
Holophone™



H2-PRO Surround Sound Microphone User Guide

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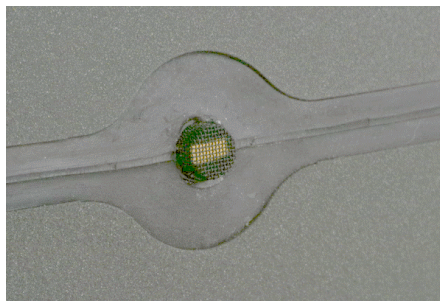
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Warnings

Failure to heed these warnings could result in an electrical shock hazard, reduced service life or damage to your equipment.

- The Holophone H2-PRO is intended for professional use only.
- All safety and operating instructions should be read before the unit is operated and retained for future reference.
- While the Holophone H2-PRO is water-resistant to some degree, take care that it does not become too wet. When used outdoors, a plastic bag placed around it with an elastic band around the cable will help to protect it against inclement weather.
- The seven external microphone capsules located on the perimeter of the Holophone are free-floating in the rubber gaskets surrounding the “head”. This has been designed as a feature to protect the microphone elements should they come in contact with a hard object. To achieve the best performance from the H2-PRO, the integrated fine mesh pop screen on the microphone capsule should be visible in its entirety on the outside of the gasket up to the line where the screen and the capsule body meet. There is a small lip built into the underside of the holes on the perimeter of the gasket which holds the capsules in place. When positioned correctly, this internal lip holds the microphone capsules in the correct location on the Holophone. In the event that the capsules become pressed in towards the frame, gently pull the capsule back outwards with fingertips or a small pair of tweezers, being mindful that the screen and gasket are delicate. The best way to pull the element out is by reaching into the gasket with tweezers placed around and underneath the capsule. Carefully grasp the capsule’s plastic body below the fine mesh screen with the tweezers, and gently pull the capsule out and into place.



Microphone element (close-up)

- The gold colored diaphragm located in each microphone capsule is delivered with the straight line of the diaphragm running parallel to the line in the Holophone’s perimeter gasket. This is for cosmetic purposes only. If the diaphragms appear to be off-center, it will in no way affect the performance of the H2-PRO.
- Refer internal servicing to qualified personnel.

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Introducing the Holophone H2-PRO

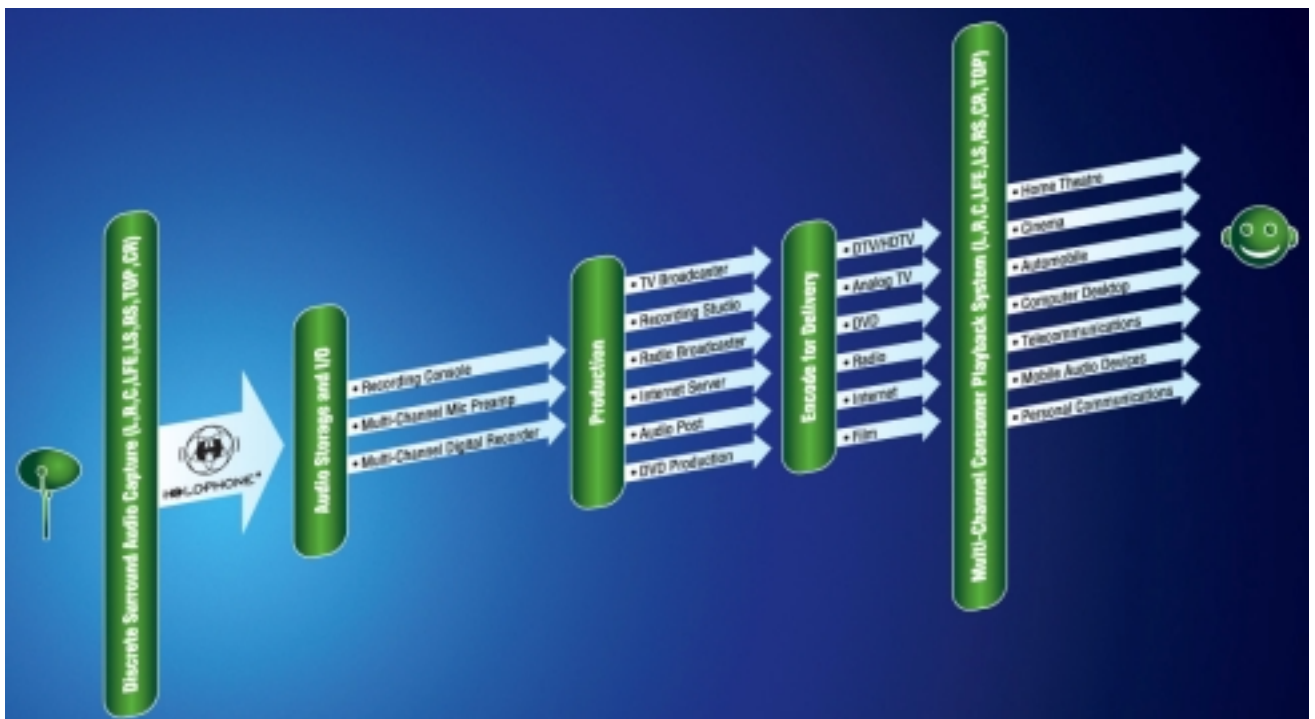


Congratulations. You have just acquired a remarkable product, combining simplicity and sophistication in an unmatched combination.

