

Build a Dolby Noise Reducer



Part II— Kit Building Instructions

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This is the second portion of a three-part series on building a Dolby B-type noise reducer and deals with construction of a stereo pair of channels used for alternate encoding and decoding. The next portion of the series will deal with building an additional pair of channels for simultaneous encoding and decoding as for three-head tape machines. While the project was found to be both fun and worthwhile by the editor who built the kit, we do not feel it should be attempted as a first project by the novice. Though no test gear is required, a good set of tools, including a low-wattage, fine-tip soldering iron and a small pair of cutters is essential. Most helpful will be prior experience with kits and familiarity with the resistor and capacitor color codes. A kit of parts is available from Integrex, Inc., whose advertisement appears near the end of this article.—Editor.

Kit Assembly Instructions

In this portion of the article, instructions are given for building two Dolby processing channels for alternate stereo encoding or decoding. Ignore the component locations marked in black, i.e. all component numbers above 200. These are for the version intended for three-head tape decks and provides simultaneous encoding for the Record head and decoding of the output of the Playback head. Instruction for this section will be given next month.

Main PC Board

A number of PC board pins are supplied with the kit; fit them by inserting them from the foil-track side of the main board, tap down lightly with a small hammer or push in with the flat of a screwdriver so that the shoulder spline is firmly seated into the board. Solder them into place, making certain that **ALL 23** are soldered. The pin positions are as follows:

- Two for the transformer input marked "Vin."
- Four for right and left meter-drive outputs marked "Meters \pm L and \pm R."
- One for the calibration oscillator marked "Cal. Osc. Out."
- Eleven for the inputs/outputs and common marked "A" through "K."
- Three for the tuner leads marked "Tuner R," "L," and "Screen."
- Two at the right-hand end positions of resistors R13, 113 marked "PR" and "PL."

Close-tolerance components are packed separately. Mount and solder the close-tolerance components first, pushing all components close to the board before soldering. The close-tolerance components to be mounted are: R7, 107 (1%); R34 (2%); R35 (2%); C10, 110 (1%); C11, 111 (1%), C14, 114 (1%); C15, 115 (5%), and C4, 104 (5%).

There are five jumper links to be inserted on the main PC board. Use wire cut off from resistors for these at the positions marked "JL."

Fit the remaining resistors and capacitors EXCEPT R13, 113. Make certain that the electrolytic capacitors are inserted the correct way—the grooved end goes to the plus marking on the board.

Fit the small surface-mount trim pots RV6, 106, RV7, and 107. Fit coils L1, 101. **DO NOT ADJUST L2, 102.**

Fit the transistors, diodes, and ICs. Note the metal insert on the IC regulator and the round indentation on the ICs. The banded end of the diode goes to the plus mark on the board. The two transistors have a flattened "D" shape; the larger flat face, with the sharp corners of the "D" goes toward the two large, gray-bodied capacitors, C4, 104. See the outline drawing to check the locations of the collector, base, and emitter. Note the view is from beneath.

Before fitting the push-button switches, it is advisable to check that they function correctly as they are difficult to remove once soldered. Check mechanical interdependence of AUX, FM, and FM Dolby. Check with battery and bulb or ohmmeter for electrical operation; the switch positions are ganged in sets of three. Take care to push the switches fully into the board and insure that they fit squarely, using the front panel as an alignment guide; **any skew will result in misalignment with the front panel. Solder.**

Insert the "Cal. Tone" switch, taking care that the brass spring is up. Align it using the front panel as a template so that it is in line with the main bank of switches. Solder.

Solder the ends of R13, 113 away from the pin position. Leave the other end, the one toward the pin, standing loose, away from the board, and unsoldered.

Sub PC Board

Components are fitted on the **FOIL** side of the smaller PC board.

