

## WARRANTY

The IR2100 is warranted to perform within advertised specifications for one year from the original date of purchase. This warranty includes parts and labor when work is performed by an authorized Sound Concepts service facility or by the manufacturer. This warranty does not apply in cases of obvious mechanical or electrical abuse. This warranty is transferable. The registration card should be returned immediately to validate the warranty and record the date of purchase.

## SERVICE

If at any time the IR2100 should fail to perform satisfactorily, please write directly to the factory describing the problem in as much detail as possible, including steps taken to isolate the IR2100 as the source of the problem. We will promptly advise you of the best procedure to follow. Packing materials will be provided if required. Please do not ship the unit back to us before corresponding and receiving shipping instructions.

The IR2100 has a number of internal adjustments critical to its overall performance which can be properly accomplished only with special test equipment. Under no circumstances should you attempt to service the IR2100 yourself or to have it serviced by anyone other than an authorized Sound Concepts service facility, since in doing so you will void the warranty.

Serial no. \_\_\_\_\_

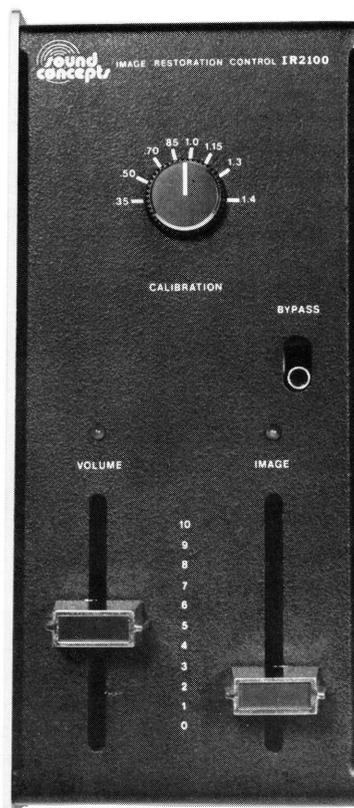
Purchase date \_\_\_\_\_

Dealer \_\_\_\_\_



BOX 135, BROOKLINE, MASSACHUSETTS 02146

# IR2100 IMAGE RESTORATION CONTROL



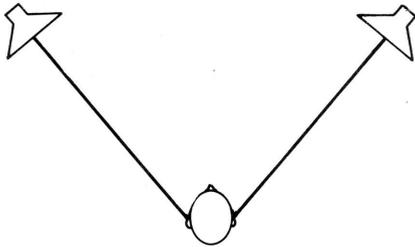
The Sound Concepts IR2100 is a hand-held, remote-control device capable of expanding the stereo image *beyond* the speakers of a normal stereo system to provide a full frontal hemisphere of sound, with instruments precisely imaged from left to right and with greatly enhanced front-to-back imaging.

## THEORY OF OPERATION

The Sound Concepts IR2100 represents an application of new technology to a theory developed in 1960 by Benjamin Bauer of CBS Laboratories. A basic compromise (actually a distortion) inherent in normal stereo systems occurs because each ear hears both speakers. This causes interference or "crosstalk" between the first-arrival sounds that create the stereo image and thus degrades that image. Elimination of this interference will restore the stereo image.

### THE STEREO IMAGE

An explanation of how stereo works may help to make this clearer. A listener seated equidistant between and some distance back from a pair of stereo loudspeakers listening to a typical stereo recording will perceive a sound that occurred at stage center to originate midway between the speakers. The sound was recorded equally loud in both channels and the distance the sound travels from the speaker to the listener's ear is equal for both channels.

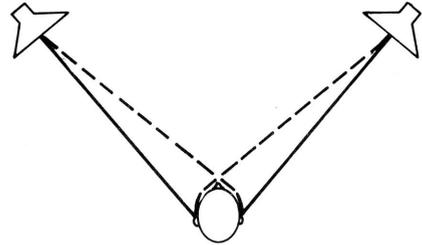


Now if we move the sound a bit to one side, say to the left, it will be recorded more loudly in the left channel than in the right, and because it is closer to the left microphone, it will be recorded a fraction of a second earlier in the left channel than in the right. On playback, the listener perceives the sound as originating left of center because it is louder in the left channel and because it is reproduced earlier in the left channel and thus reaches his left ear sooner than his right.

### INTERFERENCE EFFECTS

Now let's complicate this fairly simple stereo model by introducing a little more of the real world. Our original model doesn't take into account the fact that each ear hears both speakers. As the diagram shows, there is a direct path from left speaker to left ear and from right speaker to right ear, but there is also a slightly longer path from left speaker to right ear and right speaker to left ear.

