

# *A new dimension in sound perception.*

## **In the Service of Music**

Today, high fidelity speaker system design rests more firmly than ever on the foundation created by Acoustic Research during three decades of innovation and development.

Now, the new Research Series MGC-1 carries these contributions into another dimension of sound reproduction. In the MGC-1, the engineering precision that is an Acoustic Research tradition is combined with extensive application of the principles of psychoacoustics, the scientific field concerned with the limits of human hearing and the qualities of sounds perceived by listeners.

The products of the world's loudspeaker companies closely follow the pattern created in the acoustic suspension systems first introduced by Acoustic Research in 1954. The dome driver, bookshelf cabinets, vertical arrays and sound absorbing surfaces introduced by Acoustic Research have become the dominant features of high fidelity speaker systems in every country. Few companies in any industry have so consistently received such tribute; few technical innovations have shown such endurance in a world of rapid technical change.

In the MGC-1, Acoustic Research offers music listeners a dramatic extension of sound reproduction technology.

The MGC-1 incorporates all of Acoustic Research's well-known contributions to modern speaker system design. It also contains new, advanced electronic circuitry that offers listeners unprecedented control over the acoustics of the listening environment. Inside its solid walnut cabinet, the MGC-1 contains the elements of an acoustical design that represents a new level of sophistication.

The Research Series MGC-1 represents a new standard of authority and accuracy in presentation of the recorded and broadcast sound field, through the first application of the newest results of world-wide research into the perception of sound.

## **Technical Design of the MGC-1**

In the MGC-1, Acoustic Research has applied its own acoustic suspension design and a scientifically designed radiation control array of mid- and high-frequency radiators, together with signal processing electronics.

The new technology in the MGC-1 sustains the high standard of sound reproduction realism listeners expect of Acoustic Research Products, while integrating innovations concerned with the interaction of the speaker systems and the listening room; the listener's perception of the effects of this interaction; and the addition of new processes, under the control of the listener, that make possible the adjustment, correction or entire transformation of the perceived space that is the setting of the musical performance.



## Control of Primary Reflections

A high-resolution optical lens is not simple in shape; it produces finely focused images by combining many elements, each with surfaces of complex curvature. To achieve comparable performance in the domain of sound, a speaker system must deal as well with sound waves as does the fine lens with light waves. In the MGC-1, multiple elements are designed and positioned, like the elements of a high-quality lens, to control the radiation of sound through absorption, diffraction and wave interference.

Some sounds, like the attack of a guitar or piano note, or the hard sound of a percussion instrument when struck, have a duration that is measured in microseconds. The integrity of such sounds may be captured effectively in modern digital recordings, but is then often softened or diluted by the strong, early reflections in domestic listening rooms, or by unwanted reflections from cabinet design details.

In the MGC-1, the multiple mid-range units are arranged in accordance with an exactly calculated geometry that causes their emitted waves to reinforce each other in the direction of the listeners, but to cancel in the directions that cause the most disturbing early reflections. At high frequencies, carefully constructed, three-dimensional absorption units shape the radiation pattern systematically to perform the same function as the mid-range diffraction geometry.

The result is a sound remarkably free of image distortion, in which individual instruments and voices are reproduced with precise location and a high order of stability.

Because the overall energy spectrum of the MGC-1 and its forward radiation spectrum are uniform, listeners in various parts of the room observe the same precision imagery and consistent tonal balance.



## Delayed Ambience Control

The presence of delayed ambience in large performance environments has long been recognized as a fundamental distinction between a live performance and its reproduction in the relatively small environment of the listening room.

The MGC-1E ambience control unit corrects this fundamental difference by electronically delaying a very small amount of the signal being sent to the MGC-1. This delayed signal is then amplified by a built-in 100 watt stereo amplifier and reradiated through the side firing speakers on the MGC-1. The effect of reflecting a delayed signal off the side walls of the listening room is to move the side walls outward 20' in each direction, thereby creating a perceived space of the appropriate size for a live performance.

The MGC-1E ambience control provides the listener with unprecedented control of the listening environment. By using the controls on the MGC-1E front panel the listener can control the width of the perceived soundstage, the amount of ambience, or actually extract ambient information from live recordings and recreate the sound of the specific concert hall in the home listening room.

