SONY®

VARIABLE DIRECTIVITY
CONDENSER MICROPHONE
C37-FET
SOLID-STATE

TECHNICAL MANUAL
OPERATING/SERVICE INSTRUCTION

SONY CORPORATION

PROFESSIONAL AND INDUSTRIAL DIVISION

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Frontispiece SONY FET Condenser Microphone
Model C37-FET Solid State

SELECTABLE DIRECTIVITY
FET CONDENSER MICROPHONE model C37-FET
SOLID-STATE

1. GENERAL

The SONY Model C37-FET Condenser Microphone is a battery operated selectable directivity microphone of the highest professional quality having the operating convenience of an ordinary ribbon or moving Coil Microphone.

The capsule polarizing voltage and the impedance conversion circuits are solid-state and are enclosed within the microphone housing case as is the battery power source.

2. FEATURES

HIGHEST PROFESSIONAL STANDARDS

The C37-FET covers the entire audio frequency range with flat response and very wide dynamic range. Inherent noise level has been improved by an average of 4 to 6 db over that of ordinary condenser microphones.

RELIABILITY, STABILITY AND DURABILITY

The unique design using selected and specially treated components, and the most advanced and rigidly controlled production techniques insure permanent high performance.

VARIABLE DIRECTIVITY AND RESPONSE

Uni-directional or omni-directional characteristic easily selected by switch. The directional characteristics are maintained throughout the entire frequency range. A three position low-cut switch is provided for selection of best operating characteristics. A Hi-cut switch is also provided.

3. SPECIFICATIONS

General Specifications

1) Model : C37-FET Condenser Microphone, Solid-State
2) Capsule : C-3 type two directional characteristics (uni-, or omni- selected by switch)
3) Transistors and Diodes : SONY Junction type Field Effect Transistor TX-133A
   SONY SEP type Transistor 2SC401-3
   Zener Diode 1S-332
   Power Diode FR-1U, 1T22J, and 1S-205 one each

4) Power Supply : SINGLE 006P type, EVEREADY No. 216 or Equiv. dry battery (9V)

5) Microphone Cable : 7 mm ø, 4 Conductor Cadmium Bronze Cable. Stripped & tinned, 20 feet, No Plug

6) Mounting Thread : Standard 1/2" Pipe Thread (available 5/8"-27 adaptor)

7) Dimensions : Shown in figure 1.

8) Weight : 600 grs. (1. 3 lb) Less cable

9) Accessories :
   a. Carrying Case
   b. Microphone Cloth Cover
   c. 006P Dry Battery
   d. Screw Driver for Directivity Control
   e. 5/8" -27 Stand adaptor
   f. Technical Manual, Operating Instruction

10) Optional Accessories :
   a. DC-109 type Battery Adaptor (two "EVEREADY" No. E234 Mercury Batteries)
   b. AC-109 AC adaptor (AC 100~240 V, 50~60 c/s)
   c. 4 wire Extension Cable (10m, 20m, 30m) etc.

ARCHITECT'S AND ENGINEERING SPECIFICATIONS

The microphone shall be SONY model C37-FET Condenser microphone or equivalent. A condenser type microphone with a frequency range of 50 to 15,000 c/s, this unit shall have 3 step low cut and I step high cut switch in order to have an optimum tone control. The condenser capsule mounted in the microphone unit shall have two different directional characteristics namely, cardioid and omni-directional characteristics. The unit shall be equipped with a switch for this selection. In the use of cardioid pattern, the cancellation at the rear in the horizontal plane shall be more than I5 dB in the range of 400 to 4,000 c/s. Almost no deviation shall be observed in the range of 400 to 2,000 c/s in all directions of a horizontal plane when the omni-directional characteristic is used. The microphone shall be equipped with the three output impedance, 50 ohms, 250 ohms and 600 ohms, either of them shall be selected by resoldering a tap of a transformer. The output level at each output impedance shall be as follows:

Output Impedance (ohms)	Effective Output Level (dBm)*	Gm (dB)**
50	-50.8	-143.6
250	-50.6	-142.6
600	-50.8	-142.8

* 0 dBm = 1mW/10 microbars at 1,000 cps.
** EIA Rating

The microphone shall have a mounting socket with a standard 1/2" pipe thread, and shall be equipped with an efficient shock mounting inserted between the microphone unit and the mounting socket. The microphone cable shall be a shielded cable of 4 conductor using high quality cadmium bronze wire. This unit shall be supplied without connecting cable. A battery NEDA No. 1604 (Burguess 2V6, RCA VS323, Eveready No. 216, or equivalent) housed in the microphone unit shall be the power for this microphone. The battery shall be continuously operated more than 300 hours at normal operating conditions. The microphone shall also be equipped with a battery check meter in order to monitor the battery discharging conditions. The battery check meter shall be able to indicate the residual electromotive power of the battery before each use of this unit or shall be able to indicate abnormal drain current, if present, during operation.

The overall dimension of this microphone shall be 8 1/2" in height, 2 3/8" in width, and 1 13/16" in depth. The weight shall be 1.3 lbs. less cable.