Insert the large, up-right trim pots RV3, 103, RV4, 104, and RV5, 105 into the board and solder the back leg. Attach the plastic adjustment inserts into RV3, RV4, and RV5. Adjust all of the trim pots so that they align with the "Cal." holes in the front panel and are square with the front of the sub PC board. Solder and trim remaining legs. The sub PC board should be spaced about 0.09 inch away from the top of the main switch bank to ensure that the "Cal." trim pot centers line up with the front panel holes. Wooden kitchen matches are a convenient spacer for this; the metal shoulders of the adjustment screwdriver are about this distance, but the driver should **not** be used while soldering the sub board in position.

PARTS LIST — INTEGEX NOISE REDUCER

Two-channel alternate encode/decode

RESISTORS

R 1, 101	470K
R 2, 102	150K
R 3, 103	3.9K
R 4, 104	4.7K
R 5, 105	4.7K
R 6, 106	2.2K
R 7, 107	3.3K 1%
R 8, 108	47K
R 9, 109	180
R10, 110	270K
R11, 111	560K
R12, 112	270K
R13, 113	330K
R14, 114	330K
R15, 115	150K
R16, 116	150K
R17, 117	560
R18	3.9M
R19	3.9M
R20	1.2M
R21	18K
R22	680K
R23	680K
R24	680K
R25	680K
R26	330K
R27	1M
R28	3.9M
R29	10K
R30	10K
R31	100K

R32, 132	220
R33, 133	220

R34	180K 2%
R35	15K 2%
R36	82

CAPACITORS

C 1, 101	10 μ
C 2, 102	10 μ
C 3, 103	0.33 μ
C 4, 104	10 nF 5% Gray body
C 5, 105	3900 pF Styrene 5%
C 6, 106	3000 pF Styrene, Installed 5%
C 7, 107	2200 pF Styrene 5%
C 8, 108	10 μ
C 9, 109	10 μ
C10, 110	5600 pF Styrene 1%
C11, 111	4700 pF Styrene 1%
C12, 112	10 μ
C13, 113	10 μ
C14, 114	27 nF 1% Styrene
C15, 115	47 nF Mylar
C16, 116	10 μ
C17, 117	0.1 μ
C18, 118	0.33 μ
C19, 119	0.33 μ
C20, 120	10 μ
C21	10 μ
C22	1000 μ 25V
C23	0.1 μ
C24	1 nF Styrene
C25	1 nF Styrene
C26	150 pF
C27	0.047 μ
C28	0.047 μ
C29	220 μ 10V
C30	0.1 μ
C31	47 nF Square, red plate ceramic

C32	47 nF Square, red plate ceramic
C33, 133	1 nF Disc
C34, 134	1 nF Disc

SEMICONDUCTORS

TR1, 101	ZTX109C
IC1, 101	LM1011A

IC2	LM3900
IC Reg.	1415,131

COILS

L1, 101	30569
L2, 102	30568 Installed, DO NOT ADJUST THESE COILS for the 19-kHz filter.

POTENTIOMETERS

RV1	50K Log/Reverse Log Dual Control Pot
RV2	50k Log/Log Dual Control Pot
RV3, 103	50K Log Cal. Pot—Large, Upright
RV4, 104	50K Log Cal. Pot—Large, Upright
RV5, 105	5K Log Cal. Pot—Large, Upright
RV6, 106	47K Linear Trim Pot—Small, Surface-Mount
RV7, 107	1K Linear Trim Pot—Small, Surface-Mount
RV8	5k Log/Log Dual Control Pot

MISCELLANEOUS

SW1, 2, 4, 5, 6	7-position switch bank
SW3	4-pole on-off cal.-tone switch
SW7	Main power switch, DPST
Large PC Board	
Small PC Board	
Phono socket assembly	
23 PC Board Pins (minimum)	
D1, 2, 3, 4	4001, 4002, 4003
D5, 105	1N914, 1N4148, 1S44
D6, 106	1N914, 1N4148, 1S44

Chassis; wood case; front panel with angle mounting brackets; knobs; shield for power supply area; line cord; strain relief; transformer; fuse and holder; meter; self-adhesive foam strip to cushion meter; bulb; 4-lug terminal strip; long sheet-metal screws with stand-offs for power switch; short sheet-metal screws for angle brackets to hold front panel; pan-head screws for main PC board; cadmium-plated screws with nuts for front panel and phono socket board; flat-head screws with nuts for transformer, fuse holder, and meter bracket; long flat-head screw with large washer to secure wood case to chassis; screened wire for connection of main and sub boards; meter and terminal strip connection wire; card for beneath main PC board; plastic inserts for trim pots RV103, 104, and 105 with adjustment screwdriver. Note: Extra hardware, e.g. screws, nuts, PC board pins, will be included.