The new Holophone H2-PRO Surround Sound Microphone is the only patented device specifically designed for capturing discrete 5.1, 6.1, and 7.1-channels of surround sound for all professional audio applications. The H-2 Pro provides engineers and producers total control over all incoming, discrete surround sound audio signals and delivers those signals in an intuitive way.

Its flexibility, ease of use, and performance make the H2-PRO ideal for recording live events and in-studio use. It is well suited for television broadcasters (standard TV, DTV, and HDTV), radio broadcasters, music producers and engineers, film location recording crews, for independent project studios and for permanent installations in concert halls, entertainment venues and arenas.

All surround sound recordings from the H2-PRO are discrete and occur in real-time. That makes it very easy to bring the recorded three-dimensional sound into any broadcast or studio environment, and manipulate, mix and/or encode it into any of the professional surround formats and all of the standard consumer playback formats – Dolby, DTS, and Circle Surround.



The Holophone H2-PRO Surround Sound Microphone is entirely compatible with all standard analog and digital I/O devices that accept up to eight channels and provide internal phantom power, including hard disc based and DVD-based recorders, multichannel preamplifiers, standard multichannel I/Os, and all mixing consoles.

The Holophone H2-PRO takes the guesswork out of recording surround sound.

- Lightweight and inexpensive solution to instantly capture live surround sound for professional recording or broadcast.
- Direct and discrete signal path from the mic to the monitor, with no mixing, signal manipulation or processing required.
- Easy set-up, point and shoot operation with plug and play capability.
- Compatible with all eight-channel mic preamps, location recorders and recording consoles providing phantom power.
- Compatible with all surround sound encoding/playback formats (Dolby, DTS, Circle Surround, IMAX etc.)
- Rugged design for outdoor environments

What is the Holophone?

The Holophone is a specially designed microphone system for capturing sound in three dimensions, while keeping signals discrete for surround sound playback.

Designed specifically for creating sound tracks for surround sound playback systems, the Holophone's superb realism and ease of use make it the preferred choice for a wide range of other applications.

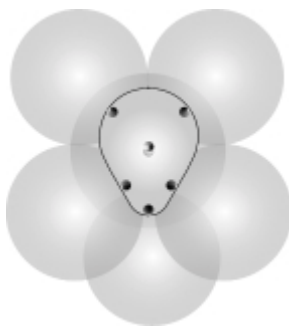
The 90's witnessed an explosion of surround sound technology in the form of motion picture playback systems, home theater, and Digital Video Discs (DVDs). The recording of natural and instantaneous surround sound was left behind, until the Holophone.

Three-dimensional sound is based on the brain's amazing ability to decode subtle differences in timing and volume of sounds coming from different directions as the waves bend around our head.

Surround sound has traditionally been created by mixing sounds recorded from multiple sources. The sound engineer controls the mix to simulate what a person sitting in a particular space would hear. The mixing approach is costly and time consuming, and the results are inconsistent.

The Holophone solution is to place multiple discrete microphones on the surface of a specially-designed *head*. Multiple microphones capture the sounds that come from multiple directions. An internal microphone captures low frequency sounds.

The Holophone's head is actually an ellipsoid. It looks more like a pointy football than a real human head. Acoustically, however, it performs remarkably like the real thing.



Holophone H1

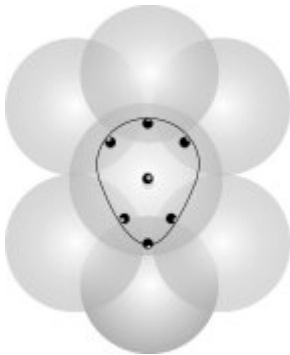
Without the head, each microphone would have an omnidirectional response field. The Holophone head provides a spherical boundary layer of varying proportions between each microphone, which effectively divides the incoming sound into sectors so that each microphone picks up sound primarily from one direction. The shape of the head also ensures that one microphone's response does not bleed directly into another but will bleed enough to be a smooth transition from channel to channel. These channels relate directly to the channels in a standard surround-equipped audio playback system. Small differences in the time it takes for a sound to be picked up by the various microphones are interpreted by the brain to determine where the sound is located.

Our real head performs similarly, shielding each ear from sound waves that are picked up by the other. Small differences in timing are interpreted as position. This phenomenon is known as *binary localization*. The output from all the speakers arrives at our ears with the same small differences in timing, and we hear as we would if our own head was in the same position as the Holophone when it recorded the sounds.

This simple principle governs the recording process, and determines where to position the Holophone. Recording is very subjective. Different positions produce different effects for different purposes. The best guide is simply to ask yourself "where does it sound best?" and put the Holophone there.

The primary advantage of the Holophone system over all other existing approaches is that no signal manipulation is required. The output of the Holophone itself can be used directly, and in most situations this will produce the best results.

The initial design was completed and a patent application filed for the new system in 1994. When it became apparent in late 1996 that the patent would issue, the first prototype was built. The Canadian government's National Research Council became interested in the technology and joined in a collaborative research agreement to fine-tune the system and build a prototype that was compatible with industry requirements.



Holophone H2-PRO

The Holophone surround system is available today for professionals wishing to optimize their surround sound recording projects. The new version, the H2-PRO, adds an eighth microphone at the rear, making it compatible with the 7.1 systems that have recently been developed. At the same time, control has been simplified, so that the H2-PRO can be readily connected with industry-standard preamplifiers and sound recording devices.

