C720

MULTIPATTERN CONDENSER MICROPHONE

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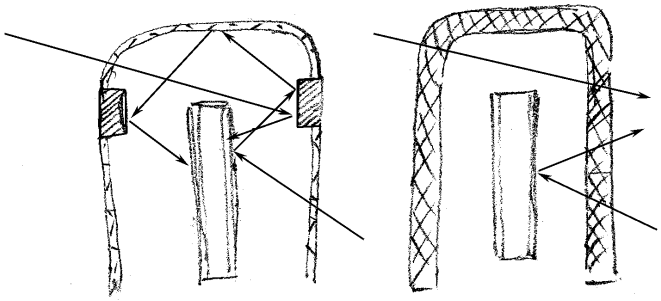
The Josephson C720 is the latest in the Series Seven range of large diaphragm side-address microphones. It uses a dual-cardioid capsule with separate outputs for the front and back. Dual-diaphragm microphones since the 1940's have used a similar principle internally to allow the user to select any desired directional pattern. The C720 allows greater freedom and versatility by providing an output of each capsule half through a discrete impedance converter/preamp stage. Having separate outputs allows each output to be recorded independently, permitting the pattern to be controlled in mixdown rather than at the session. The user can make the pattern choice at another location, or another time.

A unique feature of the C720 is its (patent pending) open-cell metal foam basket. Unlike traditional microphone housings made of perforated metal or screen with reflective metal support structures, this highly open material protects the capsule mechanically, provides electrical shielding and some pop and wind screening; no supporting structure is necessary. A fine acoustically transparent screen inside the basket helps protect the capsule from breath moisture when the C720 is used as a vocal mic. We were able to avoid using a traditional support structure because the foam itself is a tough self-supporting aluminum alloy. It's a highly open structure so that sound reflected by the basket is negligible, while the basket still provides full protection for the capsule. Traditional designs incorporate rings and bars to support the grille material, leading to the reflection



Conventional Basket
showing reflections from structure

Highly Open Metal Foam Basket
internal reflections greatly reduced

in the left picture. These reflections in turn introduce acoustic resonances in the microphone response which contribute to frequency response anomalies and

ringing. Maintaining acoustical transparency around the capsule is important in achieving the sonic clarity that is this mic's signature.

The output cable of the C720 terminates in a 7-pin XLR type connector. An adapter is provided to bring front and back outputs to normal 3-pin XLR connectors. Either the front or the back may be used as a cardioid microphone – just plug the corresponding connector into your recording chain.

Pattern Control

The user may accomplish the same function provided by a traditional pattern control switch or box, by connecting the front and back signals from the C720 to two inputs on a mixer. Use just the front signal or the back signal for a front- or rear-facing cardioid. Mix the two signals in phase to make an omni pattern, or flip the phase of the rear-facing signal and mix, to make a figure-8 pattern. Any intermediate pattern can be made by mixing the two signals in different proportions. Use this chart as a starting point for your own experiments.

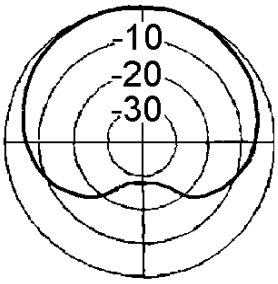
Pattern	**Rear Phase**	**Front Gain**	**Rear Gain**
Front Cardioid	Normal	0	off
Rear Cardioid	Normal	off	0
Subcardioid	Normal	-2	-15
Omni	Normal	-3	-3
Hypercardioid	Invert	-2	-15
Figure-8	Invert	-3	-3

Where the geometry is appropriate (for instance, in an ambient room pickup) the C720 may also be used as a stereo microphone, with its two closely matched cardioid capsules facing left and right.

About Directional Patterns

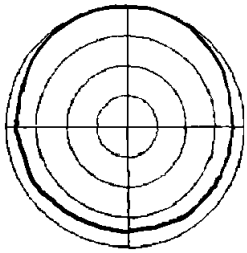
Microphones achieve their directional response by subtracting sound that comes from some directions, from the overall sound. This doesn't let us focus a beam of pickup sensitivity in one direction, but it does allow us to steer a "null" in one direction, and the response to sounds arriving from the area of the null may be

reduced 20 dB or more from response to sounds coming from other directions. The C720 allows all the traditional patterns to be selected, but its real advantage is in allowing fine adjustments to be made to the pattern to suit the sound and the environment.



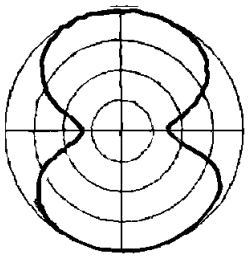
The basic pickup patterns of the two halves of the C720 are "cardioid." Sensitivity to sound arriving from the sides, is reduced by 6 dB (half) compared with sensitivity toward the front. Toward the rear, sensitivity is reduced by 20 to 25 dB. The polar graph above shows this response. Toward the top of the page represents the direction in front of the microphone. Each half of the C720 has this directional pattern; one is facing forward and the other faces to the rear.

