”



Crown's Vice President of Research and Development, Gerald Stanley.



## Macro-Tech Advanced Features

The Macro-Tech Series employs a number of innovative, patented technologies. Let's look at them in detail.

### IOC® (Input Output Comparator)

The IOC circuit compares the output signal of the amplifier with the input signal. If there is any difference other than gain, then it is considered distortion and the IOC indicator flashes. This LED lights whenever there is distortion of 0.05% or more. (Note that amplifier clipping is typically close to 3% THD.) An IOC condition also is sensed by an IQ-PIP module installed in PIP-compatible amplifiers.

IOC is designed to report any form of distortion. IOC not only checks the waveform for distortion, but also reports input overload and even a protective action that mutes or shuts down an amplifier. With all of these features, IOC monitors the entire amplifier. When the IOC indicator is off, the amplifier is definitely operational and undistorted. IOC provides a real-time proof of performance.

### Output Device Emulation Protection (ODEP)

Gerald invented ODEP to solve two long-standing problems with amplifier designs:

- Preventing amplifier shutdown during demanding operation, and
- Increasing the efficiency of the output transistors.

ODEP limits the signal when necessary to prevent overheating and failure of the amplifier output transistors. Crown engineers established a rigorous program to measure the safe operating area (SOA) — related to temperature — of each output transistor before installing it in an amplifier. Gerald also designed intelligent

circuitry to simulate the instantaneous operating conditions of those output transistors. Its name describes what it does: Output Device Emulation Protection or ODEP. It not only simulates the operation of the output transistors but it also compares their operation to their known SOA. If more power is about to be asked of the output devices than they are capable of delivering under the present conditions, ODEP immediately limits the drive level until it falls within the SOA. Limiting is proportional and kept to an absolute minimum — only what is required to prevent output transistor damage.

When ODEP limiting begins, the IOC circuitry will see that the input waveform does not match the output waveform, and an error signal is generated. If the compressors are on, they will see the error signal and compress the input signal to correct the problem. When this happens, there is no audible signal degradation. Compression is subtle, and not noticeable unless the system is driven to extremely high levels.

How does ODEP limiting increase the efficiency of the output transistors? It keeps them at the optimum temperature.

The transistors are neither overheated, nor overprotected.

Overprotecting results in transistors not being driven to their full output level.

In short, ODEP enables the amplifier to use the output transistors more efficiently while greatly increasing their reliability.

Finally, the status of ODEP is monitored in two ways. First, the front panel ODEP indicators show whether the amplifier is functioning correctly or if ODEP is limiting the drive level. Second, ODEP data is fed to the PIP connector at the back of the amplifier so advanced



One of Gerald Stanley's many patents.

PIP modules like the IQ-PIP-USP3 can use it to make decisions and control the amplifier. With ODEP you get the maximum power with the maximum protection — the show goes on!

### Grounded Bridge

Crown's Grounded Bridge topology makes the amplifier deliver peak-to-peak voltages to the load that are twice the voltage seen by the output devices and twice the voltage generated by the power supplies. In other words, the amplifier can produce louder sound without stressing the output transistors. The results are higher efficiency, lower distortion and superior reliability.

### Class AB+B

Crown invented the Class AB+B amplifier design, which provides both high efficiency and low distortion. AB+B circuitry draws less AC power and wastes less heat than Class A, and has less distortion than Class B or Class AB. To explain how AB+B works, first we need to explore other amplifier classes.

Audio power amplifiers are classified primarily by the design of the output stage (the transistors and related circuitry that send signals to the loudspeakers). Classification is based on the amount of time the output devices (power transistors) are made to operate during each cycle of the signal. Amplifier classes are also defined in terms of output bias current (the amount of current flowing in the output devices with no signal present).

In Class A operation, both output transistors conduct continuously for the entire cycle of signal swing, so the bias current flows in the output devices at all times. Both devices are always on. Class A amplifiers are single-ended designs with either PNP or NPN output devices. Class A is the most inefficient of all power

### Grounded Bridge theory for electronics-savvy readers

The power-supply bridge rectifier is not ground referenced, and the transformer secondary is not center-tapped. This allows the power supply to deliver +VCC and -VCC from the same bridge rectifier and filter as a total difference in potential regardless of their voltages with respect to ground.