Development is underway for a series of miniaturized Holophone products, that will serve as the ideal complement to camcorders, computers and communication devices.

A Brief Overview of Surround Sound

In the beginning there was mono. No matter how many speakers there were, the sound coming from each speaker was the same. In monaural recording, the effect was as if all the sound was recorded from the same single location, and for the most part this was how it was recorded.

In 1940, Disney introduced surround sound to cinemas with the movie *Fantasia*, using three channels behind the movie screen, with additional speakers on either side and at the rear. Implementation was expensive, and the results were demonstrated in only two theaters — one in New York and one in Los Angeles.

In the 1950s, stereo recording was introduced to the mass consumer market. Stereo is based on the premise that we have two ears. If the sound is recorded from two sources, we get a better image of where the sound is coming from. Through the 1960s, stereo sound swept monaural out of the marketplace.

Throughout the seventies there were a number of experiments with quadraphonic sound for the home market. Quad sound failed to catch on for a variety of reasons — lack of material, high cost of systems and lack of consumer demand.

In 1970, George Lucas's *Star Wars* introduced Dolby Stereo to movie theaters, and within a few years it became the most common audio format. Contrary to its name, Dolby Stereo can actually deliver four sound sources, thanks to an ingenious principle called *matrixing*: left, right, center and rear. If the theater was not set up for four channels, the sound was delivered effectively as conventional stereo. Dolby Surround and Dolby ProLogic are home cinema versions of Dolby Stereo. For television home video, the four signals are compressed into two conventional stereo tracks, and then decompressed into four if the home equipment supports surround sound. This compression is referred to as 4-2-4.

Today, surround sound in theaters is delivered most commonly by Dolby Digital systems (including Dolby Digital 5.1, Dolby AC-3, Dolby SR-D (Spectral Recording Digital)). Dolby Digital employs six sound sources, as follows:

- Center
- Left
- Right
- Left surround
- Right surround
- LFE (or Low Frequency Effects)

This configuration is known as 5.1, with the “.1” referring to the LFE source (also known as a *subwoofer*). Dolby Surround Digital is the home video version, available on digital video disks (DVDs).

A competing system called DTS (Digital Theater Systems), introduced with *Jurassic Park*, also uses the 5.1 configuration. Circle Surround analog decoding system also supports 5.1.

IMAX uses a 6.1 system, adding a top channel to the 5.1 standard. This is the configuration that is supported by the Holophone.

Recently, Dolby, DTS and SRS Labs (among others) have come out with extended surround formats that use a 6.1 configuration. Dolby Digital EX, DTS ES (Extended Surround) and Circle Surround II (CS II) all add a center rear channel.

Sony has introduced a standard, SDDS (Sony Dynamic Digital Sound), which has a 7.1 configuration. It adds a *left center* and a *right center* speaker, but omits the top speaker. The Holophone does not support this standard directly. (However, the two additional sound sources can be generated in the studio, using the center channel in combination with the left and right channels.)

The Holophone is compatible with all consumer audio formats, including:

- | | |
|------------|---|
| 6.1 | IMAX
Dolby Digital EX
DTS ES
Circle Surround II (CS II) |
| 5.1 | Dolby Digital
Dolby ProLogic II
DTS
Circle Surround
AAC (Advanced Audio Coding – MPEG 4)
WMA (Windows Media Audio) |

If you wish, when using the Holophone, you can add “height” by mixing the top channel incrementally with the five (L,R,C,Ls,Rs) channels after recording.

- | | |
|------------|-------------|
| 7.1 | SDDS |
|------------|-------------|
- Generate the two additional sound sources in the studio, using the center channel in combination with the left and right channels.