Unit in mm

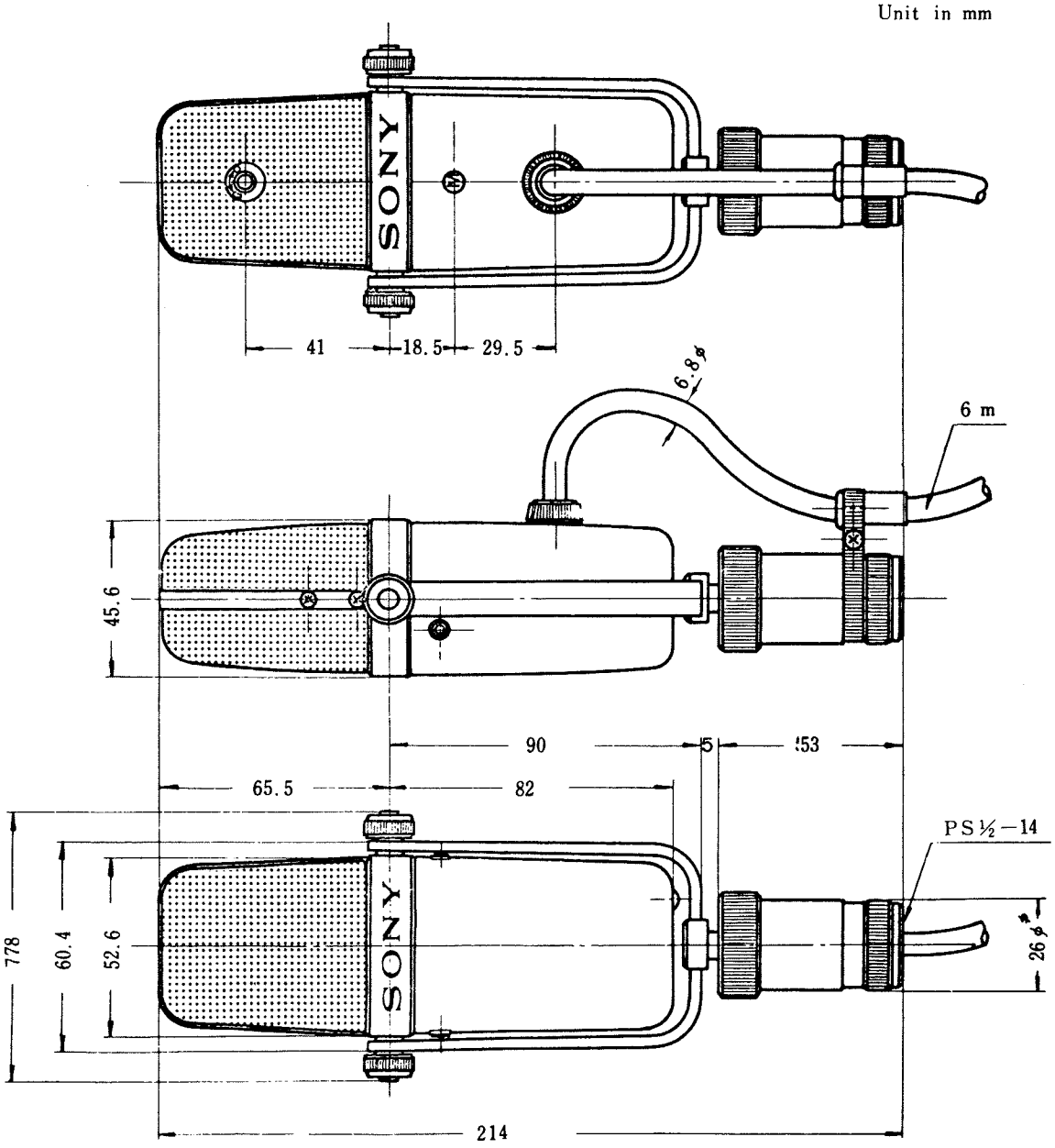


Fig. 1 Dimensions C37-FET Condenser Microphone

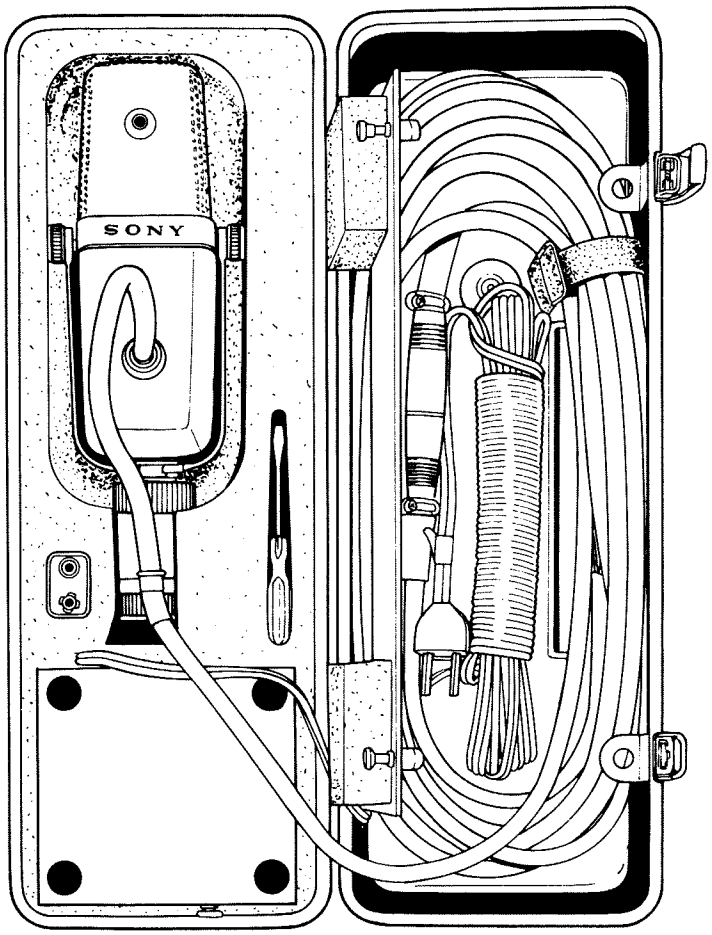


Fig. 2 Model C37-FET Carrying Case

4. PERFORMANCE CHARACTERISTICS

1) Frequency Response : Refer to Figure 9 for uni-directional characteristics and to Figure 10 for omni-directional characteristics.

2) Low-cut, High-cut Characteristics : Refer to Figure 9 and to Figure 10 for the response characteristics obtainable with the Selector Switch in the position of M1, V1, V2 and Hi-Cut Switch respectively. The sound incidence is perpendicular to the microphone front face.

3) Sensitivity :

Output Impedance	effective output level	Open circuit voltage		EIA rating GM
50 ohms	-50.8 dbm*	-57.8 db**	1.29 mV	-143.6 db***
250	-50.6	-50.8	2.88	-142.6
600	-50.8	-47.0	4.56	-144.8

* The effective output level is defined as the ratio in db of the electric power available from the microphone relative to 0.001 watt on the sound pressure level of 10 micro-bar. The calculation is based on the nominal microphone impedance.

** 0 db = 1 volt per 10 micro-bar

*** EIA standard

4) Directivity Characteristics : Polar response for the sound from all directions is given in Figure 11 and in Figure 12.

5) Electrical Impedance : 50, 250 or 600 ohms $\pm$ 20% (1,000 c/s)
(One can be selected by soldering terminals)

6) Power Supply :
a. Standard Operating Voltage: 10.0~7.2V
b. Minimum Operating Voltage: Approx. 4.8V
c. Drain Current: 1 mA. approx.
d. Battery Life: Longer than 300 hours approx.

Note: 1. Standard Operating Voltage Range is set within 2 db sensitivity drop from the rated sensitivity.

2. Minimum Operating Voltage Level is the point where the oscillation of the converter stops. (See Fig. 13)

7) Noise :

a. Signal-to-noise Ratio: Better than 50 db. (1,000 c/s. 1 u b a r.)

b. Noise Level converted to Equivalent Input Sound Level: 24 db ± 3 db (0 dB = 2×10^{-4} u bar)

c. Wind Noise: 37 db ± 5 db. SL.

Note: Wind Noise is the value which is measured with a wind velocity of 2 meter/second applied directly to the front of the microphone. The noise output is then converted to the equivalent sound level.

d. External Magnetic Field Induction Noise: Less than -20 db/m Gauss. SL.

Note: This value is measured with the microphone placed in the alternating magnetic field of 50 c/s, 1 m Gauss. The maximum noise value is then converted to the equivalent sound level.

e. Maximum Input Sound Pressure Level: Approximately 134 db.

Note: This is the maximum input level which produces less than 1% harmonic distortion at the output with 1,000 c/s. This is further converted to the equivalent sound pressure level.

f. Dynamic Range: Approximately 110 db.

5. TECHNICAL INFORMATION

5.1 Case of the Microphone.

The case is made of Brass which is precision press fabricated and finished half in satin-nickel plating and half in leather-tone mat-coating. The color and modern styling is designed with television and stage appearance in mind. The microphone is well balanced and may be mounted either on a stand, a boom and stand or on a perambulator and will remain stable after it is directed toward the sound source.

5.2 Microphone Capsule.

C37-FET Condenser Microphone uses a type C-3 dual directional capsule (uni-, and omni- directional) which has established a world wide reputation for its excellent sound quality and stable performance. The C-3 is a single-diaphragm type, the directional characteristics of which may be selected by means of a shutter. (Opening the shutter gives the uni-directional characteristic and closing it gives omni-directional characteristic.)

5.3 FET Circuit (See Figure 7, Table 1)

The Field Effect Transistor (2SC401-3) is a Silicon Junction Transistor specially developed for use in a condenser type microphone.

It forms a source-follower circuit as illustrated in the attached Figure 7. The Gate Circuit has a very high input impedance (approximately 2 pF, 400 Mohms) and picks up the electromotive force generated by a C-3 Capsule (internal capacitance approximately 50 pF) without distortion.

Non-linear distortion of this circuit is reduced to less than 1% with 1V Gate input signal at 1,000 c/s. It is equivalent to 134 db SL when it is converted to the equivalent acoustic imput level at C-3 capsule. This circuit on the other hand has an inherent noise as small as 24 db SL. Accordingly, a dynamic range of 110 db is obtained which allows the microphone to receive a high level peak input without distortion; for example, in the case of full orchestra fortissimo.

All circuit components are mounted on an epoxy-tetron printed board which is completely moisture-proof, and housed on the top of the case and protected by a dust cover. This assures stable operation even in the most humid operating conditions.

5.4 Polarizing Circuit (See Figure 8).
DC polarizing voltage applied to C-3 capsule is produced by stepping up 9V to 140V by an extremely small-size DC-DC converter. See attached Figure 8 for the circuit diagram. Voltage of very low frequency pulse wave-form of approximately 20 c/s is rectified and the ripple is eliminated by a large time constant filter circuit. This circuit provides a very stable DC voltage.

The converter circuit is housed in an electro-magnetic shield case and located in the bottom of the case so as to be separated from the F.E.T. circuit. (Note: the polarizing voltage cannot be measured by an ordinary voltmeter or VTVM.)

5.5 Microphone Cable.
The microphone cable has been specially developed for the C37-FET and has an extremely long service life, due to its flexibility in all conditions of temperature and the fact that it does not become curly-stiffened after it is wound on a roll. The cable is constructed of cadmium-bronze alloy wire and tetron fabric.

5.6 Windscreen and shock mounting.
The metallic Grill is equipped with wind-shielding sponge which surrounds the capsule.

2 diaphragm type shock-absorption rubbers are mounted in the support pipe to absorb most of the irregular harmful vibration transmitted through buildings, floor, etc.

6. OPERATING INSTRUCTIONS

6.1 Output Impedance
The Model C37-FET is factory connected for an output impedance of 250 ohms.
For an output impedance of 50 ohms or 600 ohms, an internal wire must be resoldered to the corresponding terminal.
Figure 14 shows the connection for the desired output impedance; i.e., (50, 250 or 600 ohms).

First remove 2 screws which hold the terminal-plate cover and take off the transparent cover. Resolder the red colored wire, the other end of which is connected to the COV terminal, to the desired position. Remount the cover and tighten the screws.

Note: A low-temperature, small-power soldering iron should be used and the soldering work should be accomplished as quickly as possible.

6.2 Battery Removal and Insertion.

A single battery is used to supply all power for the circuits of the model C37-FET. The battery is an EVEREADY No. 216, 006P type or equivalent. This is the common 9 volt, universally used transistor radio battery, available anywhere. Figure 3 shows the correct procedure for removal or replacement of the battery.

a. Open front case by pulling two latches and then swinging the case lid out and down.
b. Pull the white battery compartment slightly out as illustrated.
c. Insert a new battery in the battery compartment, making sure of correct polarity for the battery.
d. Close front case by pressing it until it is firmly locked.
e. Remove battery as soon as it weakens, otherwise the snap terminals may corrode.