Composite output devices are arranged to function as gigantic NPN and PNP devices. Each output stage has two composite NPN and two composite PNP devices. The devices connected to the load are referred to as "high-side NPN and PNP" and the devices connected to ground are referred to as "low-side NPN and PNP." Positive current is delivered to the load by increasing conductance simultaneously in the high-side NPN and low-side PNP stage, while decreasing conductance of the high-side PNP and low-side NPN in synchrony.

Imagine a graph of current versus voltage (I versus V) in an output stage of a power amplifier. This graph has four quadrants: +V and +I, -V and +I, -V and -I, +V and -I.

Grounded Bridge is a four-quadrant amplifier topology. Resistive loads only use the first and third quadrants (+V, +I and -V, -I). Reactive loads also use the second and fourth quadrants (-V, +I and +V, -I).

amplifier designs, averaging only 20%. Because of this, Class A amplifiers are large, heavy and run very hot. That is because the amp runs constantly at full power. On the other hand, Class A designs have the least amount of distortion.

Class B operation is the opposite of Class A. Both output devices are never allowed to be on at the same time. The bias is set so that current flow in a specific output device is zero when not stimulated with an input signal. Each output device is on for exactly one half of a complete sinusoidal signal cycle. Due to this operation, Class B designs show high efficiency, but poor linearity around the crossover region.

This is because it takes time to turn one device off and the other device on, causing extreme crossover distortion. All of this restricts Class B designs to applications with low power consumption, such as battery operated two-way radios and other communications equipment.



“ It allows Crown to pack large amounts of power into a compact package...”

An amplifier power supply must be large enough to handle both the maximum voltage and maximum current the amplifier needs to drive its rated power into a specified load. In order to meet this requirement, most conventional supplies are heavy, large, and produce lots of heat. In contrast, the VZ supply gets more current AND voltage out of a smaller, lighter, and more efficient package by dynamically adapting to both signal and load requirements in real-time. This provides the best power match to the widest range of loads.

The VZ power supply is divided into two segments. When the output stage requires high voltage, the segments are arranged in series to deliver twice the voltage of a single segment. When the output stage requires high current, the segments are arranged in parallel to deliver twice the current of a single segment.

Sensing circuitry “watches” the voltage of the signal to determine when to switch VZ modes. The power supply continuously adapts to the output signal: high voltage or high current. The switching circuitry is designed to prevent audible switching distortion to yield the highest possible dynamic transfer function.

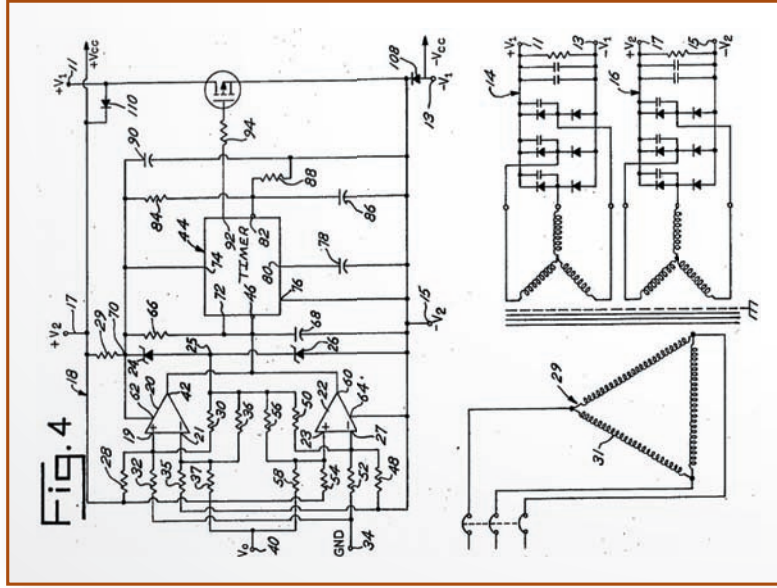
Class AB operation allows both devices to be on at the same time (as in Class A), but just barely. The output bias is set so that current flows in a specific output device appreciably more than a half cycle, but less than the entire cycle. That is, only a little current is allowed to flow through both devices — unlike the complete load current of Class A designs — but enough current to keep each device operating so they respond instantly to input voltage demands. Thus the inherent non-linearity of Class B designs is eliminated, without the gross inefficiencies of the Class A design. It is this combination of good efficiency (around 50%) with excellent linearity that makes Class AB the most popular audio amplifier design.