4-2-4

Dolby Stereo

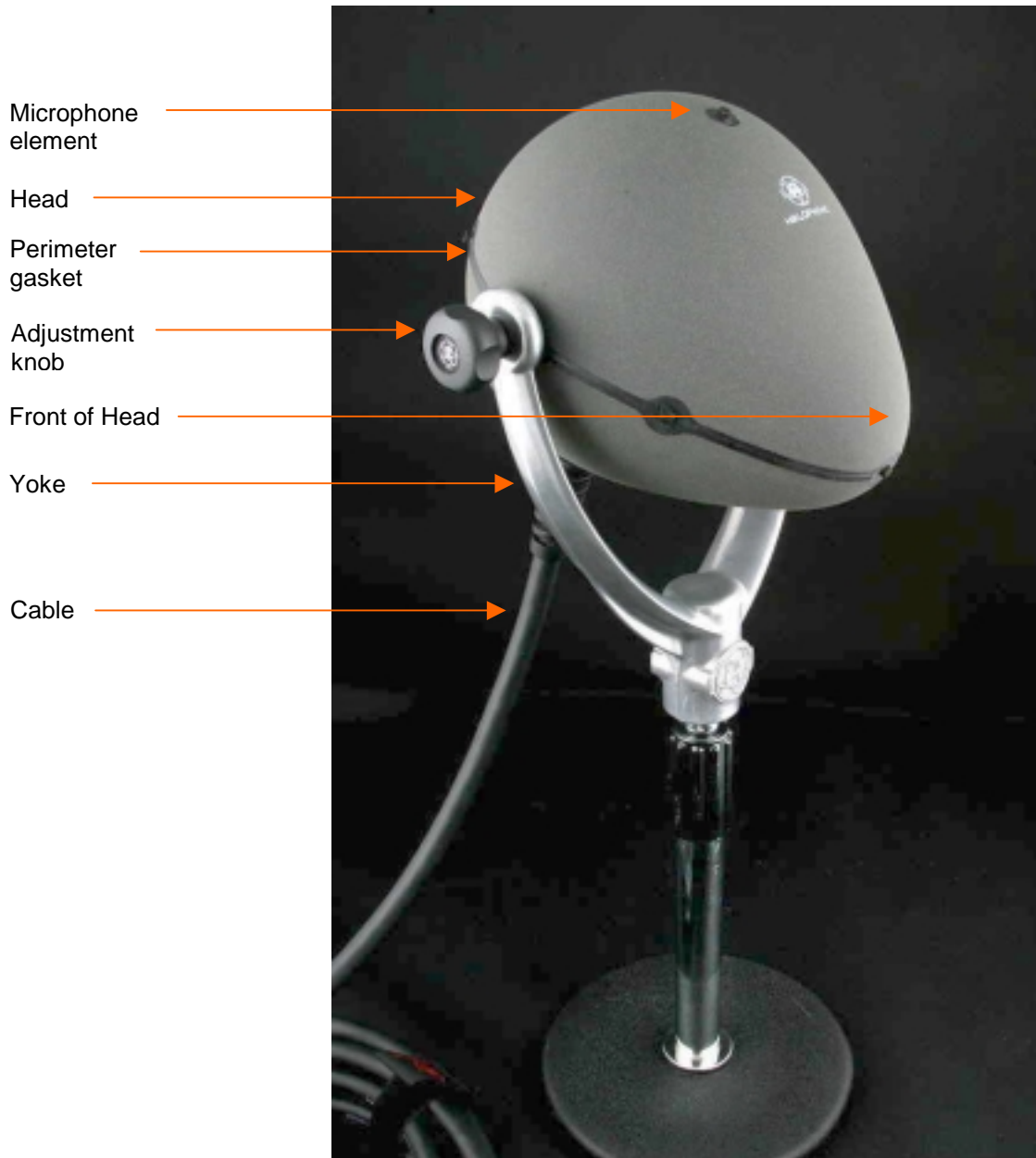
Direct support for center, left and right channels. Left surround and right surround are combined into one mono output. Mix the top incrementally with the four backbone channels.

Stereo

Mix down to stereo.

Note: Dolby, Dolby Stereo, Dolby Surround, Dolby ProLogic, Dolby Digital, IMAX, DTS (Digital Theater Systems), Circle Surround, AAC, WMA, SDDS (Sony Dynamic Digital Sound) are trade-marked terms.

The Holophone H2-PRO



Holophone H2-PRO Surround Sound Microphone

The Holophone Microphone System consists of

- ellipsoidal Holophone head housing eight condenser microphone elements
- yoke with 180° rotation
- 5 m. cable terminating in 8 XLR cable ends.

Phantom power for the condenser microphone elements can be supplied from a recording console, or a portable audio recorder with built-in phantom power. You can mount the Holophone H2-PRO on a boom or microphone stand, or hand-hold it using the optional hand grip.

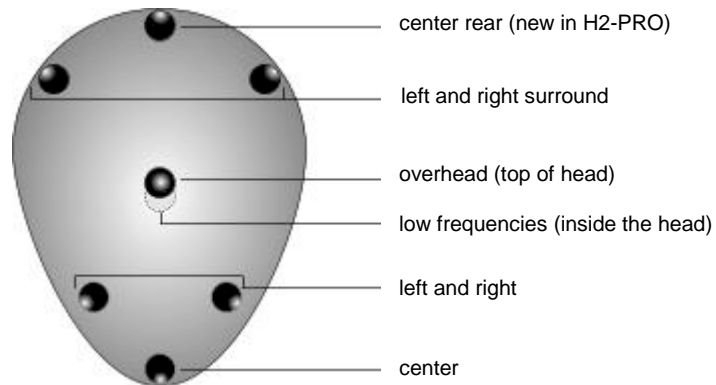


Use the Holophone H2-PRO on a microphone stand . . .



. . . or loosen the adjustment knob and turn the yoke upside down to hang the Holophone H2-PRO. (The Holophone must remain in the normal orientation, with the top microphone element at the top.)

Inside the Holophone, there are eight microphone capsules:



The microphone elements installed in the H2-PRO are DPA 4060 134db omni-directional condenser microphones.

Note: Microphone elements with higher or lower SPL (sound pressure level) and sensitivity are available as custom orders.

The cable terminates with eight balanced XLR output connectors. These are assigned to each of the microphone elements as follows:

Channel	Microphone
1	left
2	right
3	center
4	low frequency effects (LFE)
5	left surround
6	right surround
7	top
8	center rear

It is necessary to keep the channel assignments discrete through the recording and mixing process. For example:

- Channel 1 (left):
 - to channel 1 of a mixer
 - to channel 1 of a tape deck
 - to channel 1 of the final deliverable media
 - to left speaker in a surround sound playback system (5.1, 6.1, 7.1).