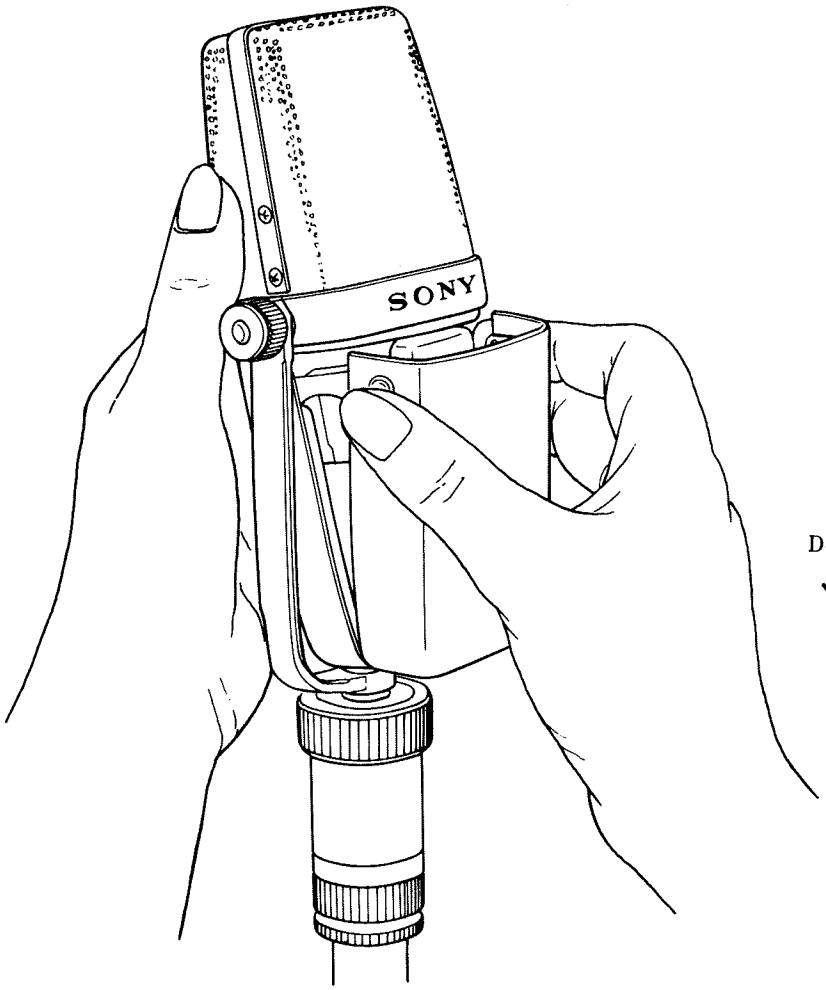
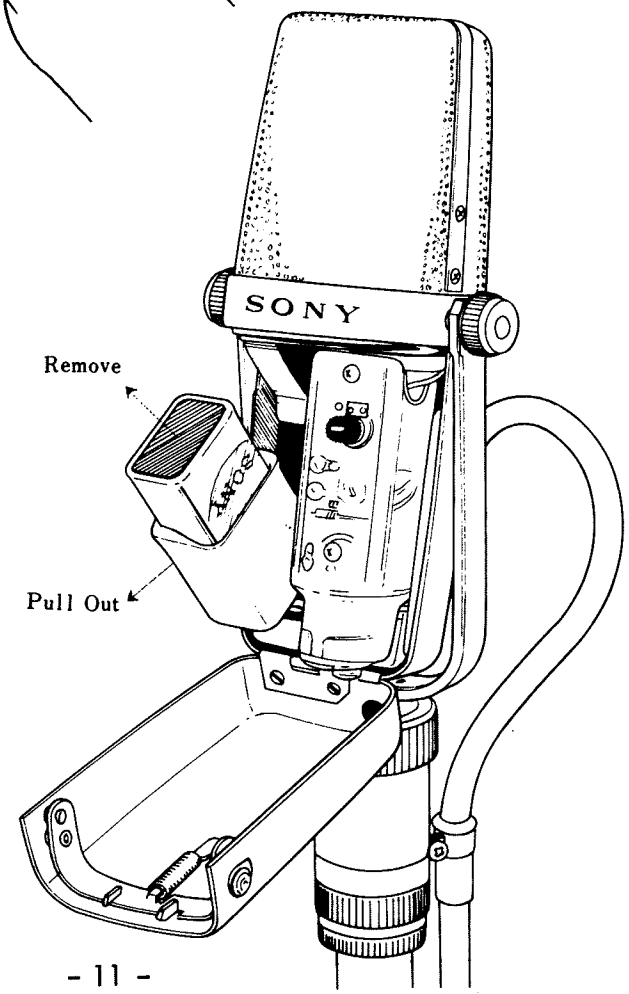


Fig. 3 Unlatching Front Case



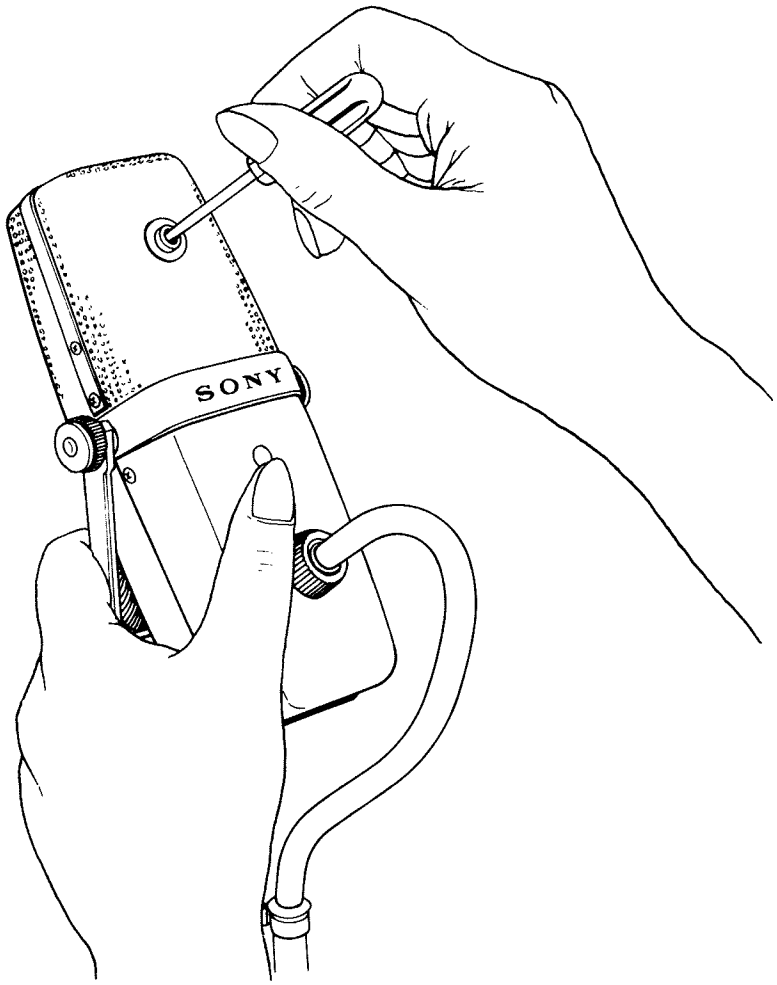


Fig. 4 Turning Directivity Control Switch

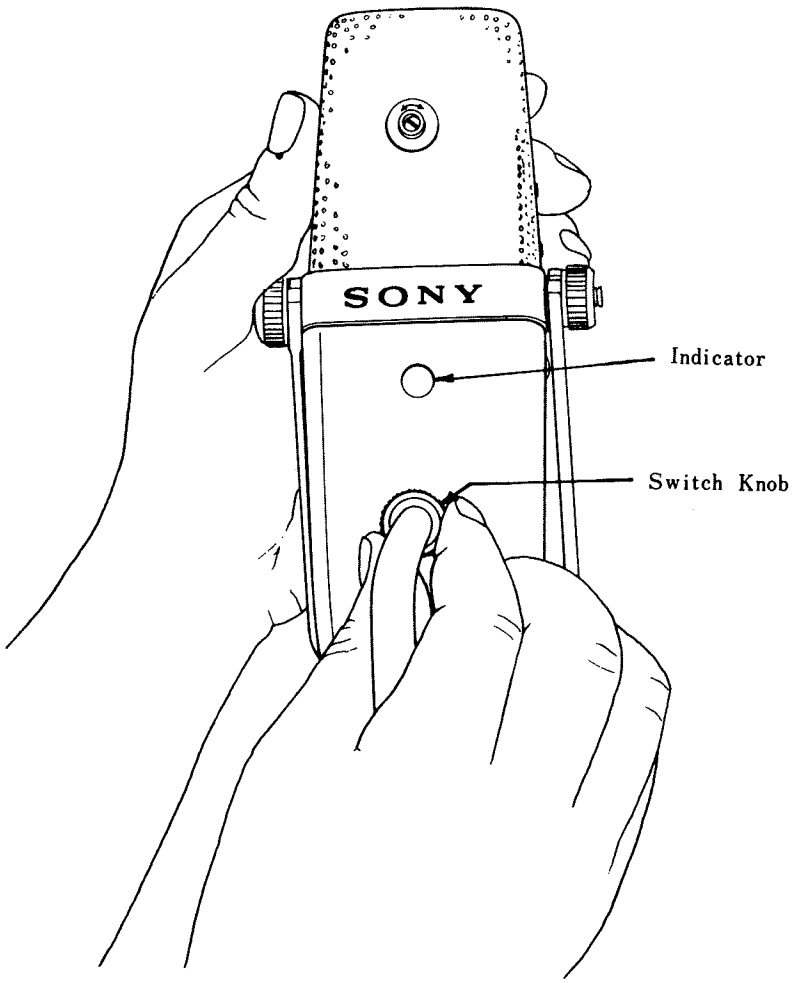


Fig. 5 Turning Operation Select Switch

6.3 Directional Pattern (See Figure 4).
Select the directional Pattern (omni-or uni-directional) desired by turning the screw, located in the center-rear of the top cover to the corresponding position. Use the screwdriver supplied. Cardioid Mark (△) represents uni-directional Pattern and the circle Mark (○) represents the omni-directional pattern. See Figure 11 and Figure 12 for polar plots of Directional Patterns. Response VS Direction for 4 different Sound Source frequencies.