Class AB+B design involves two pairs of output devices. One pair operates Class AB, while the other pair operates Class B. Class AB+B designs are just as efficient as Class AB, but have even less distortion.

To summarize, AB+B circuitry draws less AC power and wastes less heat than Class A, and has less distortion than Class B or Class AB.

### Variable Impedance (VZ)

VZ is the name of Crown’s patented bi-level power supply technology. It allows Crown to pack large amounts of power into a compact package while achieving ultra-low distortion and without generating excessive heat.



A Circuit Diagram from the VZ Patent.

Normally, the power supplies operate in the high-current (low-impedance) mode for maximum thermal efficiency. When the voltage demand spikes, the supplies quickly shift into high-voltage (high-impedance) mode. Because voltage and current requirements vary with the output level and frequency content of the source signals, the power supplies are designed to be able to continually switch between the two modes as needed with no degradation to the audio signal. With VZ, you get not only maximum power, but also the best power matching to your load.

### **ILoad/ILimit (MA-5000)**

This LED indicates the maximum real-world load that you can put on your amplifier. The ILoad/ILimit feature is designed to help you get the maximum power out of your amplifier. In the real world, loudspeaker impedance varies with frequency, and loudspeaker impedance ratings are only approximations. Without ILoad/ILimit, you have to do some lengthy calculations to approximate the maximum number of loudspeakers you can drive with the amplifier — and this does not allow for a 4-ohm loudspeaker whose impedance drops below 2 ohms at 80 Hz.

This is why your amplifier has ILoad/ILimit. The ILoad function turns a channel's ILoad/ILimit indicator green when it senses that current is flowing to the load. The ILimit function turns the indicator red when it reaches maximum current output. This makes it possible to connect real loudspeakers and conduct realistic tests to find the maximum number of loudspeakers that should be connected. To do a test like this, you can operate under worst-case conditions and continue to connect additional loudspeakers in parallel with each output until the ILoad/ILimit indicator turns red. The optimum load is achieved before the ILoad/ILimit indicator turns red, so disconnecting the last added loudspeaker gives you an optimized load.





### Loudspeaker Offset Integration

Loudspeaker Offset Integration (LOI) protects speakers from damaging asymmetrical waveforms, DC and ultrasonic signals. LOI circuits use double integrating filters in the amplifier's feedback circuitry to protect loudspeakers in several different ways. First, they center asymmetrical audio waveforms that cause off-center woofer cone movement. Off-center cone movement increases loudspeaker heating and distortion while reducing the loudspeaker's power handling ability. Second, LOI filters unwanted DC and subsonic frequencies using a third-order Butterworth filter with a 35-Hz corner frequency. Third, LOI filters unwanted ultrasonic frequencies (RF) that can cause tweeter burnout using a second-order Bessel filter with a 50-kHz corner frequency.

LOI does NOT protect loudspeakers from large transient voltages or excessive power levels for prolonged periods of time. For information on techniques to protect loudspeakers, refer to the *Crown Amplifier Application Guide*, available online at [www.crownaudio.com](http://www.crownaudio.com).

