

Microphone Headquarters  
225 W. Huron Street  
Chicago, U. S. A.

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Model 720A "TRI-POLAR" Crystal  
Microphone

## MODEL 720A "TRI-POLAR" CRYSTAL MICROPHONE

**GENERAL:** Model 720A is an advanced all-purpose ultra wide-range crystal microphone with three separate and distinct directional characteristics, each instantly available through a 3-point selector switch built into the unit. It is thus possible to solve, with one microphone, difficult pickup problems and to obtain highly satisfactory operation under adverse conditions of reverberation and background noise where a conventional microphone would be practically useless. (See "Acoustic Considerations" for a discussion of directional characteristics.)

The "Tri-Polar" contains two diaphragm-type elements, one of which is pressure actuated while the other is velocity actuated. The 3-point switch selects either one or combines both of these elements to give Non-directional, Bi-directional or Uni-directional response.

The crystals used are Grafoil (high-capacity) Bimorph units, triple moisture sealed to withstand adverse climatic conditions. Complete compensation for barometric changes is provided by means of specially designed acoustic networks.

**APPLICATIONS:** Model 720A is suitable for high-quality public address, broadcasting, recording and similar applications. Because of its unparalleled versatility, the 720A is ideal as a general-purpose microphone for use in all types of public-address, studio and remote broadcast work.

**INSTALLATION:** Model 720A has the standard 5/8"-27 thread and may be mounted on any Shure Desk, Banquet, or Floor Stand. For overhead suspension, an A35A Suspension Adapter may be used. The microphone is supplied with 25 feet of shielded-rubber-jacketed single-conductor cable which may be run inside or outside the stand tubings as desired. The internal elements of the microphone are isolated from the outer case by means of a special spring suspension. External flexible couplings are unnecessary.

**CONNECTIONS:** The "Tri-Polar" requires a high-gain amplifier designed for crystal microphone input. Many suitable amplifiers are commercially available. The microphone may be used with medium gain crystal amplifiers but may not give full output on the Uni-directional or Bi-directional switch positions due to the inherently lower output of the microphone under these conditions. (See "Acoustic Considerations" for output data.) A suitable preamplifier can, of course, be used with main amplifiers of insufficient gain.

The microphone should be connected to the grid circuit of the first tube across a resistance of 5 megohms. Input resistances as low as 1 megohm may be used if necessary, but higher values are recommended because of the better low-frequency response obtained thereby. Make certain that input connections are totally shielded. The "green" lead should be connected to the grid and the remaining lead to the ground side of the input.

~~The cable may be lengthened to a maximum recommended total length of 50 feet if necessary. The cable may be shortened if desired, but a capacity of 30 micro-microfarads per foot of cable removed, should be connected across the amplifier input. Correspondence with the factory is suggested on applications requiring special cable lengths.~~

**OPERATION:** After the microphone is set up, the switch should be set to the desired directional response. The switch knob is at the bottom of the case and has been designed to appear as an integral part of the microphone. Non-directional, Uni-directional or Bi-directional response is selected by turning the knob so that the chromium spot is beneath the corresponding position on the designation plate.

The "front" side of the microphone is indicated by the name and designation plates. When set for Non-directional response, the microphone will pick up sound from every direction. This setting should be used when conventional crystal microphone performance is desired. The Uni-directional setting gives wide-angle pickup

from the "Rear" opposite side. On the Bi-directional setting, the microphone picks up from the "Front" and "Rear" and is dead at both sides. (See "Acoustic Considerations" for further discussion of directivity.)

The highest output is obtained in the Non-directional position with successively lower microphone output on Uni-directional and Bi-directional. Should the output be too low for the particular amplifier on the Bi-directional setting, it is usually possible to satisfy the directional requirements of the particular pickup problem with the microphone set for Uni-directivity. A preamplifier can, of course, be used with main amplifiers of insufficient gain.

The microphone should not be left in the rays of the sun in hot weather for a considerable length of time, or in closed automobiles, cabinets or enclosures of any type where the temperature is likely to build up to more than 125° F. (51.6°C) as the crystal may be permanently damaged.

The microphone may be seriously damaged if accidentally connected to loud speaker or power supply outlets carrying high voltage. Check your connections carefully!