6.4 Switch.
The Switch, located in the center of the back lower cover, the Knob of which surrounds the Microphone Cable, has three functions. (A small window, located directly above the switch knob, allows different symbols to be seen for each position.) Refer to Figure 5.

SYMBOL	SWITCH POSITION AND FUNCTION
BAT	Rightmost position (spring action-spring return to OFF). For checking condition of battery in conjunction with Operation Check Meter. See below, "Operation check Meter".
OFF	Leftmost position. The microphone is OFF in this position.
M	First Left position. For flat (Full Range) frequency response. *See Figs. 9 and 10
M1	Second Left position. Slight Low frequency attenuation.
V1	Third Left position. Low frequency attenuation.
V2	Fourth Left position. Severe Low frequency attenuation (roll-off).

The Operating Characteristic; i.e., M M1, V1 or V2 can be selected to provide the best frequency characteristics for the Specific Sound Pickup circumstances.

6.5. Operating High Cut Switch.
Frequency response characteristics of C37-FET in the upper transmission range can be changed by means of the High Cut Switch. This is a two position switch; flat response over the entire frequency range is obtained as the white bar on the Switch is placed in the horizontal direction. (solid line in Fig. 9, 10) The upper range higher than 5 KC is markedly attenuated (dotted line in Fig. 9, 10) when the Switch is turned 90 degrees and the bar is placed in the vertical direction, ⟍ mark. Open the microphone front cover and locate the High Cut Switch in the center. This switch may be used to decrease undesired high frequency noise.

6.6 Operation Check Meter.
Operation of the Check Meter is controlled by the Operation Select Switch.

(1) When the Operation Select Switch is turned further clockwise from the OFF position, "BAT" (battery) position is obtained. At this position of the Operation Select Switch, the Check Meter indicates the condition of the battery. Either a white or a red plate will be visible in the window.
   a. White plate is visible in the window: Battery condition is good and it is not necessary to replace it.
   b. Red plate becomes partly visible: Battery has power to operate the microphone more than 20 to 30 hours at least. However, sensitivity of the microphone starts declining very slightly and it may be better to replace the battery.
   c. Red plate visible in the window: Replace the battery with a new one.

   Note: When the switch is turned to "BAT" position, R8 (3.3K ohms) is used as a dummy resistor and the meter indicates the terminal voltage at the ends of the resistor with current of approximately 3mA flowing through it. The switch is designed to return to "OFF" position by spring action. Diode D1 (1T22J) is connected in series with the meter to protect the circuit in case of reverse polarity connection of the battery.

R7 (33 ohms) protects C3 (30 uF) against surge during switching period. Diode D2 (FR-1U) protects the meter against over load and the variable resistor R6 (20K ohms) is factory adjusted for proper sensitivity of the meter.
Zener diode D3 and R5 (220 ohms) add non-linear emphasis on the meter indication characteristic curve, thus narrowing the transition range from white plate showing to red plate showing.
Figure 13 illustrates the discharge curve of battery 006P when it is operated continuously. At a voltage of 7.2 V, sensitivity declines by 2 dB. The shaded region means the normal operating condition and the indicator has white plate showing during this period.
This is approximately 280 hours.
Between 7.2 and 6.6V region (cross-hatched region) the indicator shows partially white and partially red. This period lasts for approximately 40 hours of operation. After voltage drops below 6.6V, battery power sharply declines with the red plate showing in the window. AT 4.8 V, microphone stops operating.

6.7. Performance Checking.
Check Meter acts as an ammeter while it is operating. When the red plate shows in the window, it means that some trouble is occurring in the power supply circuit and the microphone is not working properly. The possible cause may be loose contact of the battery terminal, incomplete insertion of plugs or troubles in the power supply circuit.

6.8 Power Supply.
Model C37-FET microphone can be operated on either one of three different power sources, namely (1) internal small-size battery, (2) commercial AC power line and (3) separate outside large size battery.

(1) For small-size battery installation inside the microphone unit any one of the following may be selected: laminated 006P type battery commonly used in transistor radios, EVEREADY 216 or mercury battery E146.
The laminated 006P type battery can be purchased anywhere in the world.

The battery is held by an upper spring to insure against loose contact. The metallic wall of the battery case is rust-proofed and isolates the circuit components from the case for protection against leakage or chemical corrosion of battery solution.

(2) Use of A.C. Adaptor.

The C37-FET can be operated on AC power line with the use of the AC Adaptor model AC-109 (available as an optional accessory). The AC Adaptor is contained in a compact box with two CANNON plugs; 5 pin female plug (CANNON XLR-5-13) for input to be connected to microphone and 3 pin male plug (CANNON XLR-3-14) for signal output.

The AC Adaptor has a rectifier with a voltage regulator incorporated and operates on AC 100/120V, 200/220V (50/60 c/s) and supplies 9V, 5 mA DC power to the C37-FET. The change from 100/120V to 200/220V is accomplished by internal change of primary leads. Make sure to disconnect AC supply before opening case.

The microphone is supplied either with a stripped and tinned microphone cable or with a 3 pin CANNON Connector attached to the end of the cable.

Re-soldering of the microphone cable to a 5 pin CANNON male plug which mates with the 5 pin female plug at the Adaptor side is necessary when using the Adaptor. Refer to Figure 7 which shows the connection diagram of the microphone cable to CANNON 3 pin plug and to 5 pin plug (CANNON XLR-5-12C). As long as the AC Adaptor is in use, the microphone output signal is obtained from the 3 pin output plug of the AC Adaptor. Requirements for the AC power line are 50/60 c/s, 100/120V or 200/220V.

A diode D1 is placed in the power circuit to prevent accidental break-down of the circuit when AC Adaptor is connected while the internal battery 006P also is in use.

When the C37-FET is to be operated on internal 006P battery but is equipped with a 5 pin plug for AC power source, a CANNON female plug XLR-5-11C should be prepared separately and the output signal is then obtained from pins 1, 2 and 3.

7. REPAIR

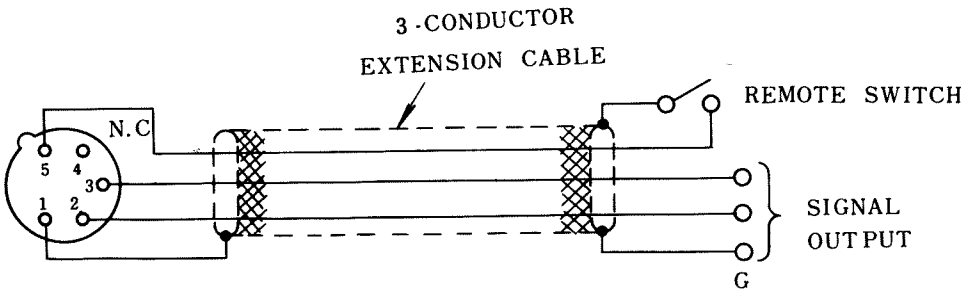
Many components of a condenser microphone require high insulation and should not be disassembled without proper tools and equipment.

7.1 Microphone Cable at Microphone End.
If the microphone cable is worn at the microphone end, cut a few inches out of the cable using the following procedure. First, remove the terminal-plate cover and holding screws as shown in Figure 14. Disconnect all cable soldering on the terminal plate. Take off the cable clamp and the signal cable can be moved freely through the switch bushing. Cut the worn portion of the cable and resolder it as illustrated in Figure 14. Mount to clamp again.

7.2 Replacement of Battery Case.
It is advisable to replace the battery case with a new one if the snap terminals of the battery case get contaminated due to leakage or corrosion of the battery.

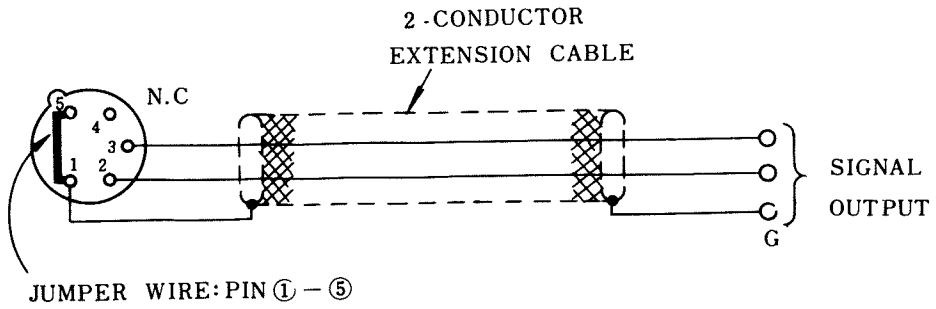
To replace the battery case, loosen the case holding screw on the bottom of the case (screw holding paint may be removed with solvent.) and take it off together with the spring. The case may then be removed. After it is replaced, complete the soldering of the wires as shown in Figure 14.