### PIP™ Modules

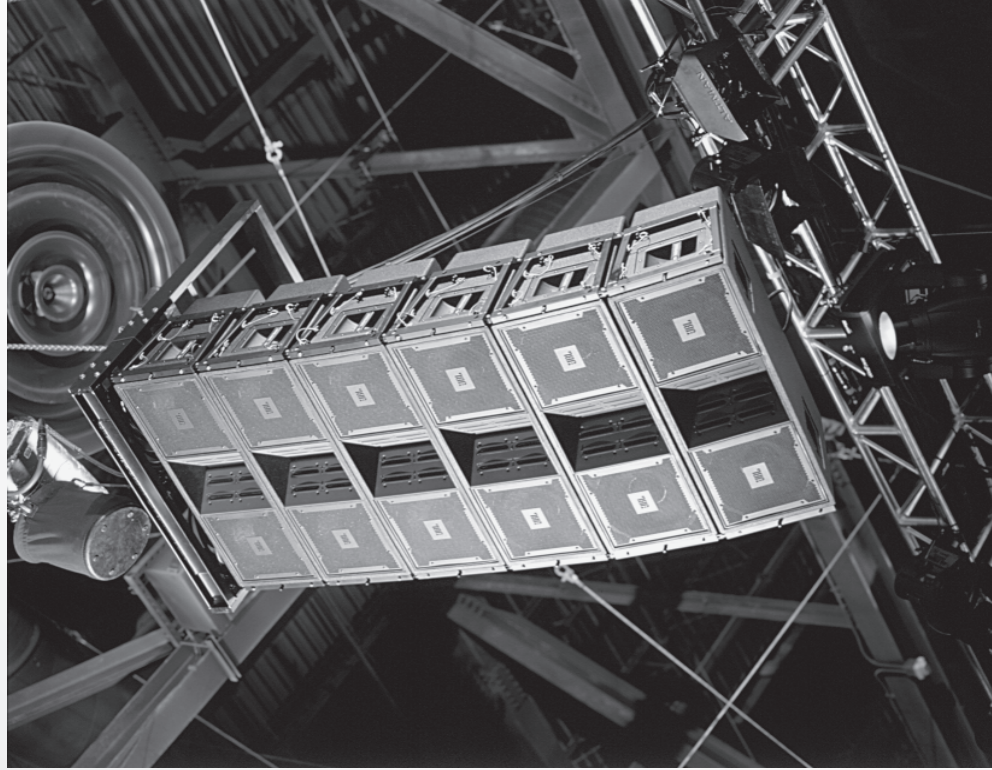
PIP (Programmable Input Processor) modules provide features that can be added to customize the amplifier. PIP modules plug into the connector inside the back panel of the amplifier. Features range from error-driven compressor/limiters to remote control and monitoring via System Architect or IQwic™. Your amplifier is a PIP2 amplifier, which means it can take advantage of the many advanced features found in PIP2 modules, as well as all standard PIP modules. Visit the Crown website at [www.crownaudio.com](http://www.crownaudio.com), or contact Crown Customer Service, for descriptions of available PIP and PIP2 modules.

### Reference articles on Macro-Tech amplifier technology

Go to the Crown website's *Amplifier Technical Information* page at this address: [http://www.crownaudio.com/amp\\_htm/ampinfo.htm](http://www.crownaudio.com/amp_htm/ampinfo.htm).

Under the heading "Other Crown Amplifier Technologies" check out these articles:

- IOC Distortion Detector
- Understanding Damping Factor
- Grounded Bridge Topology
- ODEP (Output Device Emulator Protection).



In the 1990s, nearly 9 out of 10 major touring companies chose Macro-Tech amplifiers to power their sound systems.

## Crown Amplifiers Time Line

- 1971: Gerald Stanley invents Grounded Bridge topology.
- 1974: Gerald invents Junction Temperature Simulation (JTS).
- 1975: M-600 was the first amp to use Grounded Bridge. SA-2 and PSA-2 first used JTS.
- 1984: MT-1000 was the first combination of Grounded Bridge and JTS, and Crown's first amp intended for the MI and Touring Sound markets.
- 1985: MT-1200 was a higher power version of MT-1000. MT-600 also was released. MT-1200LX and MT-600LX had a fancy extruded front panel and more displays.
- 1986: MA-10K provides 10,000 watts of power. The first MA-10K application is to power 465 speakers at the Indianapolis 500 Motor Speedway.
- 1987: MA-1200 and MA-600 (with PIP panels).
- 1991: MA-3600VZ featuring Variable Impedance (VZ) bi-level power supply switching. VZ technology was first prototyped in an MA-1200. The first bi-level amps were MRI units custom-made for Picker.
- 1992: MA-5000VZ also features Variable Impedance. MA-3600VZ and MA-5000VZ quickly become the touring standards. MA-24x6 and MA-36x12 for bi-amping are introduced.
- 1999: MA-602, 1202, 2402 and MA-5002VZ.



