

DATE: November, 1939

SUBJECT: Model 99C and Model 98A  
 "ZEPHYR" Crystal Record Reproducers

Model 99C and Model 98A "ZEPHYR" Crystal Record Reproducers

**GENERAL:** Model 99C and Model 98A Crystal Record Reproducers are intended for reproduction of 10" and 12" lateral-cut records and are designed to give high-quality frequency response with medium output and unusually low record wear. The crystal element is a Grafoil Bimorph torsion unit with special-process moisture-proofing, completely shielded in a cast metal cartridge. Model 99C supersedes the earlier Model 99B. The frequency response (See Fig. A, p. 2) has been modified and the mounting cushioned to increase isolation from the motor-board. The 98A reproducer has a base designed for single hole mounting.

Low record wear is assured by "Balanced-Tracking", (which maintains the horizontal projection of the needle closely tangent to the groove at all times), by low needle-point impedance, and the low needle pressure of 2.7 oz.

Model 99C "ZEPHYR" Pickup is provided with a 3½ ft. single-conductor, shielded cord; Model 98A, with a 1½ ft. single-conductor shielded cord.

**APPLICATIONS:** Models 99C and 98A Crystal Phonograph Pickups will give high-quality wide range reproduction with lateral-cut recordings at either 33-1/3 or 78 r.p.m. speeds.

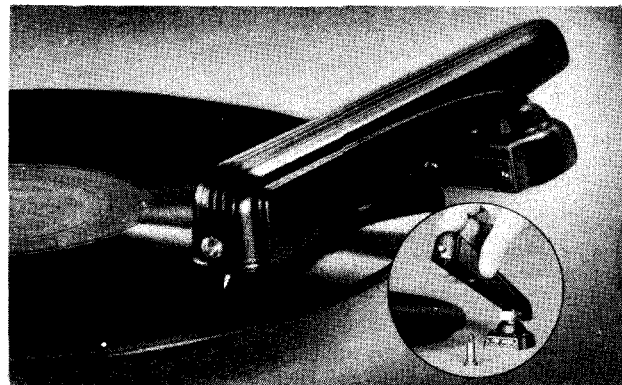
The output voltage of the pickup is approximately 2 volts for an overall groove amplitude of 0.84 mil at 1,000 cycles which is sufficient to produce full output from the audio stages of modern radio receivers and from moderate-gain audio amplifiers.

**INSTALLATION:** The Pickup should be mounted on the motor-board so that the arc of travel of the needle passes 1/4" from the center of the record on the far side of the tone-arm pivot. A drilling template is furnished with each pickup to facilitate motor-board layout. The motor-board should be heavy and well isolated from vibrations of the motor and the loudspeaker. Mounting of the pickup on rubber blocks or similar materials, is not necessary.

The motor should be mounted so that the playing surface of the record is approximately 7/8" above the top of the motor-board. It should be resiliently mounted to the motor-board by means of soft rubber washers, or other suitable resilient material, to prevent undesired vibration from reaching the pickup.

If necessary, the length of the cable can be increased considerably without excessive output loss. Low-capacity shielded single conductor cable is suitable for this purpose. Make certain that joints are well shielded to avoid hum pickup.

Model A70A Arm Rest as shown above is included with each pickup. The arm rest post is screwed to the motor-board. The tone-arm is simply pushed down over the post to lock, and releases when lifted up.



(Ill. approximately 1/4 full size)

Sufficient cabinet ventilation should be provided to keep the ambient temperature about the pickup at the lowest possible value. In any event the ambient temperature should not be allowed to exceed 125° Fahrenheit. (51.7° C.).

**CONNECTIONS:** The Pickup should be connected to the grid circuit of a vacuum tube across a load resistance of 1/2 megohm or more. The green coded conductor should be connected to the "high" side of the amplifier input; the shield (black conductor) should be connected to ground or chassis.

The full output of the Pickup may reach voltage peaks as high as 20 volts during loud passages of modern recordings, and therefore should not be applied directly to the grid of the tube without the use of a volume control or some other type of a voltage divider, unless the grid bias is at least 20 volts. If the volume is not controlled at the grid of the first tube, the voltage of the pickup should be reduced to correspond to the bias of the first tube. A convenient way of attenuating the output voltage is by shunting the pickup terminals with a shunt condenser as indicated in dotted lines in Fig. A. A .001 mf shunt condenser will reduce the peak voltage to 10 volts; a .01 condenser to 2 volts, etc., without adversely affecting the frequency response. Crystal Microphone amplifiers may be used with the Models 99C and 98A Pickups, provided the pickup output is attenuated to avoid overloading the first amplifier tube.