Let's see what happens to our left-of-center sound when we apply this model. The first signal the listener hears is the left speaker in his left ear. The second signal he hears will be either the left speaker in his right ear or the right speaker in



his right ear. Which of these he hears first depends on many variables, but primarily on the distance left of center that the sound originates. Lastly, he will hear the right speaker in his left ear. Since he hears first the left speaker in his left ear, he has no trouble determining that the sound originated left of center, but the effect of the interference (also called "crosstalk" or "leakage") signal to the right ear is to pull the sound to the right, closer to stage center.

Up to now we have been dealing with a single sound. When we expand the model to include a complex combination of sounds such as music, we find that the effect of the interference signals is to confine the stereo image to the area *between* the speakers. This is a basic distortion inherent in all normal stereo systems.

### ELIMINATING INTERFERENCE EFFECTS

The Sound Concepts IR2100 effectively reduces this distortion by introducing a time-delayed, phase-inverted, error-cancelling signal that eliminates the interference signals. The result is that the stereo image expands beyond the speakers and both lateral and front-to-back imaging of instruments is improved.

The actual synthesis of the error-correcting signals involves consideration of many factors including diffraction effects, frequency cancellation effects, speaker placement, listener location, etc. Indeed, the process is so complex that when the theory was originally developed in the 1960's, the only way it could be implemented was with the use of a very large digital computer. Recent advances in large scale integrated (LSI) circuitry have made it possible to reduce the circuitry to fit into the hand-held Sound Concepts IR2100.

# OPERATING INSTRUCTIONS

## CONNECTIONS

The Sound Concepts IR2100 is designed to be connected into a stereo system via a tape monitor or external processor loop or between the preamp and power amplifier. A special low-capacitance 12-foot cable allows the compact unit to be hand-held at the listening position for ultimate convenience and accuracy of control settings. The red and black pair of phono plugs are, respectively, the right and left inputs to the IR2100 and should be connected to the tape out, external processor out, or preamp outputs of the preamp, integrated amplifier, or receiver. The white and black pair of phono plugs are, respectively, the right and left outputs of the unit and should be connected to the tape in, external processor in, or amplifier inputs.

To minimize the size of the control unit, power is supplied by a plug-in transformer (similar to a calculator power supply) connected to the unit via the cable. The transformer can be plugged into a switched outlet on the preamp, integrated amplifier, or receiver and be switched on and off with the system. Alternatively, since the unit draws very little power, the transformer can be plugged into an unswitched outlet and be left powered at all times. This may extend component life or eliminate turn on/turn off transients in some systems. If the transformer blocks other outlets, it can be connected via an extension cord.

## SPEAKER SELECTION AND PLACEMENT

To achieve the maximum image resolution with the IR2100, the optimum speaker would be one with linear vertical alignment of drivers, with minimum cabinet reflections, and with minimum phase distortion or "time misalignment," but the unit is effective with all types of loudspeakers.

The speakers should be located along a line equidistant from the listening position so that the midrange driver is a minimum of 1 foot and preferably 2 feet from all walls or other reflecting surfaces (wooden cabinets, bookcases, etc.). From this point, minor adjustments may be made to compensate for room characteristics.

## LISTENER LOCATION

The optimum listening position for maximum effect will be located along a centerline equidistant from the speakers, but the expanded image can still be appreciated and enjoyed

about 2 feet to either side and 3 feet front or back of the optimum spot. Furthermore, the unit does not degrade the signal at any location. While the image expansion effect will be more dramatic at narrower speaker angles, the suggested range is 40 to 60 degrees (a calibration ratio of .68 to 1.0, see Calibration section).

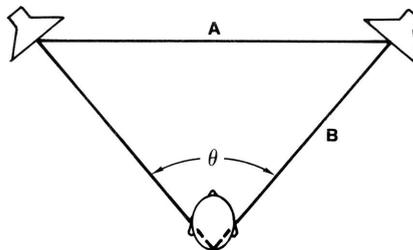
## CONTROLS AND INDICATORS

**LED's.** The LED located above the VOLUME control is illuminated when power is supplied to the unit. The LED located above the IMAGE control is illuminated when the imaging circuits are activated, that is, when the BYPASS switch is not in the BYPASS position.