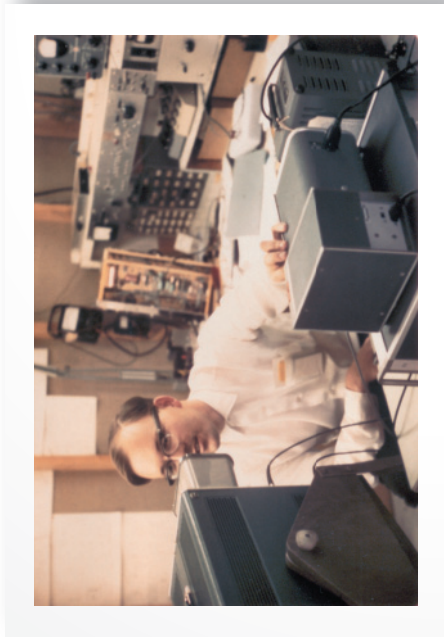
Amp room at Sooyoung Ro Church in Pusan, South Korea.

### VZ theory for electronics-savvy readers

VZ offers a simple way to apply Class-H operation to a Grounded Bridge circuit. Class H changes the power supply voltage from a lower level to a higher level when larger output swings are required. Class H also modulates the higher power-supply voltage by the input signal. This allows the power supply to track the audio input and provide just enough voltage for optimum operation of the output devices.

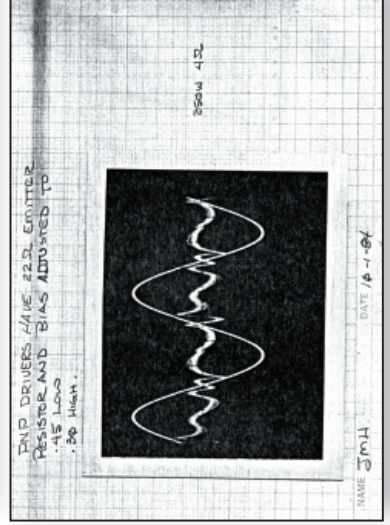
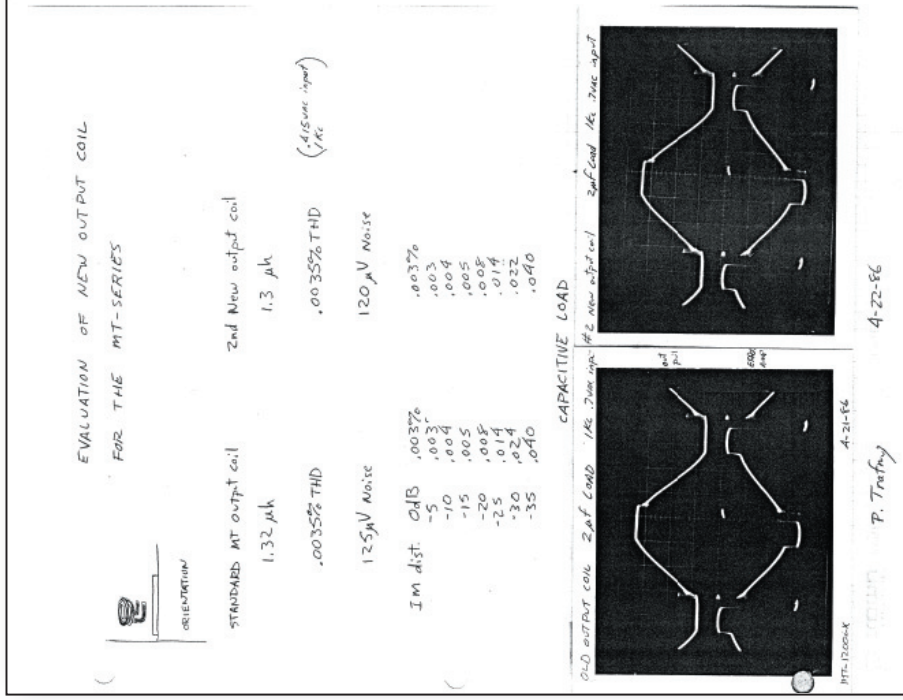
The Grounded Bridge has a particularly simple supply needed for Class H in that only one supply needs to be rail switched, whereas a common half-bridge (totem-pole) output stage needs two such switched supplies per channel. The bi-level (VZ) supply is further elegant in that the power supply is always fully utilized in both high- and low-voltage configurations. No segments of the power supply are wasted.