1. REMOTE ON-OFF SWITCHING



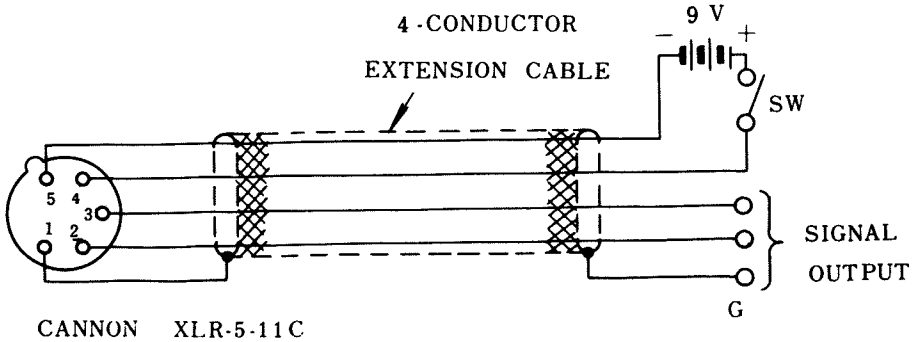
CANNON XLR-5-11C

2. CONNECTOR SWITCHING



CANNON XLR-5-11C

3. EXTERNAL POWER SUPPLY



CANNON XLR-5-11C

Fig. 6 Illustrations of the Extension Cable Wiring

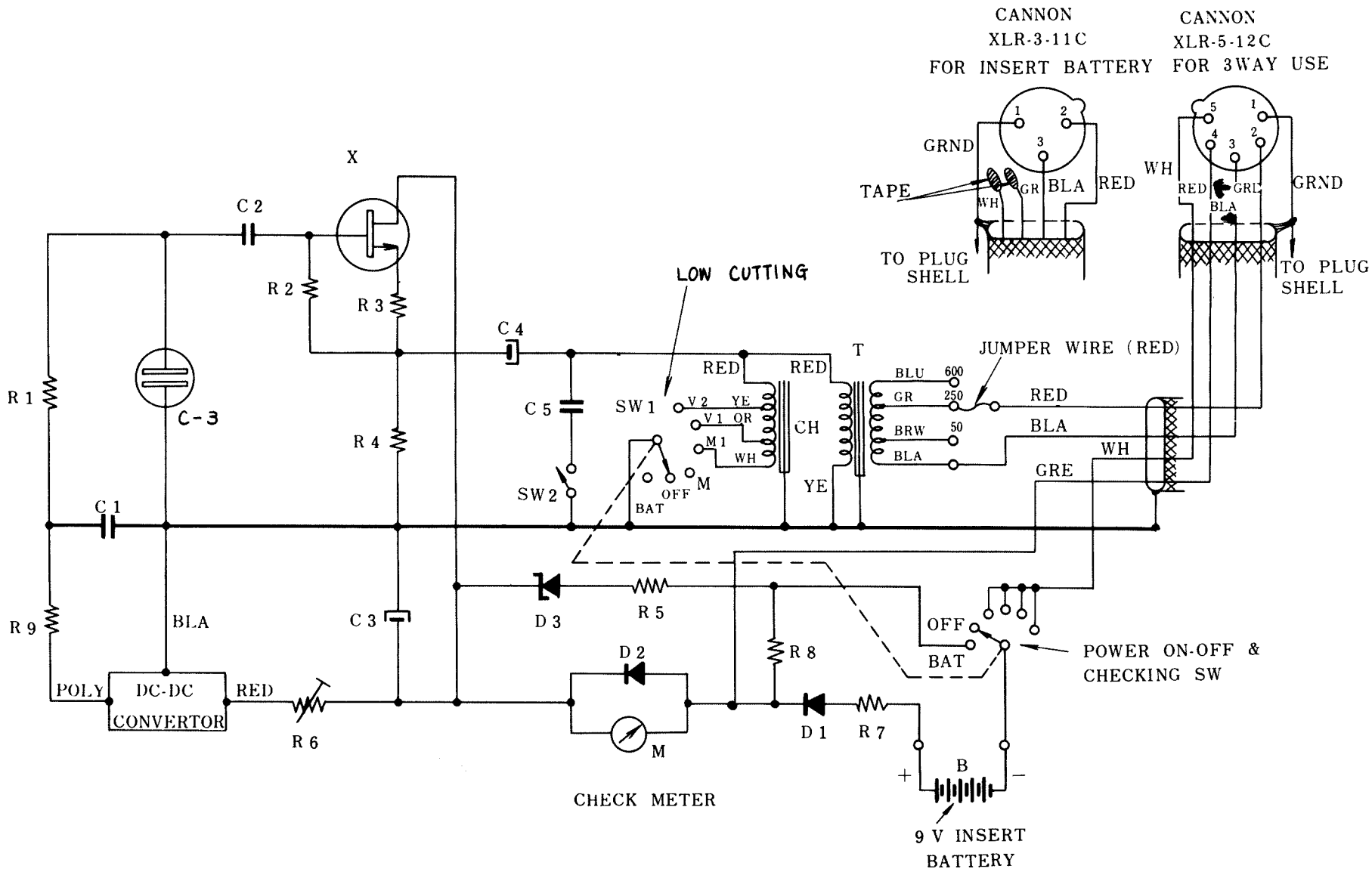


Fig. 7 FET Condenser Microphone Circuit Diagram

Table 1 C37-FET Microphone FET Circuit Parts List

Ref. No.	Parts		
R 1	Special Fixed Carbon Resistor,	HM-1/4PX	200 Mohms.
R 2	Special Fixed Carbon Resistor,	HM-1/4PX	100 Mohms.
R 3	Fixed Carbon Resistor,	RD-1/8R1	680 ohms.
R 4	Fixed Carbon Resistor,	RD-1/8RL,	4.7K ohms.
R 5	Fixed Carbon Resistor,	RD-1/8RL,	220 ohms.
R 7	Fixed Carbon Resistor,	RD-1/8RL,	33 ohms.
R 8	Fixed Carbon Resistor,	RD-1/8RL,	3.3K ohms.
R 6	Variable Resistor,	RD-1/8RL,	20K ohms.
R 9	Solid Resistor	RC-1/2	200Mohms.
C1	Mylar Capacitor	200WV,	0.01uF.
C2	Mylar Capacitor	200WV,	0.001uF.
C3	Aluminum Electrolytic Capacitor	10WV,	30uF.
C4	Tantalum Electrolytic Capacitor	10WV,	10uF.
C5	Mylar Capacitor	50WV,	0.0047uF.
C			
CH	Low-cut Choke	housed in a	
T	Output Transformer	shielding case.	
X	FET (Field Effect Transistor)	TX-133 A	
SW	Small Size Rotary Switch	2 circuits, 6 terminals.	
M	Check Meter		
D1	Diode	IT-22J	
D2	Diode	FR-1U	
D3	Zener Diode	1S-332 (7V)	

SW-PLUG Plug with Switch incorporated, 21-3P type.