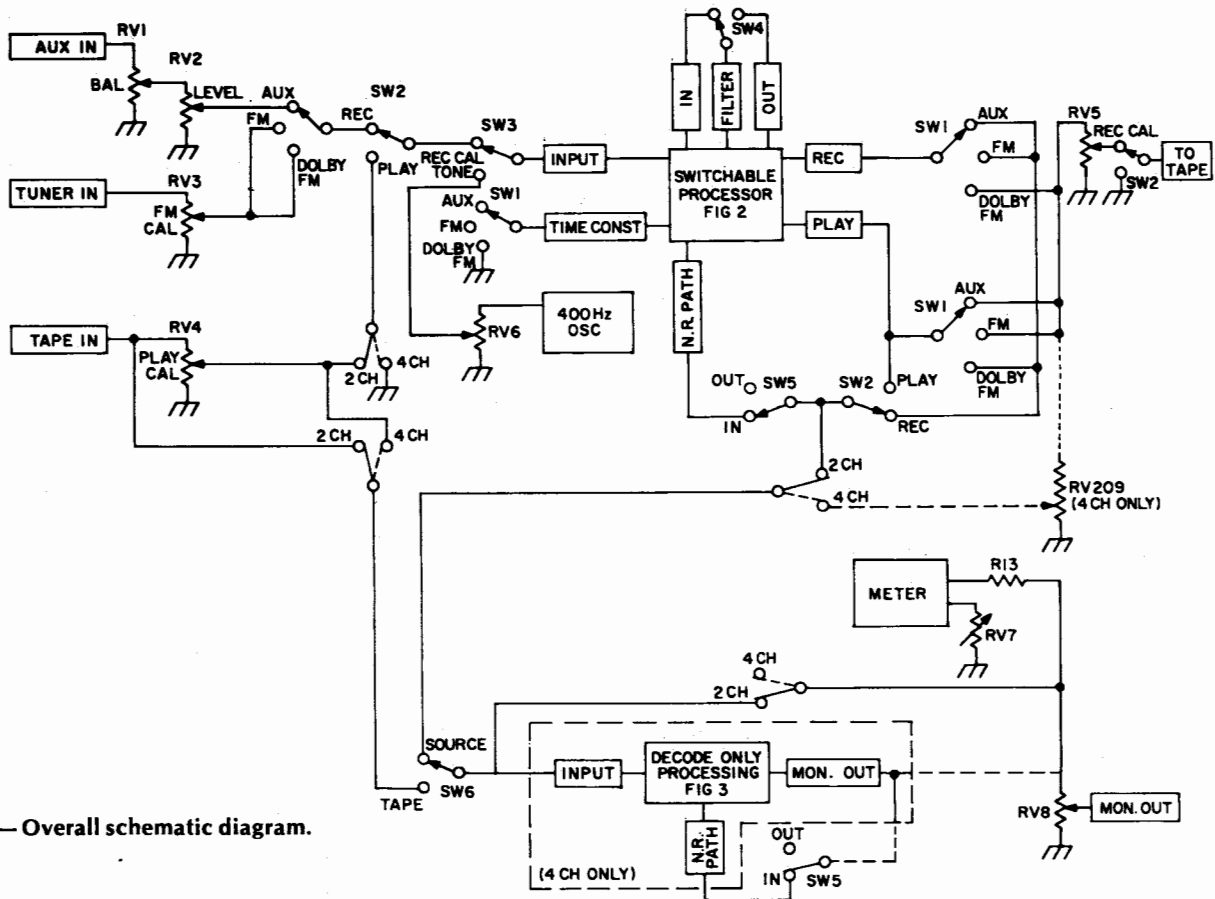


Fig. 1—Overall schematic diagram.