If you mix the front and rear signals equally, the result is an omnidirectional pattern – sounds are picked up evenly from all directions. If you mix the front and rear signals in different ratios, the result is an omnidirectional type pattern but not perfectly even. Mixing the rear signal at -6 dB versus the front signal yields this sort of pattern:



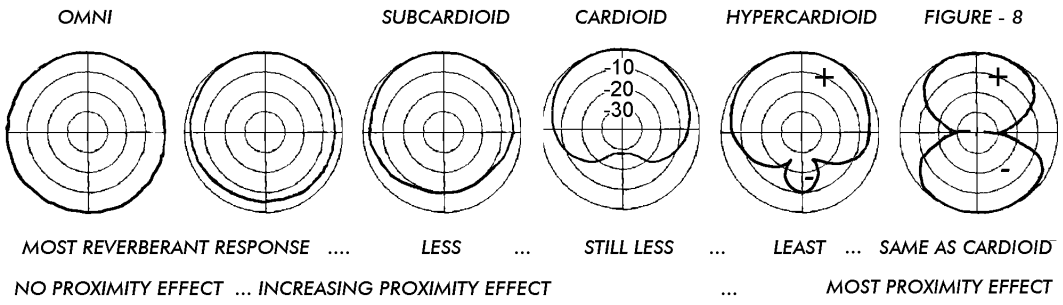
Using less of the rear signal makes a "wide cardioid," "subcardioid" or "hypocardioid" where the rear response might be -10 or -12 dB from the front response.

Inverting the phase of the rear capsule signal produces the family of patterns related to figure-8 or bidirectional pickup. With the front and rear at the same level, but one inverted in phase, the result is the classic figure-8:



Adjusting the relative level of the front and rear allows you to control the relative sensitivity of the front and back, and also determines where the null in the pattern will be.

Rather than focusing on the graphic representation of the patterns, it's most useful to listen to the results. Think of the range of patterns from omni at one end of the spectrum through cardioid in the middle, to figure-8 at the opposite end. Don't focus so much on where the front of the microphone is pointing – the response toward the front is fairly uniform for all patterns. Anything from cardioid through the figure-8 end of the spectrum will have one or more nulls somewhere in the pattern, and the direction and width of this "dead zone" make a big difference in the overall sound. As you change patterns, listen to how the overall room sound changes. If you're working close to the microphone, you'll also notice that the bass boost caused by proximity effect becomes stronger as you change the pattern toward the figure -8 end of the spectrum.



In general we recommend that the two outputs of the C720 be routed to discrete channels of a multitrack session recording without further processing, so that any desired modification to these signals may be done in mixdown without losing any of the original information. It doesn't matter whether the source

material is the two channels from the mic (mixed during the session) or as they are played back from the session recording – the signals are still the same. But while you are getting familiar with the microphone's capabilities, try mixing the two channels live.

Try some of the experiments described here. You'll need an ordinary mixer with the mic plugged in to two channels. Be sure the gain is set to exactly the same for both channels and the EQ set to bypass.

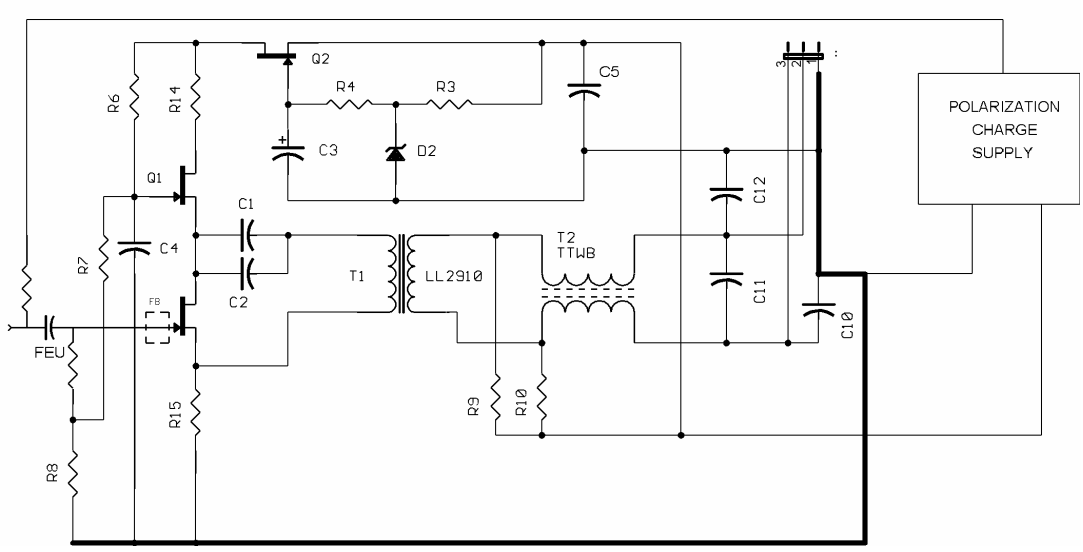
Of course the simplest pickup is just to use the front signal by itself. This is a well controlled standard cardioid pattern and is excellent for closeup vocals, detailed instrument pickup and large ensemble recording. Note how the sound color changes as you move around the microphone – more proximity effect and "reach" for sounds arriving from the front, less toward the sides, and a sharp null directly behind the mic.