A mid-1960s shot of Gerald Stanley.

Right: Prototype test data from 1984 and 1986.



Harman Pro Group President Blake Augsburg (left) and Crown President Mark Graham (right) display Gerald's latest patent plaques in a recent Crown assembly meeting.



Shown on the next three pages is a reproduction of the original Macro-Tech brochure.



**SONIC PURITY**

## Macro-Tech Sonic Purity

**Macro-Technology** — a combination of technological advances that enhance the quality of live and recorded sound, and Crown's commitment to product excellence in reaching innovative levels of performance and reliability.

**T**he Macro-Tech Series continues to build on Crown's legendary reputation as the industry reference for sonic purity, power and durability. Unmatched in the marketplace, Macro-Tech provides the excellence and reliability that industry professionals stake their reputations on time after time. And with good reason. Crown amplifiers are designed to take the heavy use of professional sound reinforcement day in and day out without failure — or coloring the sound. When it comes to delivering the purest signal transfer possible, nothing else beats a Macro-Tech.

### Superior Engineering For Superior Performance

Our amplifiers are engineered with the philosophy of producing the very best sound possible under both normal and extreme operation conditions. To achieve this, our engineers examined all the factors in amplifier design and operation. The result is a number of patented Crown circuit designs that allow the Macro-Tech Series to achieve sonic purity and reliability that Crown is known for around the world. This design philosophy, combined with

Crown's commitment to excellence in design, manufacturing and service, is what makes Macro-Tech the choice for professional sound reinforcement.

### Versatile, Earth-Shaking Power

No other amplifier can give you as much versatility in delivering earth-shaking power as Macro-Tech. Through the patented Grounded-Bridge circuitry and Multi-Mode (A, AB + B) circuitry, each Macro-Tech can drive high output levels into massive loads while achieving the lowest distortion and greatest reliability.

The Grounded Bridge utilizes output transistors in a very efficient four-quadrant bridge which is immune to dynamic crossover distortion.

With this bridge design, the transistors share the same voltage, current and load so only one power supply is required per channel. This results in an efficient use of both power supply circuitry and chassis space. Rapid, uniform heat dissipation is promoted by our transistor mounting and heat diffuser designs. Smaller, more compact chassis can be used which provide a very high output power to size and weight ratio.

## ODEP™ (Output Device Emulator Protection)

ODEP, Crown's sophisticated protection circuitry, is a radical departure from other amplifier protection methods.

Crown developed ODEP to solve two long-standing problems in amplifier design: to prevent amplifier shutdown during demanding operation, and to increase the efficiency of output circuitry. To do this, Crown initiated a program which tests every output transistor to determine its SOA (safe operating area). ODEP circuitry inside the amplifier then simulates the operation of the output transistors and compares it to their SOA. In the unlikely event that more power is required than the transistors are capable of delivering under current conditions, ODEP immediately limits their drive level until it falls within their SOA. This limiting is proportional and is kept to an absolute minimum. This level of protection enables Crown to increase output efficiency while at the same time greatly increasing amplifier reliability. You get maximum power with maximum protection.

Unlike other amplifier protection schemes that shut down the amplifier, Crown's ODEP makes certain the show goes on.

## IOC® (Input Output Comparator)

The IOC is a sophisticated built-in distortion meter that compares the wave-form of the input signal to the waveform of the output signal. In the rare instance that it detects a variation of 0.05 percent or more, it flashes the IOC indicator of the offending channel.

The IOC indicators help you troubleshoot the source of distortion by showing you where it's not — your Crown amplifier.

## P.I.P. Compatibility

All Macro-Techs are P.I.P.® (Programmable Input Processor) compatible. These circuit card modules plug into a P.I.P. connector on the rear panel of the amplifier. Crown's P.I.P. modules enable you to tailor each amplifier to specific applications as well as plug into future technology as it's developed. Installation of an IQ-P.I.P. permits each Macro-Tech to interface with our innovative IQ System™ for complete amplifier monitoring and control. Some current P.I.P. modules include a sophisticated programmable crossover and equalizer, remotable mic/line priority mixers and calibrated sensing modules.