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Position the sub board on the pins of the main bank of switches, check alignment using the front panel as a template and sighting through the "Cal." holes, and solder into position.

Join the areas of the sub board marked "Tuner L and R" to the corresponding points on the main board

using the screened twin-lead cable supplied. Ground the **shield only** at the pin marked "screen." The other end floats; do not attach it to the sub board.

Returning to the main board, RV1, RV2, and RV8 can be fitted, using the front panel as a template to align the control pot spindles with the push but-

tons. Solder the pots with the front panel in position.

Check both boards for solder shorts and/or dry joints.

Crop all leads to avoid touching chassis.

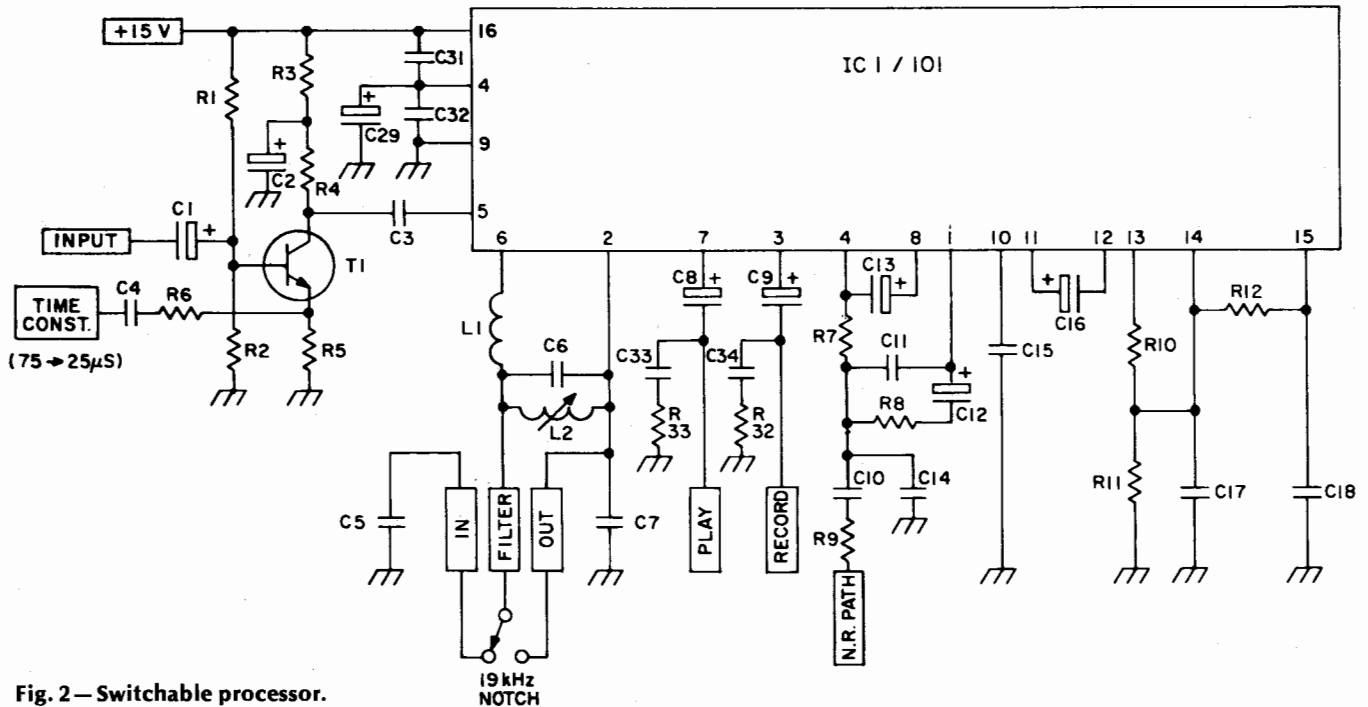


Fig. 2—Switchable processor.

Insert a thin piece of card between the main board and the chassis, and fix the board in position using the pan-head screws.