Adding some of the rear-facing cardioid signal allows the standard cardioid pattern to be adjusted to suit the pickup requirements. Try some experiments with your pickup in a reasonably live room, so you can hear the effect of your adjustments on the overall pattern. Adding a little bit of the rear-facing cardioid (say, at -12 dB relative to the front) will reduce the depth of the null in the back of the mic, producing a sub- or wide cardioid pattern – less directional than the standard cardioid, and with a greater level of room ambience. Proximity effect is reduced too, so if the performer is moving around too much and causing tonal shifts, this can help fix it. Listen to the room sound become a little more live and the overall pickup a little more open as you bring up the level of the rear signal.

If you do the same thing but with the rear signal inverted in phase, the result becomes more directional (up to a point) as you increase the inverted-rear signal. In this case the null toward the back of the microphone splits, forming a null to either side of 180 degrees. At about -12 dB relative to the front, a hypercardioid pattern is formed, with nulls at about 140 and 220 degrees. The overall rejection of reverberant or room sound is highest in this configuration, even though the null to the rear of the mic is not as deep as in the straight cardioid mode. You'll notice much less "room tone" and a greater "reach" with the mic in this mode, but with more pronounced low frequency proximity effect.

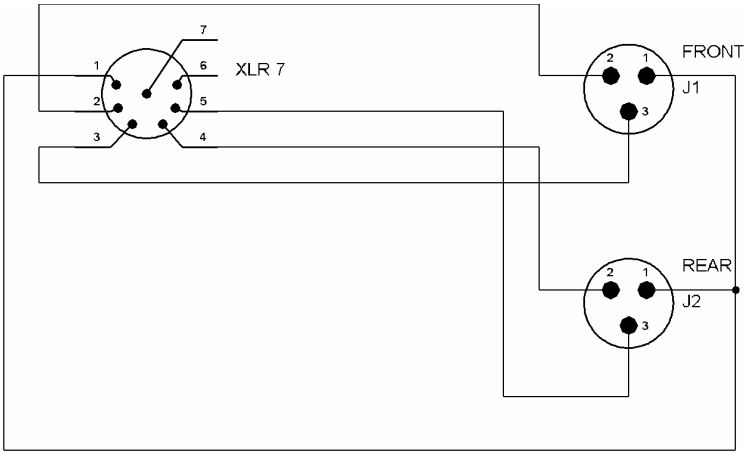
About the C720 Circuit

Like most Josephson microphones, the C720 uses an all discrete class-A circuit to transform the high impedance of the capsule to a suitable level for interface with mic preamps and consoles. A cascode FET stage directly drives a special Lundahl output transformer, which uses amorphous metallic glass as the magnetic core material. The result is a much higher overload point, even when the mic is driving long cables. It is the same audio circuit and transformer found in Josephson's acclaimed e22S microphone. The internal power supply of the C720 uses a new electrostatic circuit that provides capsule polarization charge without the use of oscillators or external power supplies.



Only one channel of the circuit is shown.

The breakout cable diagram is shown here for reference. The C720 will operate properly with either front or back sides of the microphone connected (or both). Full P48 phantom power is required.



C720 Specifications

Type: Dual electrostatic pressure-gradient transducers, cardioid characteristic
Marking: In accordance with IEC 61938
Rated power supply: Phantom 48 ±4 volts, 5 mA per output
Internal impedance: <100 ohms
Rated impedance: 200 ohms
Minimum load impedance: 1k ohms
Free-field and rated sensitivity: 1.7 mV/Pa
Frequency Range: 20-20,000 Hz
Directional characteristics: 2x cardioid
Overload sound pressure: 136 dB SPL at 1000 Hz
Equivalent sound pressure due to inherent noise: 15 dB SPL,
A-weighted rms in accordance with IEC 60268-1

Certificate of Compliance

Josephson Engineering, Inc. certifies that the C720 microphone conforms to the applicable requirements of the European Union directives as follows:

Machinery 93/68/EEC	Exempt – passive sensor
Low Voltage 93/68/EEC	Exempt – passive sensor
EMC 93/68/EEC	Exempt – passive sensor
RoHS 2002/95/EEC	Compliant for Hg, Cd, Cr6, PBB, PBDE and Pb

David Josephson, CEO
Josephson Engineering, Inc., 329A Ingalls St., Santa Cruz CA 95060 USA

Josephson Engineering, Inc.
Microphone Warranty

Josephson microphones are warranted to be free of defects for five years from the date of original purchase. If purchase documents are not available, the warranty period begins when the microphone was shipped from the factory. Josephson Engineering will, at its option, repair or replace any microphone that fails, providing that it is returned to the factory prepaid and has not been abused or altered.

There are no user-serviceable parts inside Josephson Engineering microphones. Disassembling a Josephson microphone will void its warranty.

For service information please contact Josephson at 831-420-0888. Repair shipments may be sent to:

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