## Amplifier Status At A Glance

The Macro-Tech Series front panel gives you vital operating information with a minimum of effort. Two dual-function IOC/Signal Presence indicators monitor the transfer function of each channel. Green indicator lights illuminate to show signal presence and flash brightly if distortion equals or exceeds 0.05 percent.

An amber Enable indicator, powered by a small, separate power supply, verifies operation of the amplifier's low signal circuits, DC protection and onboard digital computer.

A pair of amber ODEP indicators show the reserve energy status and indicate when unfavorable operating conditions are sensed and limiting is beginning to take place.

# LEGENDARY



While many manufacturers have come and gone, Crown has continued to prosper for over 40 years. The worldwide Air Connect line represented our commitment to the industry and our customers. Our commitment to the industry and our customers has remained the same. Our commitment to the industry and our customers has remained the same. Our commitment to the industry and our customers has remained the same.

### For More Information

For additional information on the Macro-Tech Series or any Crown product, please contact us at 1-800-368-0338.

Our relationship with our customers begins with the sale and continues long after installation. Because the industry's best amplifiers are based on a full three-year, No-Fault transferable warranty that covers parts, labor and shipping,\* Plus, an additional three years is available through our new 3+3 No-Fault Warranty program.

\*Crown's Macro-Tech Series Amplifiers are the only U.S. and worldwide amplifiers to offer a full three-year, No-Fault transferable warranty.



GUARANTEED EXCELLENCE

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# MACRO-TECH®

Macro-Tech Series — Premium Professional Power Amplifiers From Crown

The Macro-Tech Series continues to build on Crown's legendary reputation as the industry leader in professional power amplifiers. The Macro-Tech Series is the most advanced, most reliable, and most versatile line of professional power amplifiers ever designed. The Macro-Tech Series is designed to take the heavy use of professional sound systems to the next level. With the Macro-Tech Series, you can be sure that your amplifier will perform as well as possible, whether it be in a live performance or in a recording studio.

### Superior Engineering For Superior Performance

Our amplifiers are engineered with the philosophy of producing the very best sound possible under both normal and extreme operating conditions. To ensure the highest quality and reliability, every component is carefully selected and tested. The result is a number of patented Crown Macro-Tech Series amplifiers that are known for around the world. This design philosophy, combined with Crown's commitment to superior manufacturing and service, is what makes Macro-Tech the choice for professional sound reinforcement.

**Versatile, Earth-Shaking Power**  
No other amplifier can give you as much versatility in delivering earth-shaking power as Macro-Tech. Through the patented Grounded-Bridge circuitry and Multi-Mono-A, AB+BI circuitry, each Macro-Tech can drive high output levels into the most demanding loads. The patented bridge circuitry provides the lowest distortion and greatest reliability, which is immune to dynamic crossover distortion. With this bridge design, the transistors share the same voltage, current and heat so only one power supply is required per channel. The result is an efficient use of both power supply and heat sink area. The result is a compact, rugged amplifier that can be used in any environment.

### ODP® (Output Device Emulator Protection)

ODP: Crown's sophisticated protection circuitry is a radical departure from all other amplifier protection methods. It monitors the output signal to prevent amplifier shutdown during demanding operation, and to protect the amplifier from damage.

increase the efficiency of output circuitry. To do this, Crown has introduced a new operating mode, ODEP (Output Device Emulator Protection). ODEP circuitry inside the amplifier then automates the operation of the output transistors and compares it to their SCA. In the unlikely event that more power is required than the transistors are capable of delivering, ODEP will reduce the output signal to a level that is proportional to the absolute minimum. This level of protection enables Crown to increase output capability while at the same time greatly increasing amplifier reliability. You can be sure that your amplifier will perform as well as possible, whether it be in a live performance or in a recording studio.