Phono Socket Board

Place the self-adhesive label on the phono socket board.

Fit the phono socket board onto the back panel from the inside using the cadmium-plated screws and nuts.

Cut a 5½-inch piece of the solid bare wire.

Thread it through the holes of all the **OUTER RINGS** and to pin "1" on the main PC board, which is marked "Gnd."

Connections between the **CENTERS** of the phono jacks are as follows. Looking at the phono socket board from the PC board side, connections between the centers and the pins on the board are, from left, **UPPER** level, A, D, E, G, and K. Similarly, the connections for the lower-level centers are, from left, B, C, F, H, and J.

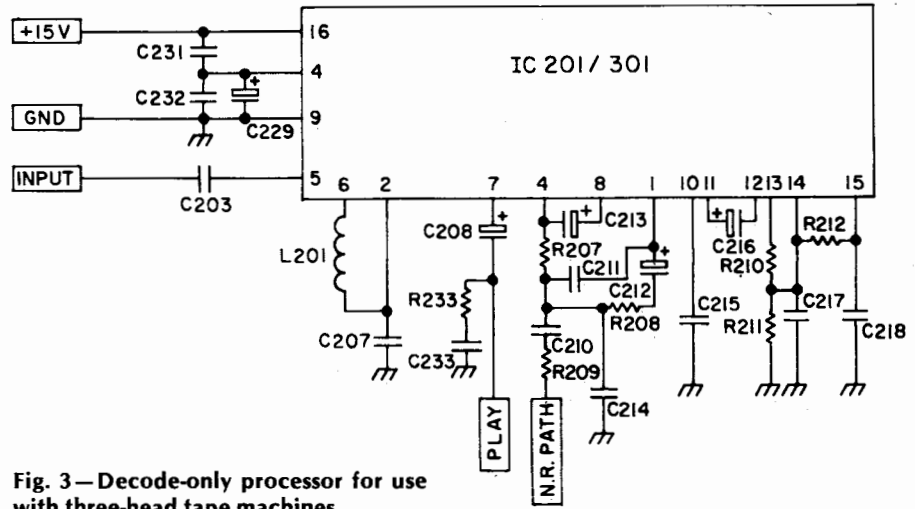


Fig. 3—Decode-only processor for use with three-head tape machines.

Off-Board Assembly

Note the exploded diagram of this area of the kit. Fit in position, using the flat-head screws from the bottom of the chassis:

- Transformer; black leads are the primary leads.
- Fuse holder, noting positioning peg.
- Main power switch, using long sheet-metal screws and stand-offs between meter/switch bracket and switch.
- Meter/switch bracket and terminal strip with the terminal attached via hole behind meter opening. It is convenient to hold the nut in position through the meter opening while tightening the screw.