Using the Holophone H2-PRO

The Holophone H2-PRO is remarkably simple to use, because it accurately reproduces in three dimensions what one would hear at a particular location in space. In most cases, if you have experience recording sound with traditional microphones, you can rely on your ear and your intuition as to exact placement for a particular event or venue.

Here are a few additional suggestions: (please note these are only suggestions)

1. The simplest method is highly effective. Give the Holophone the best seat in the house and let it do its work. You will be amazed at the accuracy of the ambient sound. For a concert situation with arena-style seating, you might place the Holophone H2-PRO a little higher than the orchestra, tilting the nose down towards the performers.
2. Use the Holophone H2-PRO to provide the “base” ambient surround sound for your mix. Make sure to give the Holophone tracks “space” in the mix in which to further construct your mix, bearing in mind that the Holophone will provide a sonically complete Surround Sound picture to begin with. The usual approach is to place the Holophone along the center line of the event to get a sonic capture with proper left/right balance. Aim the pointed front of the Holophone towards the front and the round back towards the rear of the venue. Additional spot microphones can be used to feature specific areas or instruments in the recording, and to complete the desired soundscape.

Remember: The Holophone’s microphone configuration directly relates to a listener’s perspective in a home theater, etc. Treat the Holophone like a sonic camera, keeping the center “nose” microphone element forward, the left pointing left and the right pointing to the right of the performance.

3. If you are used to working with other microphones in a particular way, you can use the Holophone H2-PRO to provide the ambient sound of a venue and build the rest of the mix around it. Place it in a position that will not cause phase or delay problems when used with the signals captured by the other microphones. In most cases, in large venues try to position the Holophone as close to “Front Row Center” as possible, rather than near the back of the room (as with some traditional ambient microphone techniques).

4. When mixing Holophone tracks with other audio tracks for broadcast, including for voice-over or sportscaster talent, try to mix the dialogue not only into the Center channel, but also place the dialogue slightly in the Left and Right and to some degree the Surround channels for increased spatial realism. When the overall captured sound is three-dimensional, the Center dialogue channel can become very thin in comparison to the rest of the sound picture. Spreading the dialogue image over a wider space seems to rectify the situation. This has proven to be very effective when combined with Holophone derived Surround Sound ambience.
5. For Sports broadcasting in most field sporting events, and for fixed installations such as arenas, it is desirable to place the Holophone either near the center of the field, or else near a Main Camera position off to the one side that will work in conjunction with the main camera angle of the broadcast. For example, place the Holophone along the sidelines on the 50 yard line of a football game, or facing center ice in an ice hockey arena. Always keep in mind the perspective of the television viewer. Mounting the Holophone on a side of a field or rink opposite to the main camera angle would seem backwards and unnatural.
6. In situations involving multiple and simultaneous use of two or more Holophone systems, combining the signals together may alter the localization characteristics of the main recording, since two soundscapes and perspectives are being combined. This can be manipulated into an intriguing effect and can also be used for multiple perspectives of a venue for DVD, or broadcast, etc.
7. For track sports, including motor sports or running events with multiple camera angles on corners, hills or jumps, you can employ multiple Holophone units with an audio switcher from unit to unit. Use this configuration in conjunction with a camera switcher to match the changing perspectives of the cameras.
8. The Holophone can be mounted “upside down” from the ceiling by turning the adjustment knobs on the sides of the unit, flipping the system over, and then re-tightening the knobs. (The top microphone stays in the top position pointing UP, so that the Holophone’s microphone layout remains intact and compatible when used in conjunction with the corresponding channels of the eventual playback system.)



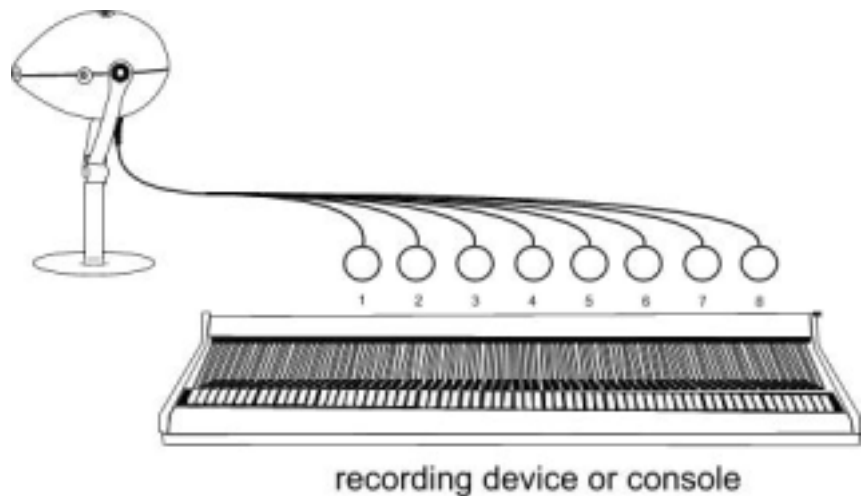
9. Audio “zoom” can be achieved by “riding” the faders of a mixer connected to the Holophone. The front (L,C,R) channels can be “pushed” in the mix while the rear (Ls, Rs, CR) channels can be “dimmed” slightly to increase the fore/ aft bias of the recording to the front (or vice versa). Side to side “zoom” can be achieved in a similar fashion.
10. For Holophone Surround Sound recording of acoustic instruments, including drum kits, pianos and voice at close range, try placing the Holophone near or above the instrument that is being recorded. For vocal or choirs, position the singers around the Holophone and monitor in Surround to hear the results! The possibilities are limitless. Please e-mail us and let us know if you find something cool!