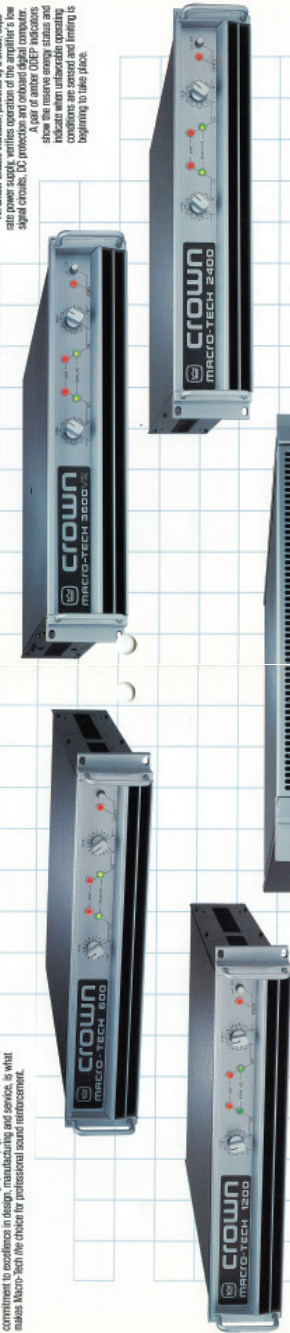
### ODP® (Output Device Emulator Protection)

The ODEP is a sophisticated built-in distortion meter that compares the waveform of the input signal to the waveform of the output signal. In the case where the input signal is distorted by more than 0.1% percent of the input, the ODEP will reduce the output signal to a level that is proportional to the absolute minimum.

The DCI indicators help you troubleshoot the source of distortion by showing you where it's at — just Crown amplifiers.  
**PLF Compatibility**  
All Macro-Tech amplifiers are PLF (Programmable Logic Processor) compatible. This means that you can use the PLF circuitry to control the operation of the amplifier. Crown's PLF modules enable you to tailor each amplifier to specific applications as well as take the latest technology as it develops. Resolution of an I/O bus is available to Macro-Tech to make it easier to integrate with other systems. For compatibility with other systems, Crown's PLF modules include a sophisticated programmable crossover and equalizer, variable mix/monitor, and a variety of other processing modules. To name just a few.

### Amplifier Status At A Glance

The Macro-Tech Series front panel gives you vital operating information with a minimum of effort. Two push-button DCI (Digital Presence) indicators monitor signal presence and level. A digital display shows the level of the input signal. An amber Enable indicator, powered by a stand-by power supply, verifies operation of the amplifier's low signal circuitry. DCI processing modules, such as limiter, compressor, and limiter, show the reserve energy status and indicate when undesirable operating conditions exist. The DCI indicators begin to glow when the amplifier begins to glow.



## VZ TECHNOLOGY

The new Macro-Tech 3000 VZ is the first Crown amplifier to use our patented Variable-Z VZ technology. This new VZ technology uses an articulated power supply which dynamically adapts itself to the load's requirements. Innovative energy storage circuitry allows the articulated power supply to work in a parallel mode or a series mode to meet voltage/current requirements. Combined with our ODEP circuitry, the VZ technology provides maximum power with maximum efficiency. The VZ technology provides the widest range of loads. With this design, sonic aberrations common to traditional series-parallel methods are eliminated. You hear what you want to hear. With the Macro-Tech 3000 VZ, this innovative power supply design allows us to pack an incredible 3,000 watts into a two rack unit package that weighs a mere 55 pounds.

## Legendary

While many manufacturers have come and gone, Crown has continued to prosper. For over 40 years, the ownership of our company has remained unchanged — a claim we alone can make. And through these many years, our commitment to the industry and customers has stayed true. Our tradition for unequalled excellence has been reflected time and again in accolades from our peers, including the recent ranking by Pro Sound News as number one in touring sound. Further, of the top ten touring groups at any given time, a majority are using Crown equipment.

Our technical support staff is unequalled for friendly, knowledgeable service and are within a phone call's reach. They're well versed with all aspects of Crown amplifiers and offer a level of support unsurpassed in the industry.

To ensure we achieve our standard for providing the very best product possible, we manufacture our own circuit boards, form our own sheet metal, and machine and paint our own parts. It's a constant striving for excellence that reflects the high level of pride our employees hold. Our assemblers are skilled craftsmen who have worked for us for many years, and we say without reservation or doubt that our engineers are the best. It's no wonder that our amplifiers are, too.



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Some models may be exported under the name Amcron.