**OPERATION:** Medium type needles, approximately 11/16" long, are recommended for the pickup. The "High-Lift" arm provides for convenient needle changing.

Crystal Phonograph Pickups should not be kept or used in places where the temperature exceeds 125° Fahrenheit. (51.7° C.).

**RECORD WEAR:** Built-in "Balanced-Tracking", provided by the "needle-tilt" principle in the Models 99C and 98A Pickups, keeps the tracking angle (angle between

horizontal projection of the needle and the tangent to the record groove at point of contact of needle and record) at a negligible value throughout the entire playing time of the record. A large tracking error causes rapid record wear and impairs the fidelity of reproduction, especially at the higher frequencies. The Pickup should be located in respect to the turn-table as described under "INSTALLATION", to derive the greatest benefit from this feature.

While imparting its motion to the mechanism, the needle must be relatively free to move from side to side in the groove. The low needle-point impedance of the Model 99C and 98A Pickups allows this free motion, eliminating excessive thrust and wear on the sides of the grooves. The needle pressure is only 2.7 ounces, insuring maximum record life.

**FREQUENCY RESPONSE:** Frequency response curves of the 99C and 98A Record Reproducers obtained on standard test records are shown in Fig. A. This type of response, covering a range of 50 to 7000 cycles, is very satisfactory for high-quality reproduction of records without the use of compensating circuits.

The low frequency response below approximately 400 cycles depends upon the terminal resistance as shown in Figure A. The user can thus adjust the low-frequency response over wide limits by proper choice of resistance of the input potentiometer or grid resistor. A value of 1/2 to 1 megohm will be satisfactory in most cases. The high frequency response is not affected by the value of the terminal resistance.

For more uniform overall response, the low frequency equalizer circuit shown in Fig. B, below, may be used, although it is not necessary or desirable for most applications. A variable resistor in the equalizer will permit readjustment of the overall response as desired.

**SURFACE NOISE:** Surface noise or "needle scratch" is produced by the passage of the needle over the minute irregularities in the surface of the record groove. In the 99C and 98A, with low needle pressure, low needle-point impedance, and low tracking error, there is a minimum of surface noise from the record. However, due to the wide range frequency response of the 99C and 98A (necessary for life-like reproduction) some residual surface noise may be noticed, depending on the condition of the record. In general, the higher the fidelity of the pickup and reproducing system, the more noticeable surface noise becomes. Conversely, in general, a complete absence of surface noise on lateral-cut records is an indication that the pickup or reproducing system is deficient in high frequency response.

Where maximum fidelity is not important, it is possible to decrease the audible needle-scratch level by using the circuit shown in Fig. C below. This will give a tone control effect similar to that found in most radio receivers and amplifiers. If the amplifier or receiver used with the pickup has a tone control for attenuation of higher frequencies, the above circuit becomes unnecessary.

### SPECIFICATIONS

**Voltage Sensitivity:** The output level depends upon individual recording, etc. With a standard recording the Models 99C and 98A have an output of approximately two volts for 0.84 mil double displacement at 1,000 cycles.

**Internal Impedance:** Equivalent to 1,500 mmf condenser.

**Recommended Load Impedance:** 1/2 megohm or more depending upon the response curve desired. See Fig. A.

Model No.	99C	98A	99CW	98AW
Finish:	BLACK Bakelite Molded		WALNUT Bakelite Molded	
Code Word:	RUZAG	RUZUB	RUZAW	RUZUD
Playing Radius:	8-5/8"	8-5/16"	8-5/8"	8-5/16"
Overall Length:	11-1/32"	10-9/16"	11-1/32"	10-9/16"
Overall Height:	2-3/16"	3-1/64"	2-3/16"	3-1/64"
Overall Width:	2"	1-1/8"	2"	1-1/8"
Head Width:	1-1/8"	1-1/8"	1-1/8"	1-1/8"
Head Height:	1-13/64"	1-13/64"	1-13/64"	1-13/64"
Base Length:	3-1/4"	2-3/8"	3-1/4"	2-3/8"
Base Width:	2"	9/16"	2"	9/16"
Cable Length:	3-1/2 ft.	1-1/2 ft.	3-1/2 ft.	1-1/2 ft.
Shipping Weight:	1-1/4 lb.	15 oz.	1-1/4 oz.	15 oz.
List Price:	\$7.50	\$6.50	\$7.50	\$6.50

**GUARANTEE:** Every Shure ZEPHYR Record Reproducer 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 Record Reproducers are licensed under patents of the Brush Development Company. Shure patents pending.