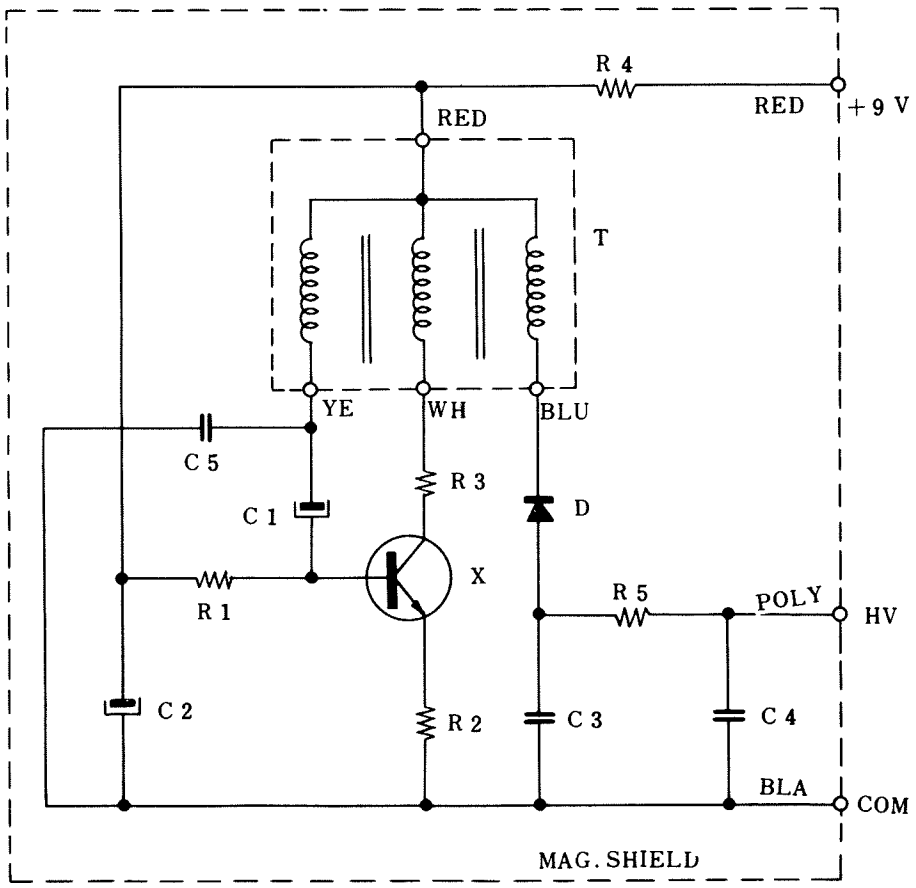


Fig. 8 C37-FET Microphone DC-DC Converter Circuit Diagram

Table 2 C37-FET Microphone Converter Circuit Parts List

Ref. No.	Parts Description	
R 1	Solid, Resistor	RC-1/8, 150 ohms
R 2	Solid, Resistor	RC-1/8, 10 ohms
R 3	Solid, Resistor	RC-1/8, 15 ohms
R 4	Solid, Resistor	RC-1/8, 4.7K ohms
R 5	Solid, Resistor	RC-1/2, 200M ohms
C 1	Aluminum, Capacitor	10V, 5uF.
C 2	Aluminum, Capacitor	10V, 30uF.
C 3	Mylar Capacitor	200WV, 0.0047uF.
C 4	Mylar Capacitor	200WV, 0.01uF.
C 5	Ceramic Capacitor	25WV, 1000pF.
X	Transistor 2SC401-3	
D	Silicon Diode 1S205	
T	Oscillator Transformer	