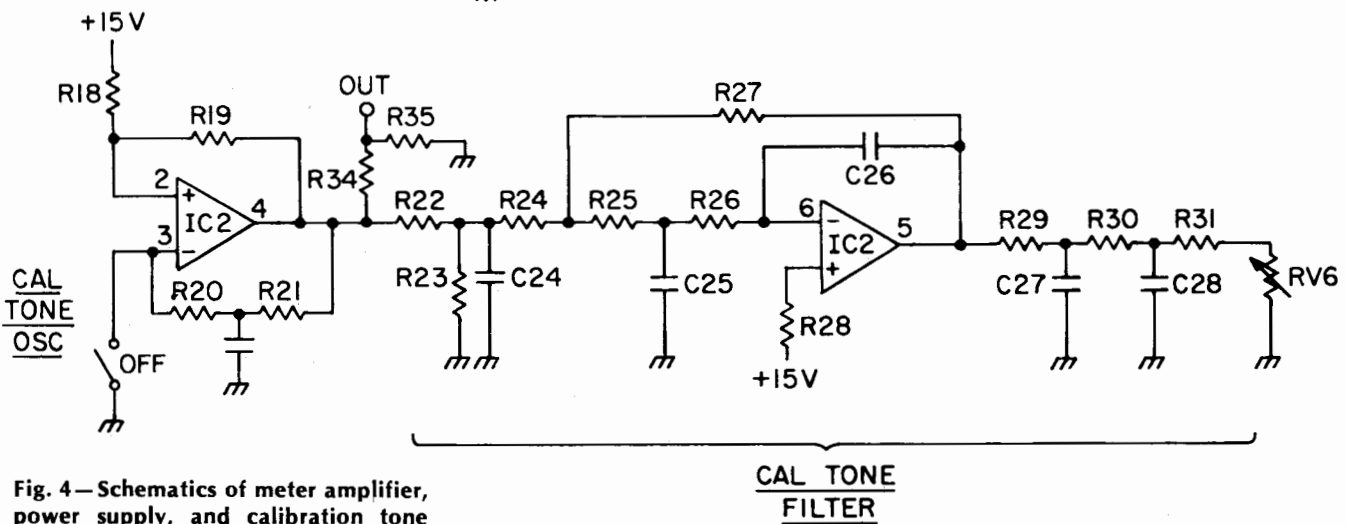
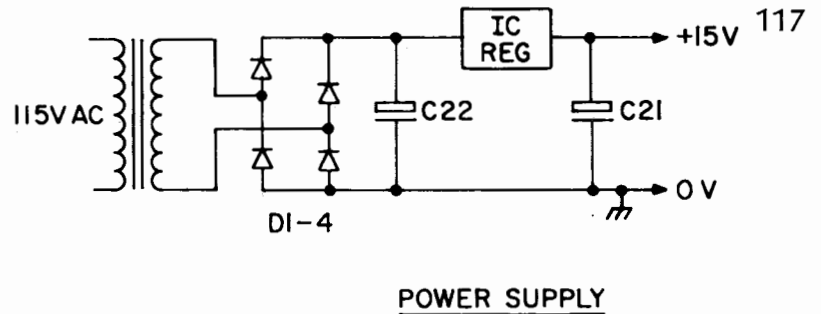
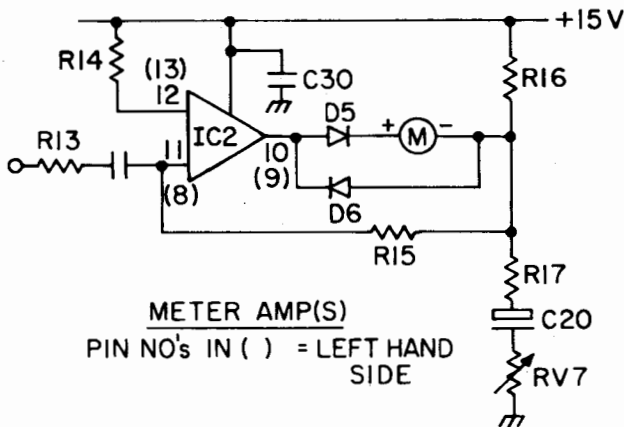


Fig. 4—Schematics of meter amplifier, power supply, and calibration tone oscillator and filter.



Fig. 5—Identification of leads of ZTX-109C. NOTE: THIS IS THE VIEW FROM UNDERNEATH.

Tape the meter to the front of the bracket using the self-adhesive foam between the meter and the bracket. The foam goes at both top and bottom. Normally the meter will be held in place by the front panel.

Feed the white secondary leads from the transformer forward to the meter/switch bracket and then to the left toward the main PC board. Fix the transformer screen in position, being careful not to nick the secondary leads. Cut the white leads just long enough to be attached to lugs No. 1 and 4 on the terminal strip. Strip and crimp the white leads to lugs nos. 1 and 4 but **DO NOT** solder. Strip both ends of the remaining two white wires and crimp one end of each to terminals nos. 1 and 4. **DO NOT SOLDER.** Do not use lug no. 2, as it is grounded.

Connect and solder the loose ends of the white wire to the Vin points near

the upper right-hand corner of the PC board (when viewed from the front).

Cut R36 leads to the proper length and crimp them to lugs nos. 1 and 3.