For current tips and tricks in using the Holophone, visit our website: <http://www.holophone.com/inaction.html>

Cabling Scenarios

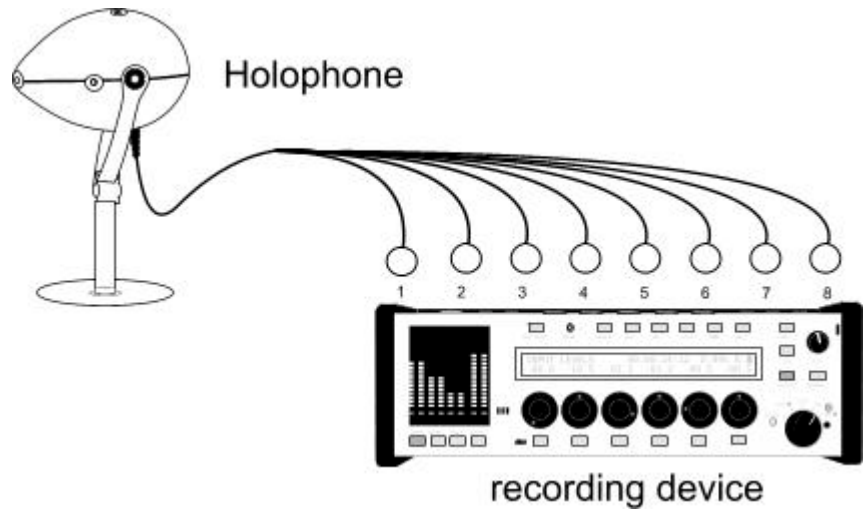
Direct to console

Plug the XLR mic-level outputs of the Holophone into the inputs of a console with gain control and phantom power available. Treat the outputs as you would eight individual microphones with all channels panned to center. for most recording situations set the gain the same across all channels.



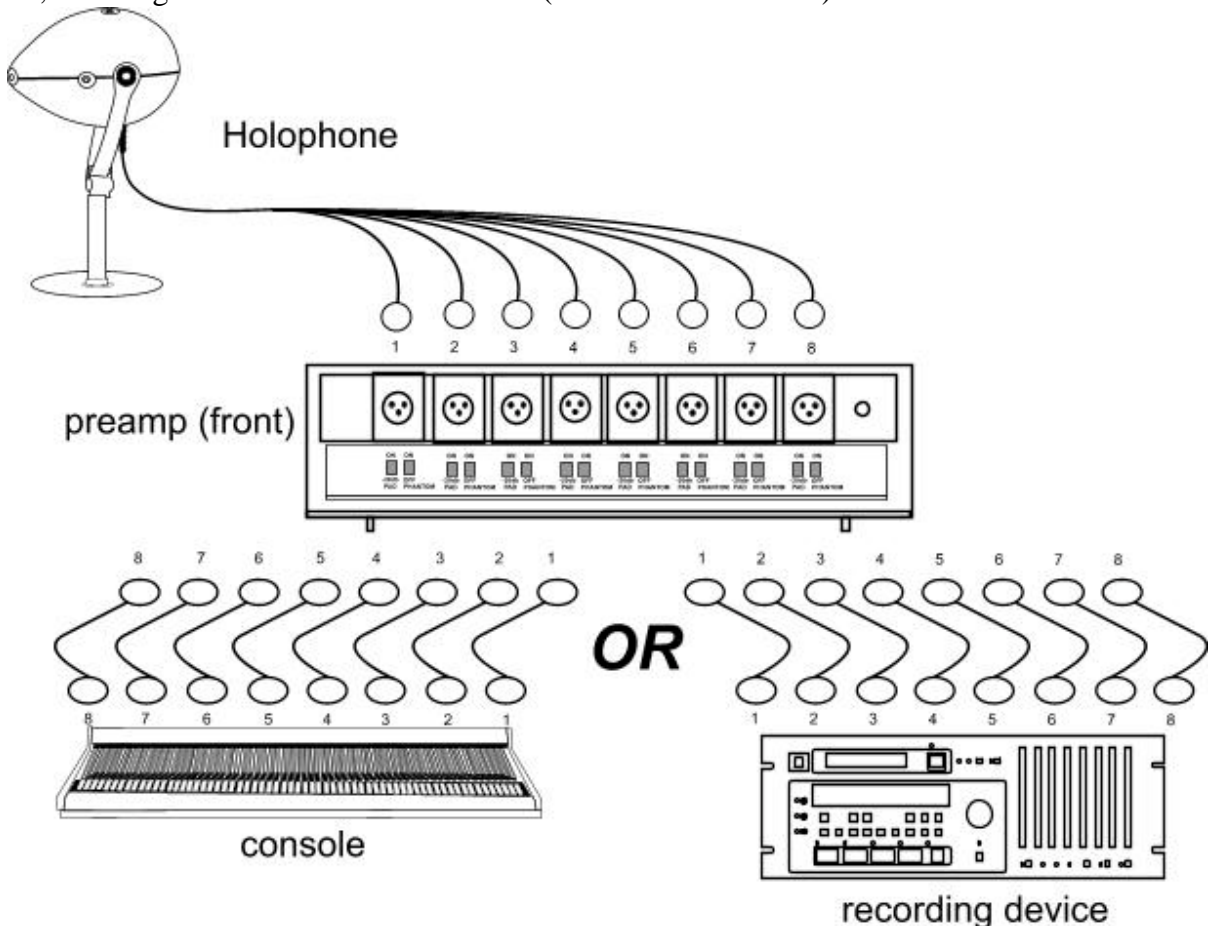
Direct to recording device supplying microphone with phantom power

Plug the XLR mic-level outputs of the Holophone into the inputs of a recording device (such as a portable audio recorder or audio console) with gain control and phantom power available.