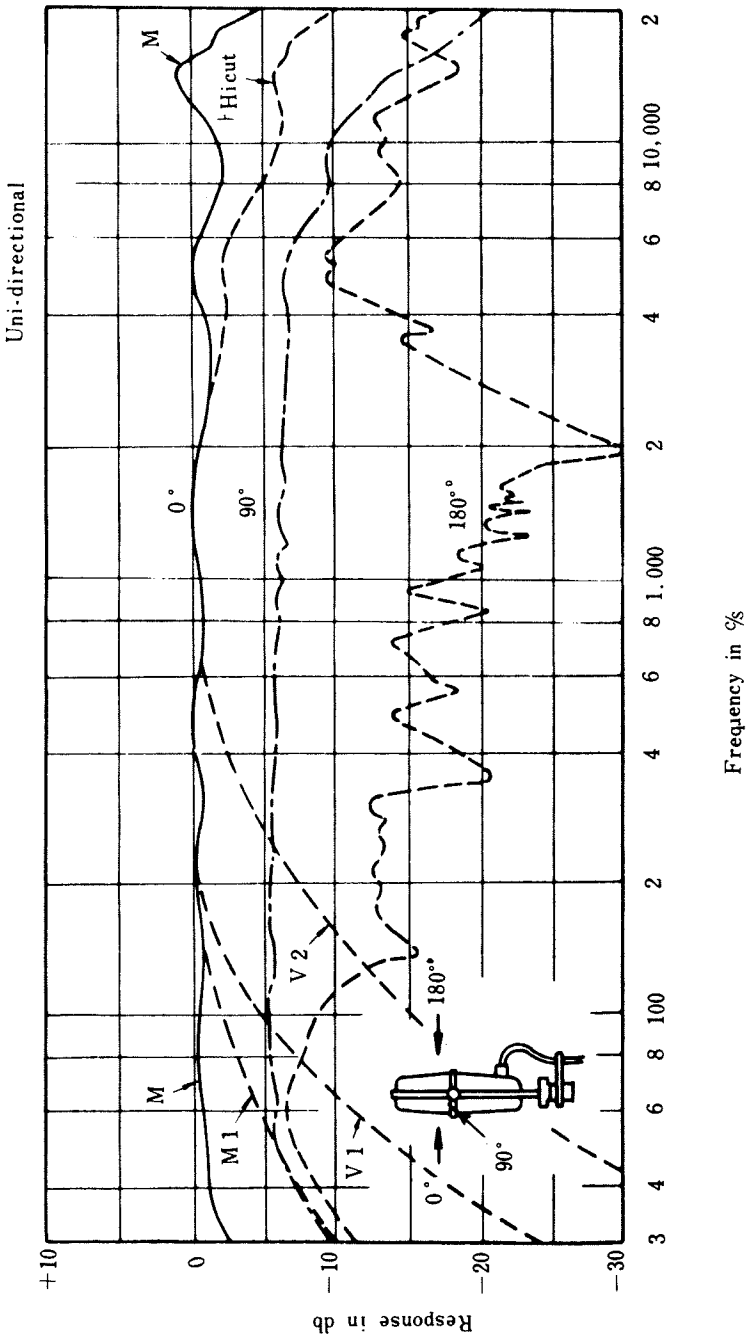


Fig. 9 Frequency Response of the C37-FET Condenser Microphone

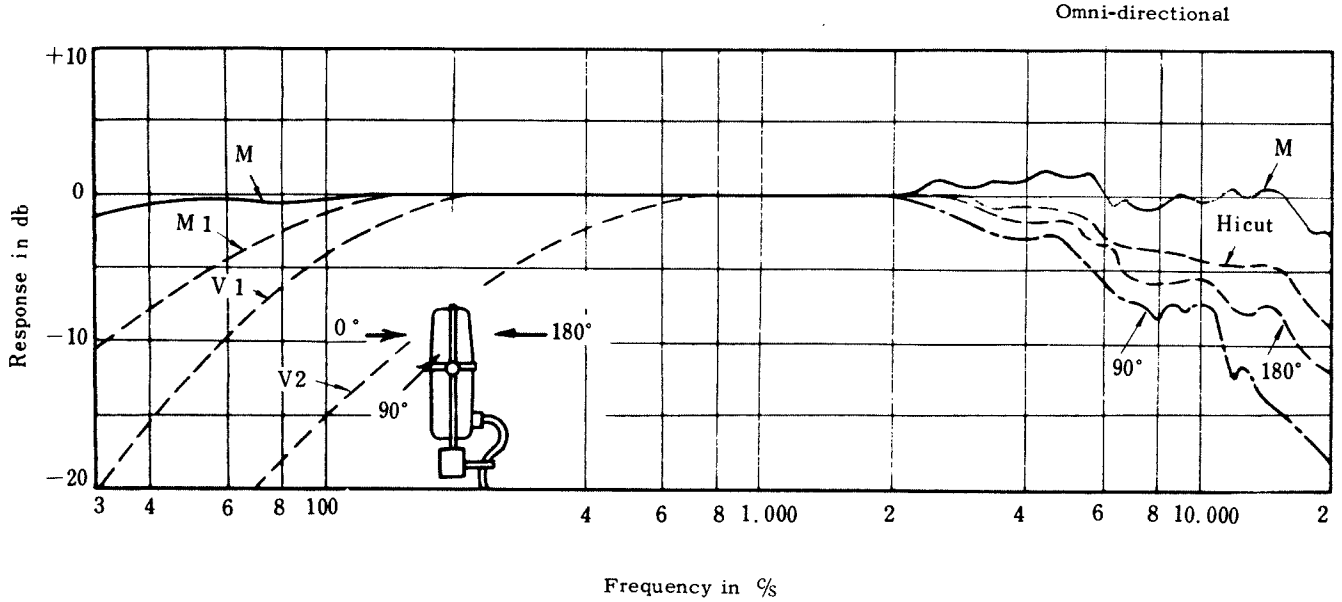


Fig. 10 Frequency Response of the C37-FET Condenser Microphone

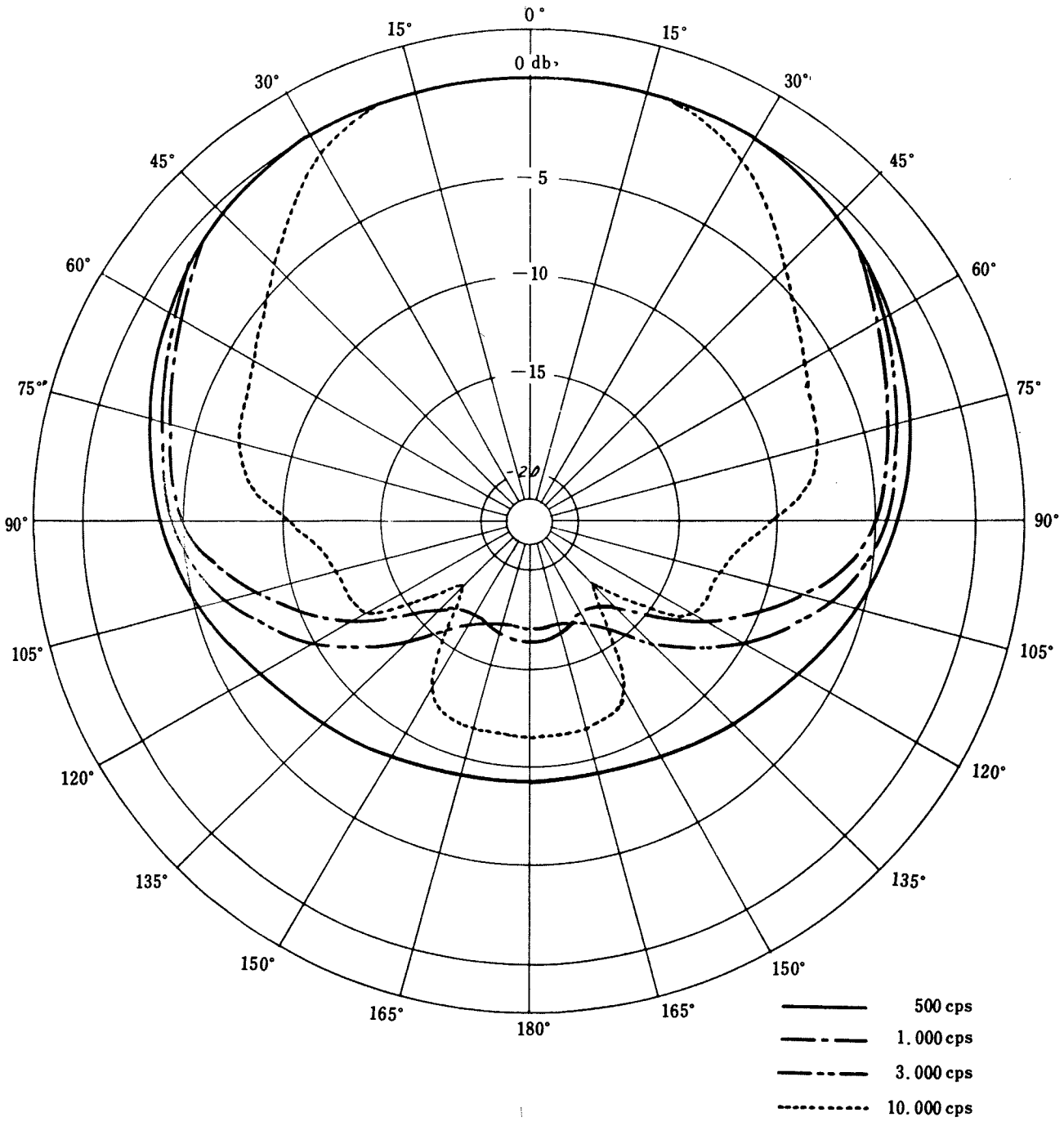


Fig. 11 C37-FET Microphone Typical Directivity Characteristics (Uni-directional Characteristics)

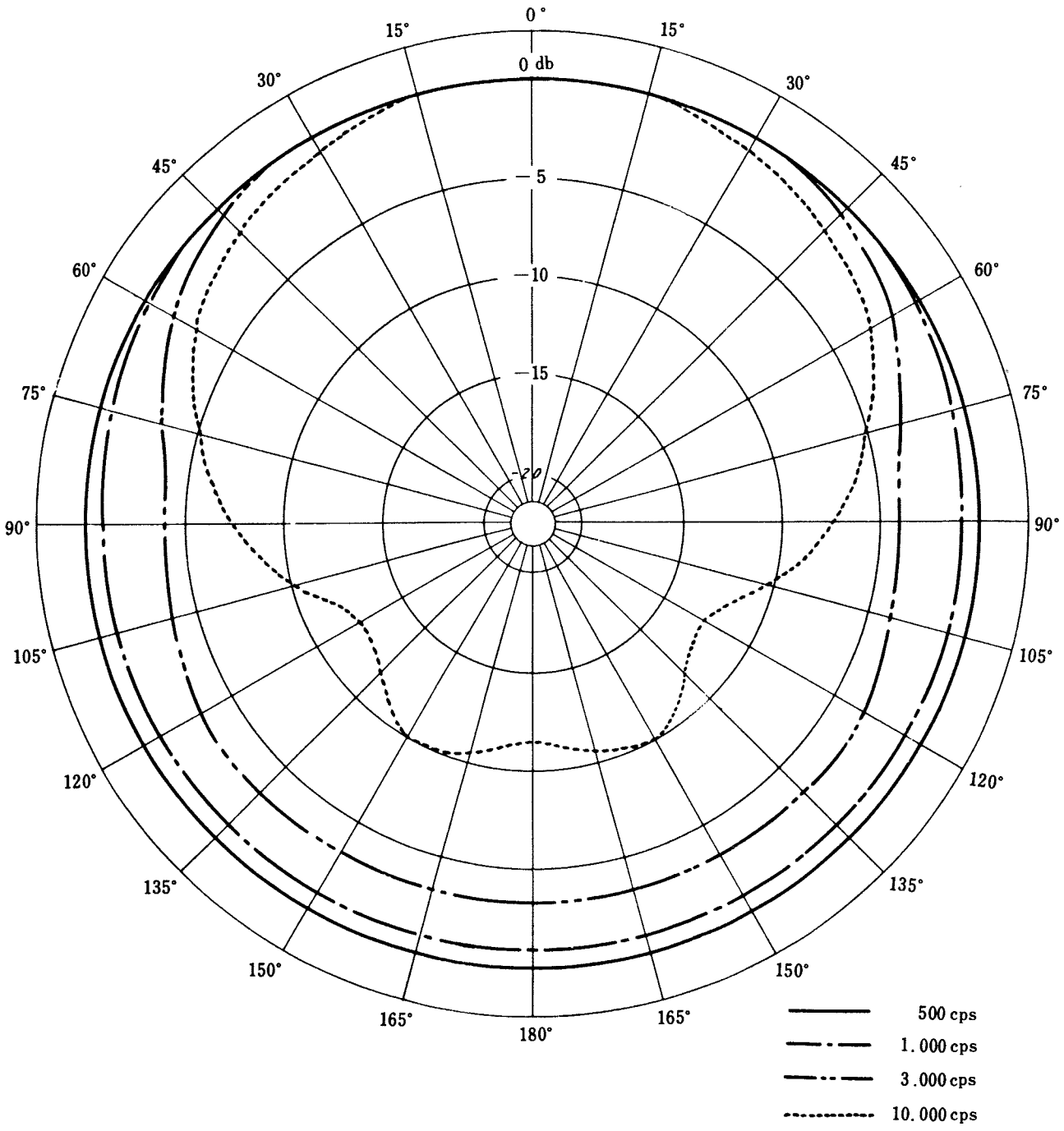


Fig. 12 C37-FET Microphone Typical Directivity Characteristics (Omni-directivity)

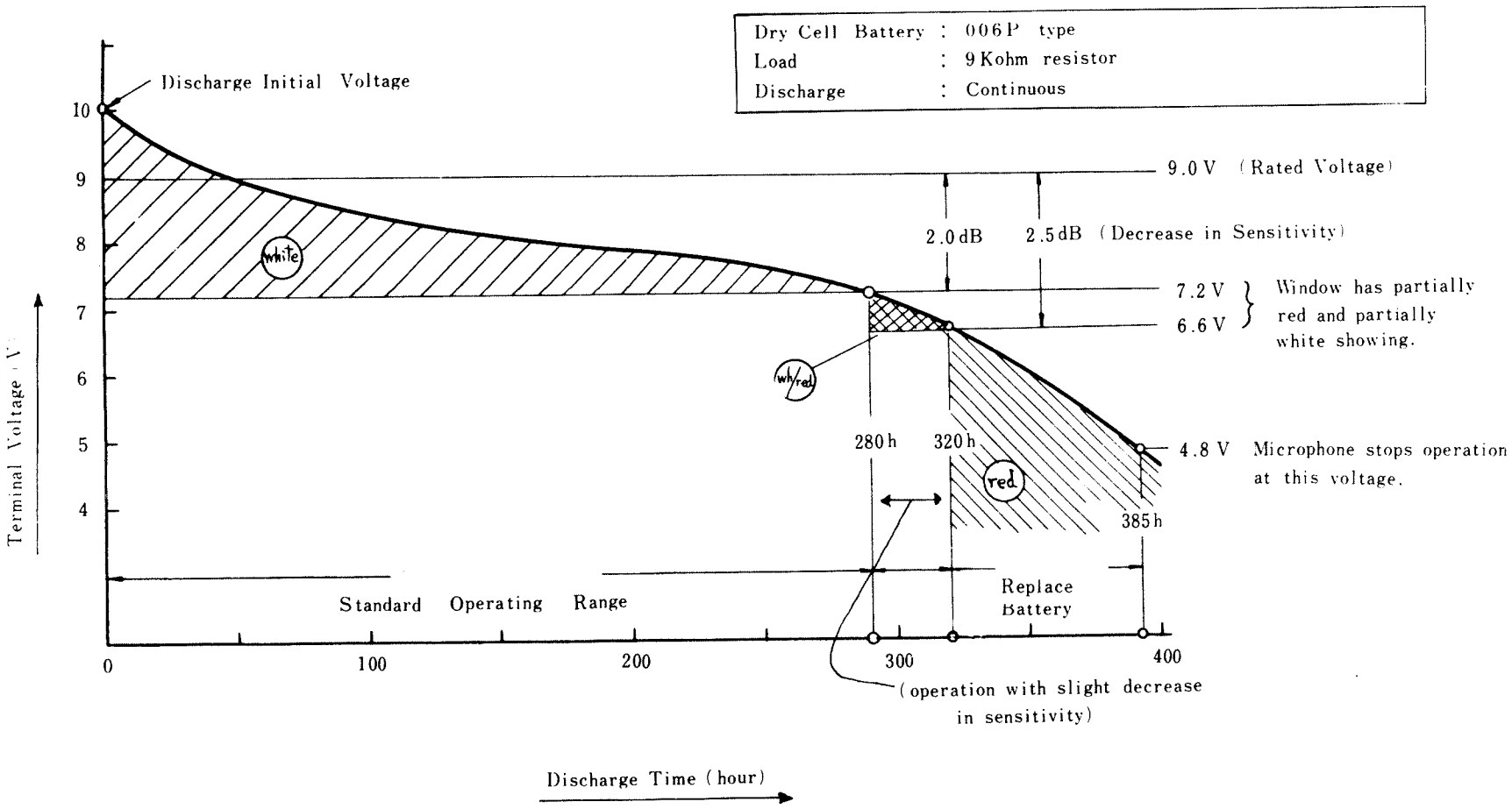


Figure-13 006P Battery Discharge Characteristics and Check Meter Indication Curve