Tack solder the leads of the grain-of-wheat bulb to lugs nos. 3 and 4. Position the bulb behind the meter.

Solder the three leads at lug no. 1. Solder the two leads at lug no. 3. Solder the three leads to lug no. 4.

Connect and solder the meter terminals to the four meter-drive pins (\pm M.R. and \pm M.L.) near the Vin pins. Note that the terminals on the meters are polarized and are reversed in polarity from side to side.

Remove the transformer screen.

Clip about an inch from the end of one conductor of the a.c. line cord. Strip both ends of this short piece and solder between the front end of the fuse holder and the front-left terminal of the power switch.

Feed the a.c. power cord through the hole in the back panel, strip and solder the shortened end to the back lug of the fuse holder, and strip and solder the longer end to the back-left terminal of the power switch.

Strip and solder the black primary leads of the transformer to the other two lugs of the power switch.

Put the strain relief around the line cord outside the chassis, pull the line cord so that it will be snug between the back of the chassis and internal connections, and insert the strain relief into the back of the chassis using a pair of pliers.

Install fuse into fuse holder.

Install transformer screen, using flat-head screws and nuts; screws insert from bottom of chassis. Be careful not to damage transformer secondary wiring.

Place self-adhesive Dolby label on back panel and red warning label on top of transformer screen.

Meter Calibration

The amplifier section of IC2, based on pins 2, 3, and 4, is wired as an unstable multivibrator switching between the 15-volt supply rail and 0 volts with a mark-space ratio of approximately 1 to 1 and a frequency of about 400 Hz. The real voltage swing is slightly less due to saturation voltages but is highly repeatable from one sample to another.

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Fig. 6—Wiring of terminal strip.

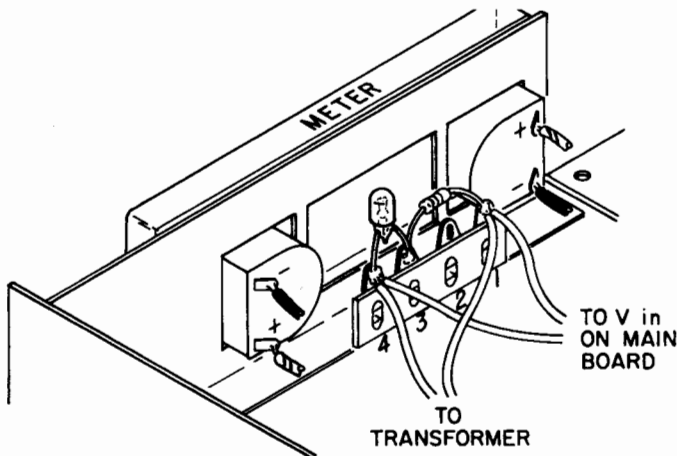
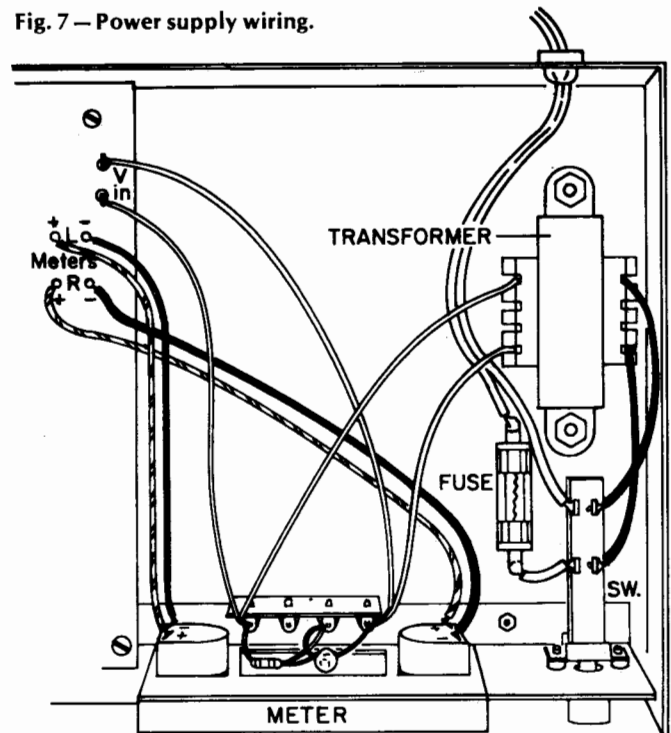


Fig. 7—Power supply wiring.