### Minimum Correlation

The sound that reaches a listener in a concert hall or at home is of two kinds. One kind of sound is the type that first reaches the ear directly from the instrument or voice, and is responsible for the listener's awareness of the location of each source of sound on the acoustic stage. The other kind of sound arrives later, after reflection from room walls, and contributes to tonal balance but should not compete with the early sound for the attention of the ear and brain.

During the past decade, extensive research in the U.S., Japan and Europe has concentrated on the effect of this later sound on the perceived quality of music.

It has first been discovered, and then extensively confirmed that music reproduction benefits most when the later sound is uncorrelated, that is, when the sound reaching the two ears of a listener is as dissimilar as possible.

When the correlation of the binaural signal is as low as possible, stereo reproduction is at its best, and the ambience in the recording or broadcast is most natural. The unusual shape of the the MGC-1 enclosures, and their construction as a mirror-image pair, result from the incorporation of angles and dimensions that have been found to produce minimum correlation in extensive research at university laboratories. In addition, the orientation of plane surfaces on the MGC-1 enclosure allows listeners to place the speaker systems so as to obtain optimally low correlation. The controlled correlation of reverberant sound in the MGC-1 produces lifelike, natural reverberant sound without obscuring the clarity of individual sound imagery.

### Fact and Illusion

Recordings do not contain all of the information that would be needed to reconstruct the sound of a performance.

The art of making recordings, and the science of making loudspeakers, depend upon understanding by both producer and engineer of the ways in which various auditory hints and clues are used by the ear and mind of a listener. When this understanding is complete and well applied, the result is a satisfying and enriching contact between the performers and the listener. It is necessary to create and sustain the illusion of reality, while remaining committed to the integrity of the facts in the recording.

Acoustic Research is proud to have consistently honored this commitment. It is the basis of the respect we have earned from musicians and listeners alike, of varying musical tastes and through decades of changing musical fashion.

In all of this, it is the ear of the listener that becomes the final judge. However, it is not always recognized that the function of hearing must be understood as well as the mechanics of loudspeaker design if high quality music reproduction is to be attained.

We believe that the MGC-1 represents the combination of such understanding with a level of current technology that is at the leading edge of contemporary acoustic design.

As would be the case for a great painting, a physical description must always be incomplete in the most fundamental way, until it is experienced by those for whom it has been created. Acoustic Research invites you to experience the MGC-1. In its factual precision and the depth of its illusion, we believe that you will find the experience extraordinary.

# MGC-1

## MGC-1 SPECIFICATIONS

### SYSTEM TYPE:

The MGC-1 is a three-part system consisting of a mirror image loudspeaker pair and an electronic control and amplification unit. Each floor-standing loudspeaker consists of two parts: a 4-way passive system featuring a 6 element, controlled directivity vertical array and an integral 2-way active sub-system for delayed ambience radiation. The electronic control unit provides signal processing, delay and power amplification for the delayed ambience sub-system, and provides user control over system parameters.

### LOUDSPEAKER SPECIFICATIONS

#### General

#### Driver Complement:

The cabinet surfaces containing drivers are angled at 26° (main system) and 54° (ambience system) for minimum interaural cross-correlation (IACC). The arrangement of the lower midranges and Dual-Dome unit causes the effective vertical acoustic centers to coincide, for best imaging.

#### Main

**System—** Two 8" (200mm) acoustic suspension woofers in independent sub-enclosures.  
Two 4" (100mm) acoustic suspension lower midrange drivers in independent sub-enclosures.  
One Dual-Dome drive unit containing a 1.5" (38mm) upper midrange dome and a .75" (19mm) tweeter dome, closely spaced on a single magnet structure.

#### Delayed Ambience

**System—** One 6" (150mm) acoustic suspension woofer in an independent sub-enclosure.  
One 1" (25mm) dome tweeter.

#### Radiation Pattern Control:

Acoustically absorbent foam is used to control the horizontal and vertical radiation patterns beyond  $\pm 30^\circ$  and  $\pm 15^\circ$ , respectively. This significantly reduces early wall, floor and ceiling reflections that cause imaging errors and tonal coloration. Additional control of the vertical radiation is achieved using computer-calculated driver spacing. Absorbent foam is also used to isolate the ambient radiation from the direct radiation.

#### System Dimensions (including grilles):

52" (1321mm) height x 26.25" (667mm) width x 16.13" (410mm) maximum depth. The cabinets have a modified triangular cross-section to yield optimum radiation directions.