Using a multichannel microphone preamplifier

Plug the XLR mic-level outputs of the Holophone into the inputs of a preamp. Connect the outputs of the preamp to the inputs of the console or recording device. Turn phantom power on, and set gain the same for all channels (relative to each other).



Optional Equipment

The Lightweight and Ergonomically designed hand grip for the H2 PRO eliminates the need for a cumbersome stand in the field



Hand Grip

The custom-designed travel case protects the H2-PRO from shock and water.



Custom Watertight Travel Case

A windscreen that encapsulates the H2-PRO head is available for outdoor use. It significantly reduces wind noise while also slightly increasing directivity.

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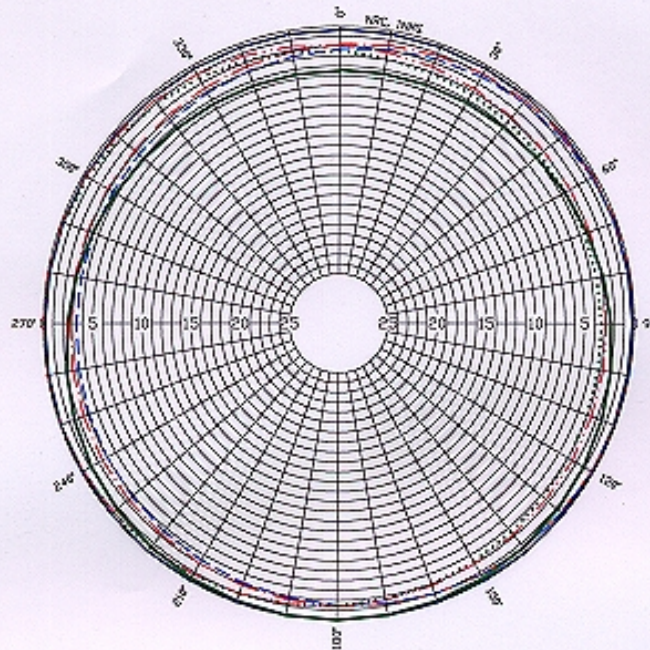
Appendix A: Directivity measurements

Directivity measurement of the ellipsoid-mounted microphones

The assessment of the directivity pattern was performed in the INMS GLK anechoic chamber. The ellipsoid holder was mounted on a rod (16mm diameter) attached to the center of a computer-controlled turntable (Brüel and Kjaer model 9640 with the 5997 turntable controller). The loudspeaker (Paradigm export monitor) was placed at a distance of 1.3 m from the front microphone of the ellipsoid. The directivity patterns of the Front, Right, Left, Right Surround and the Left Surround microphones were measured at 10 degrees intervals, with the zero degree position indicating the Front microphone facing the loudspeaker.

The outputs from the prototype Holophone PCM-7 preamplifier control module of the non-wireless Global Sound Microphone System were recorded by an eight-channel recorder (TASCAM DA-38). The pure-tone oscillator (Kroh-hite model 4180) provided the signal to drive the loudspeaker via a power amplifier at the following frequencies: 400, 1 000, 4 000, 16 000, and 20 000 Hz. The sound pressure level at the Front microphone at zero degree was maintained constant at 94 dB, with the Top channel level control set to zero to avoid the influence of the microphones by the top channel.

At each of the above frequencies, the directivity patterns of the above microphones are shown in the following graphs. The radial scales of the figures are marked at 5 dB intervals in 1 dB steps.