The calibration procedure is as follows:

Connect the "cal. osc. out" pin located in the back-middle portion of the main PC board to the end of R13 floating away from the board.

- Switch on the power.
- Push the "cal. tone" button in.
- Adjust RV7 for 0 dB on the right-hand meter.
- Switch the power off.
- Disconnect R113 and solder it to the pin PR, cut lead.

— Connect R113 to the "cal. osc. out" pin.

— Repeat steps above for the left channel using RV107.

— Disconnect R113 and solder it to the pin PL, cut lead.

The meters are now calibrated for Dolby level, and they should be calibrated before the simultaneous encode/decode part of the kit is constructed.

Oscillator Calibration

The square-wave output at pin 4 is low pass filtered by the active filter formed by the amplifier in IC 2 based on pins 1, 5, and 6 to produce a sine wave of less than 1 per cent distortion at 400 Hz. This signal is attenuated by RV 6 and 106 and injected into the circuit when the "cal. tone" button is pressed in.

To set the calibration oscillator output level, switch the unit on and push the "cal. tone" button in. DO NOT push Dolby FM or noise reduction while calibrating. Now adjust RV6 and 106 for 0 dB on the right-hand and left-hand meters respectively.

To be continued

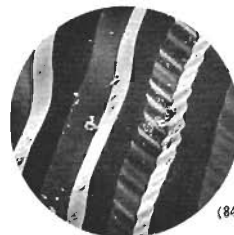
RESISTOR CODE

CAPACITOR CODE

RESISTOR COLOR CODE			
COLOR	1st + 2nd SIGNIFICANT FIGURES	MULTIPLIER	TOLERANCE
Black	0	1	—
Brown	1	10	±1%
Red	2	100	±2%
Orange	3	1000	±3%
Yellow	4	10000	±4%
Green	5	100000	—
Blue	6	1000000	—
Violet	7	10000000	—
Gray	8	100000000	—
White	9	—	—
Gold	—	0.1	±5%
Silver	—	0.01	±10%
No Color	—	—	±20%

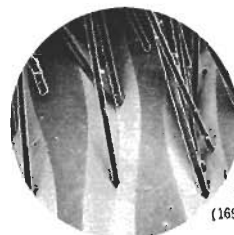
CAPACITOR CODES (CAPACITANCE GIVEN IN PF)				
COLOR	DIGIT	MULTIPLIER	10 PF OR LESS	OVER 10 PF
BLACK	0	1	±2.0 pf	±20%
BROWN	1	10	±0.1 pf	±1%
RED	2	100	—	±2%
ORANGE	3	1000	±0.25 pf	±2.5%
YELLOW	4	10000	—	—
GREEN	5	—	±0.5 pf	±5%
BLUE	6	—	—	—
VIOLET	7	—	—	—
GRAY	8	0.01	±0.25 pf	—
WHITE	9	0.1	±1.0 pf	±10%
SILVER	—	—	—	—
GOLD	—	—	—	—

Take a close look at a better record cleaner. Audio-Technica AT6002



(84x enlargement)

This is an A-T scanning electron microscope photo of the dirt that must be removed if your records are to sound clean. It's dirt that is falling on your records even as you listen.



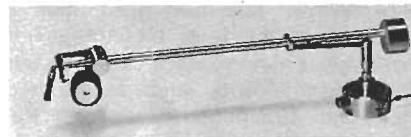
(169x enlargement)

Our unique carbon fiber brush sweeps each groove literally hundreds of times as the record plays, just *before* the stylus touches the groove. The carbon fiber brush helps conduct static charges away, making groove cleaning easier. And the incredibly small 6 micron diameter reaches deep into the groove for the smallest particles.



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