**BYPASS.** The IR2100 circuitry, except for the VOLUME control, is bypassed when this switch is in the BYPASS position. This switch allows comparison of the expanded and normal stereo images and allows the unit to be bypassed when listening to material not suitable for image expansion (see Source Material section).

**CALIBRATION.** The setting of this control is based on the ratio of the distance between the speakers to the distance from the speakers to the back of the listener's head, assuming that the listener is seated equidistant from both speakers. For example, if the distance between speakers (A) is 10 feet and the distance from speaker to listener (B) is 12 feet, then the calibration ratio (A/B) is  $10/12 = .83$ .

In measuring distance A, if the speaker drivers are arrayed vertically along the centerline of the speaker cabinet, simply measure the center-to-center distance between the speakers. If the drivers are arrayed asymmetrically, measure the distance between the centers of the midrange drivers. In measuring distance B, measure from the center of the midrange driver to the back of the listening chair.



The calibration ratio can also be determined by measuring the angle ( $\theta$ ) subtended by the speakers and the listener and applying the formula

$$R = 2 \text{ sine } (\theta/2)$$

or by using the accompanying table:

$\theta$	20°	30°	40°	50°	60°	70°	80°	90°	100°
R	.35	.52	.68	.85	1.0	1.15	1.3	1.4	1.5

After the initial setup, minor adjustments may be made by ear.

**IMAGE.** This control boosts the level of the perimeter sound image relative to center. The 0 setting is optimum for accurate reproduction of a good stereo recording, while a source with very little stereo spread will benefit from a level boost. As the control is raised toward maximum, the image may begin to wrap around and blur slightly.

**VOLUME.** The VOLUME control is a master level control that allows you to adjust overall volume from your listening seat. The 5 position corresponds to unity gain and 10 to +6 dB.

## SOURCE MATERIAL

The Sound Concepts IR2100 will operate successfully on all stereo recordings or stereo broadcasts. It will be most effective on material made with simple microphone techniques, but will provide image expansion with any stereo source.

The IR2100 will have no effect on monaural material, and may be left on or switched to BYPASS when playing monaural sources.

The IR2100 may emphasize certain kinds of noise that contain highly directional information such as severe record surface noise and FM multipath distortion. The noise will be emphasized because it will be projected to the extreme sides of the sound field where it will appear more noticeable. In severe cases, you may want to switch the unit to BYPASS.

## TROUBLESHOOTING

If the IR2100 does not seem to expand the stereo image beyond the speakers, check the following. (1) The source material may have a limited stereo spread. Try a recording of a large orchestral work with a broad image. The Telarc series (DG10039 Firebird, 10043 Marches, 10047 Tchaikovsky's Fourth Symphony, or 10048 Carmen) should

work well. (2) If the sound still seems confined, raise the IMAGE level to 10 and switch the BYPASS in and out. If there is a noticeable change in level, the IR2100 is functioning. (3) Check the speaker and listener locations. If you are much more than 10 feet from the speakers, the effectiveness of the IR2100 may be diminished. The speakers must be equidistant from the listening position.

## COMPATIBLE WITH TIME DELAY

The IR2100 is fully compatible with time delay ambience restoration systems such as the Sound Concepts SD550. The IR2100 may be connected in the system ahead of the time delay unit so that it will enhance the delay channels also.

Initial setup is best performed by first optimizing one device and then bypassing it and optimizing the other. When both have been adjusted for best performance, turn them both on together. In operation, the IR2100 will provide the front hemisphere detail and the ambience restoration system will provide the side and rear ambient sound to truly immerse the listener in a live performance sound field.

## SPECIFICATIONS

<b>Conditions</b>	Both inputs driven VOLUME = 5 (gain = 1) IMAGE = 0 CALIBRATION = 1.0
<b>Frequency Response</b>	±0.1 dB 20 Hz to 25 KHz ±1.0 dB 5 Hz to 50 KHz
<b>Output Noise Level</b>	More than 80 dB below 1 volt
<b>Harmonic Distortion with 1 Volt at 1 KHz Input Signal Level</b>	Under 0.01%
<b>Intermodulation Distortion with 1 Volt Input Signal Level</b>	Under 0.01%
<b>Input Impedance</b>	30,000 ohms minimum
<b>Output Impedance</b>	300 ohms maximum
<b>Maximum Volume Gain</b>	6 ± 1 dB, non-inverting
<b>Maximum Image Gain</b>	6 ± 1 dB
<b>Power Requirements</b>	115 VAC, 10 watts maximum