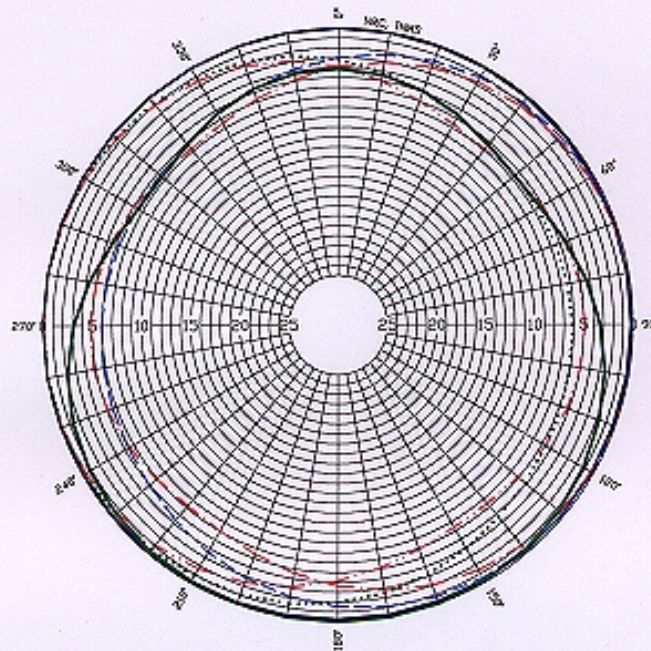


400 Hz

- R. Surround
- · - Right
- Front
- · · Left
- · · L. Surround
- Top

Non Wireless System

Rotation with FRONT microphone pointing upwards

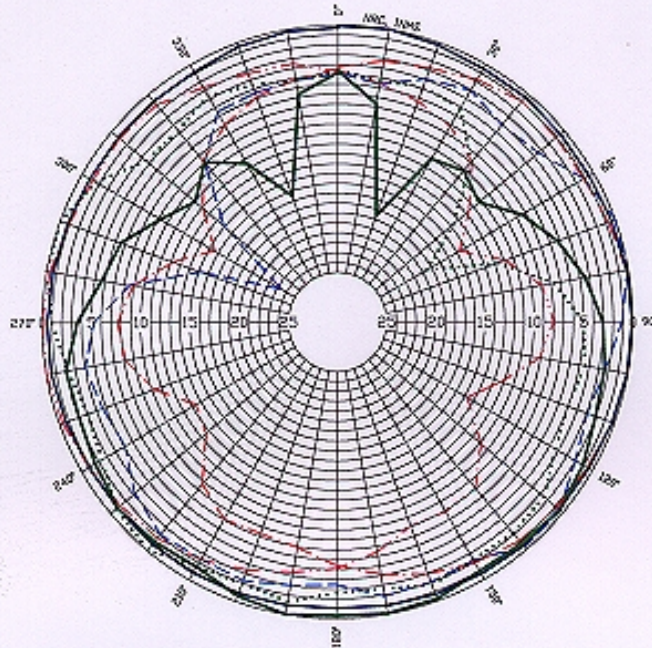


1 kHz

- R. Surround
- Right
- Front
- Left
- L. Surround
- Top

Non Wireless System

Rotation with FRONT microphone pointing upwards

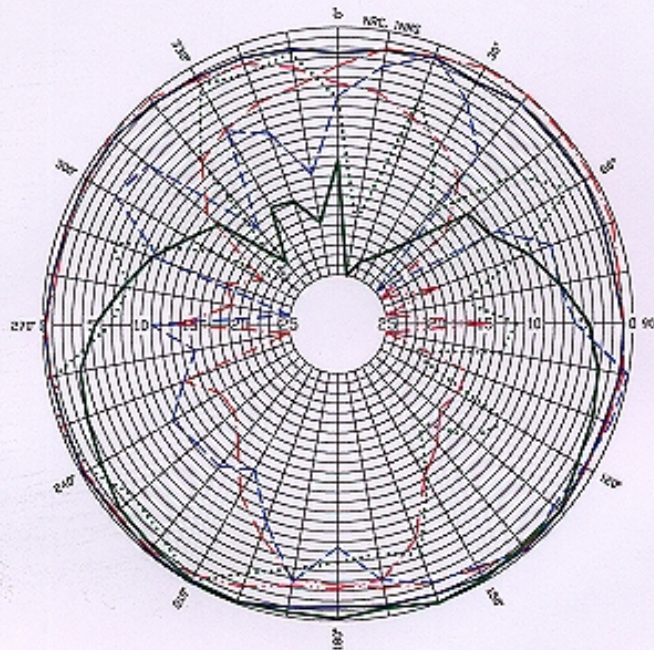


4 kHz

- R. Surround
- . - . - . Right
- Front
- Left
- L. Surround
- Top

Non Wireless System

Rotation with FRONT microphone pointing upward

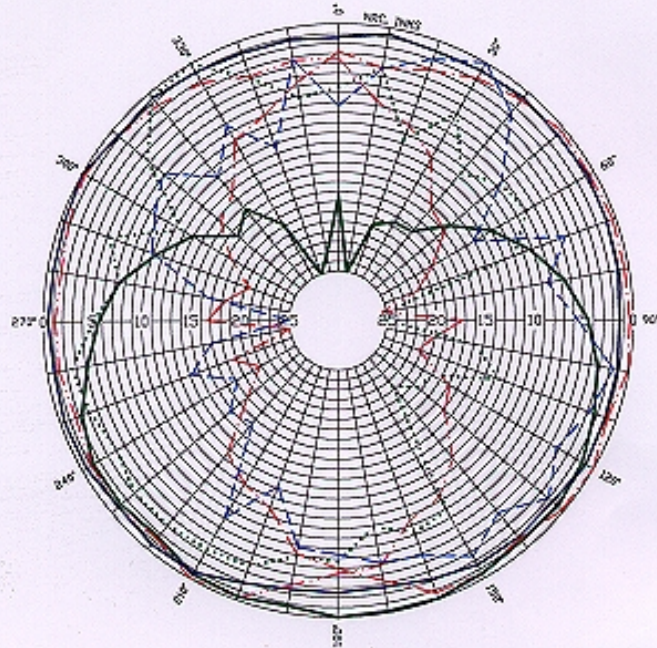


16 kHz

- R. Surround
- · - Right
- Front
- · · - Left
- L. Surround
- Top

Non Wireless System

Rotation with FRONT microphone pointing upwards



20 kHz

- R. Surround
- . - Right
- Front
- . . Left
- ... L. Surround
- Top

Non Wireless System

Rotation with FRONT microphone pointing upwards