#### System Finish:

Oiled solid walnut and oiled walnut veneer (rosewood available on special order).

#### System Weight (each speaker):

Unpacked 150 lbs. (68kg).  
Packed in Carton 182 lbs. (83kg).

#### External Connections:

Connections to the user's power amplifier are made via 5-way binding posts. 25 ft. (7.6m) dedicated cables, with high quality locking connectors, are supplied to interconnect the delayed ambience sub-systems to the electronics control unit.

#### Cabinet Internal Volume:

Two 99 ft<sup>3</sup> (27.9L) independent enclosures for the woofers. Additional independent enclosures for the lower midrange drivers and for the delayed ambience sub-system.

#### Passive System

##### Voltage Sensitivity:

2.83 volts produces 88 dB SPL at 1 meter on the Dual-Dome™ axis.

##### Efficiency:

1 watt produces 85 dB SPL at 1 meter on the Dual-Dome™ axis.

##### Power Requirement:

25 watts per channel, minimum.

##### Power Handling Ability:

May be used with amplifiers rated at up to 250 watts; amplifier being driven into clipping no more than 10% of the time on normal music and speech material in non-commercial applications.

##### System Frequency Response:

-3 dB (half-power) points at 39 Hz and 32,000 Hz; an effective Q of .97 at resonance.

##### Impedance:

4 ohms nominal, 3.2 ohms minimum.

##### Crossover Frequencies:

200 Hz, 1100 Hz, 5300 Hz.

##### Crossover Network:

The low-pass filter for the woofers is a damped full-section network.

The band-pass filters for the lower and upper midrange drivers contain damped half- and full-section networks designed for optimal impedance, phase and voltage characteristics.

The high-pass filter for the tweeter is a half-section network.

Air-core inductors wound with 18 AWG solid copper are used throughout, as are high power, non-inductive ceramic resistors. The woofer and lower midrange networks contain high quality electrolytic capacitors bypassed with metalized film capacitors. The upper frequency networks use low-loss metalized film capacitors exclusively. All internal interconnections are soldered and use 18 AWG conductors.

#### Delayed Ambience Sub-System

##### Voltage Sensitivity:

2.83 volts produces 90 dB SPL at 1 meter on the 6" woofer axis.

##### Efficiency:

1 watt produces 87 dB SPL at 1 meter on the 6" woofer axis.

##### Power Requirement:

Power for delayed ambience sub-system is supplied by the electronic control unit.

##### Frequency Response:

450 Hz to 5000 Hz; bandlimited by control unit and internal crossover.

##### Impedance:

4 ohms nominal, 3.7 ohms minimum.

##### Crossover Frequency:

3500 Hz.

##### Crossover Network:

Both the woofer and the tweeter are rolled off with a single, damped half-section low-pass filter. In addition, the tweeter network contains a half-section high-pass filter. High saturation, low distortion ferrite inductors are used, as are high grade electrolytic capacitors and a non-inductive ceramic resistor. Interconnections within the sub-system are soldered and use 18 AWG conductors.

### CONTROL ELECTRONICS SPECIFICATIONS (TYPICAL)

#### General

##### Dimensions:

4" (102mm) height x 17" (432mm) width x 12" (304mm) depth.

##### Weight:

Unpacked 22 lbs. (10kg).  
Packed in Carton 25 lbs. (11.4kg).

##### Power Consumption:

120 Vac, 60 Hz, 350 Watts.

#### Control Section

##### Control Complement:

Ambience Level, Ambience Balance Left, Ambience Balance Right, Soundstage Width, Wall Distance Left, Wall Distance Right, Power.

##### Indicators:

Power, Overload.

##### Side Wall Adjustment:

Each speaker may be placed between 1 and 10 feet from its corresponding side wall.

##### Equalization Loop:

4.5 V<sub>peak</sub> output; R<sub>s</sub> = 200 ohms.

4.5 V<sub>peak</sub> input; R<sub>in</sub> = 20,000 ohms.

##### Power Amplifier

##### Output Power:

100 W/ch RMS into 4 ohms.

##### Output Noise:

80 dB below RMS signal; .35 mV residual.

##### Distortion:

Less than .5% at 1000 Hz; 10 dB below clipping.

# Acoustic Research