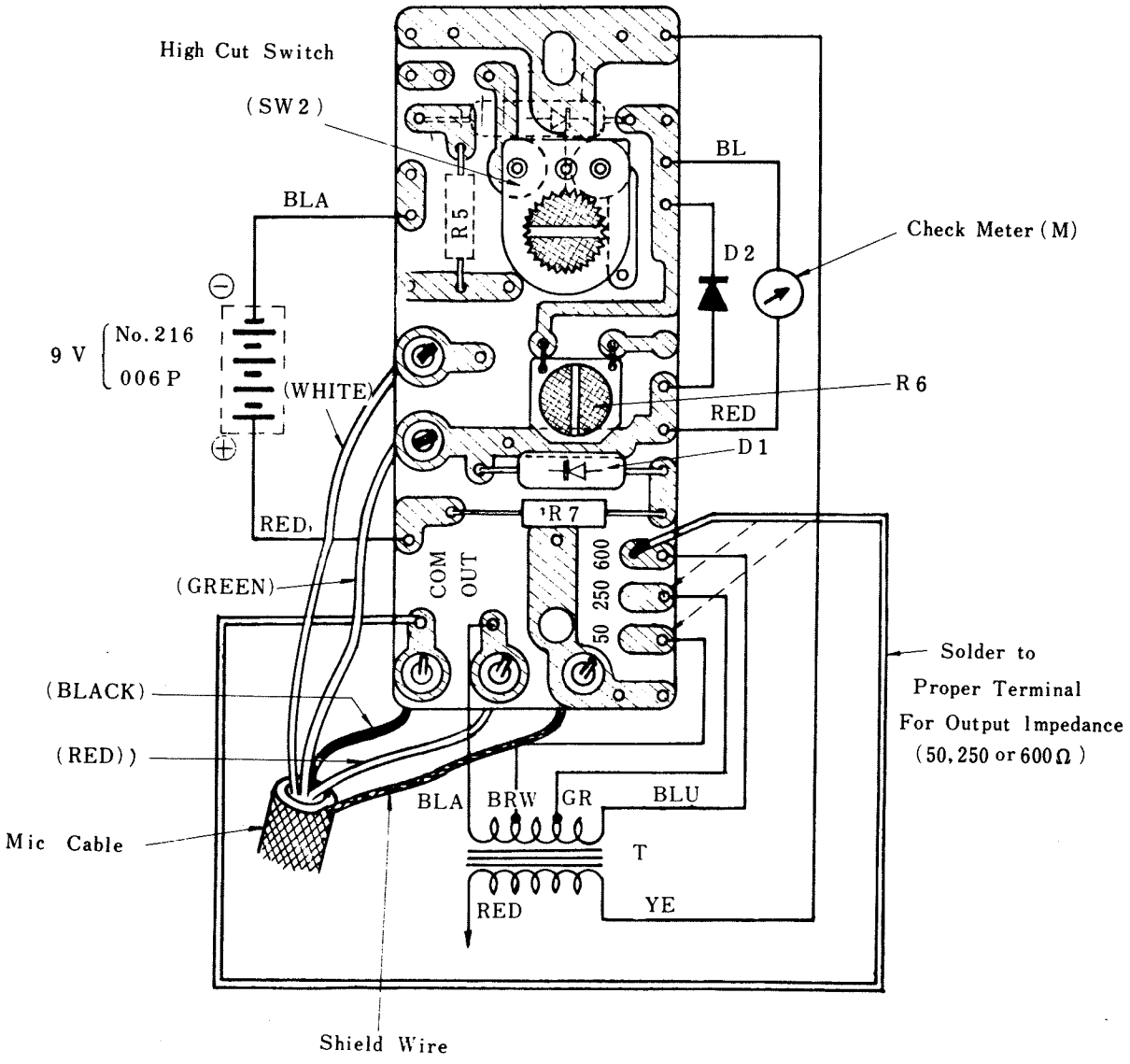


Fig. 14 Terminal Board of C37-FET Condenser Microphone

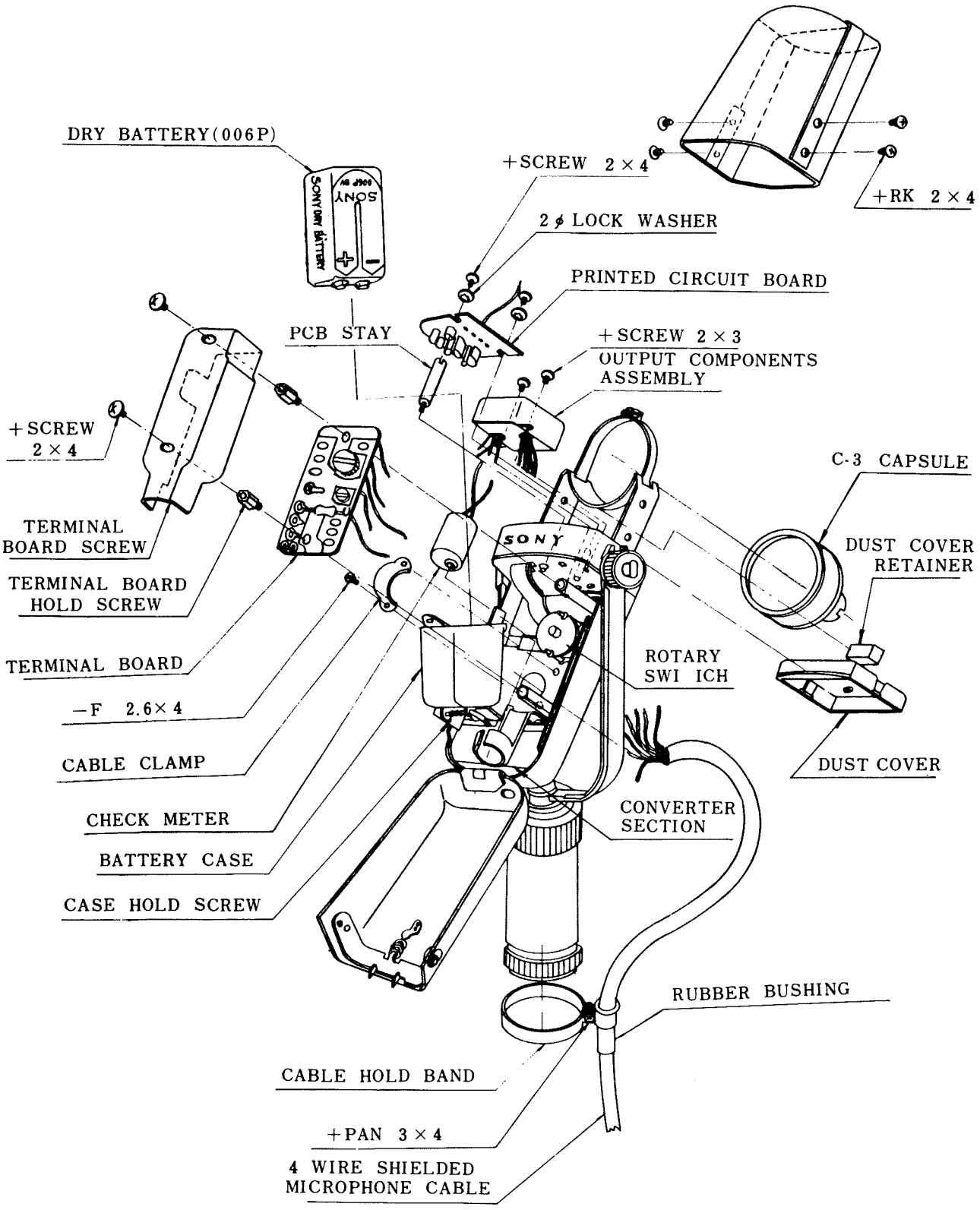


Fig. 15 C37-FET Microphone Exploded View

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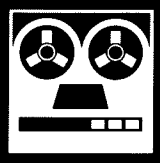

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