\* **ACOUSTIC CONSIDERATIONS:** The directional characteristics achieved over a wide frequency range in the "Tri-Polar" crystal microphone should not be confused with the slight directional effects at high frequencies only which can be produced by "baffle effects" with conventional microphones. Conventional pressure-operated microphones have no useful directional discrimination, even though exposed to the sound field on one side only. This can be easily demonstrated by noting that any conventional microphone (pressure operated) will pick up sound with practically the same "loudness" (and small changes in "quality") from all directions. This is a fundamental characteristic of all conventional pressure-operated microphones. In the "Tri-Polar", however, directional discrimination over a wide frequency is attained by properly phasing elements so that cancellation occurs in the microphone for sounds arriving from unwanted directions.

Non-directional. Polar characteristic is circular, giving pickup from all directions. Useful wherever conventional pressure microphone characteristics are desired. Suitable for pickup of orchestra, soloists, speakers and general applications. Output level 57 db below 1 volt per bar at the end of 25 ft. cable.

Bi-directional. Typical "figure 8" velocity polar characteristic. Pickup from front and back - dead at sides. Reduces reverberation energy pickup 66%. Allows artist placement front and rear while discriminating against sounds originating at the sides. Output level 75 db below 1 volt per bar at end of 25 foot cable. (See note 1 below.)

Uni-directional. Obtained by combination of pressure and "velocity" elements. Cardioid or "heart-shaped" polar characteristic with rear response down 20 db from front response. Reduces reverberation energy pickup 66%. Especially useful for discriminating against orchestra and audience noise while providing full stage coverage, and similar applications. Output level 70 db below 1 volt per bar at end of 25 foot cable. (See note 2 below.)

- (1) Low-frequency response depends on distance between source and microphone as is the case with all velocity operated devices. Response equalized to prevent "boomy" reproduction.
- (2) Low-frequency response slightly affected by distance due to variable contribution of velocity element at low frequencies.

**GUARANTEE:** Each microphone is guaranteed to be free from electrical and mechanical defects for a period of one year from date of shipment from the factory, provided all instructions are complied with fully.

**LICENSE NOTICE:** Shure Crystal Microphones are licensed under patents of the Brush Development Company. Shure patents pending.

SHURE BROTHERS

225 West Huron Street

Chicago, Illinois

HOW TO DEMONSTRATE  
THE "TRI-POLAR" CRYSTAL MICROPHONE

The Shure "Tri-Polar" Crystal Microphone is the only popular-priced Microphone that can insure trouble-free pickup under practically any acoustic condition because:

- A. The "Tri-Polar" is Uni-Directional
- B. The "Tri-Polar" is Bi-Directional
- C. The "Tri-Polar" is Non-Directional

A simple and effective method of demonstrating each directional characteristic follows. (All that is required is a Portable Public-Address System with any conventional crystal microphone amplifier.)

NON-DIRECTIONAL

1. Be sure the Switch is in the Non-Directional position.
2. Place the loud speaker at least 10 feet away from the Microphone, facing toward the rear of the "Tri-Polar".
3. Adjust the gain of the amplifier to a point just below feedback.
4. Speak into the Microphone from all angles from a distance of about six inches.
5. Explain how advantageous this type of directivity is in picking up large groups or a moving source of sound.

### UNI-DIRECTIONAL

1. Turn the switch into the Uni-Directional position. (Be sure the rear or null side of the Microphone is facing the speaker!)
2. Increase the gain to a point just below feedback.
3. Direct attention to the greater possible output of the speakers without feedback.
4. Turn the face or front side of the Microphone toward the speaker and show how it feeds back immediately. This demonstrates the Uni-Directional qualities of the Microphone.
5. The Uni-Directional feature just demonstrated permits a much closer placement of Microphone and speaker without feedback. It also materially reduces the pickup of reflection from walls, floor and ceiling, and eliminates background noise. This solves practically all of the acoustic problems encountered in church, auditorium, and night-club installations!

### BI-DIRECTIONAL

1. Turn the switch into the Bi-Directional position.
2. Keep the rear of the Microphone facing the speaker, as in the Uni-Directional demonstration.
3. Increase the gain until feedback is reached.
4. Rotate the Microphone until one side faces the speaker and feedback is eliminated.
5. Now--in this position--increase the gain until the feedback point again is almost reached, directing attention to the high output of the speakers without feedback.
6. Rotate the Microphone 360° showing the directivity.
7. You have just demonstrated that this Microphone can be used with two speakers, with satisfactory volume, placed on each side of the Microphone, without encountering feedback. This is very advantageous for orchestra work and similar applications.