

Stereo Review's

\$1.35

TAPE RECORDER ANNUAL 1969

REEL-TO-REEL • FOUR-TRACK • EIGHT-TRACK • CASSETTE

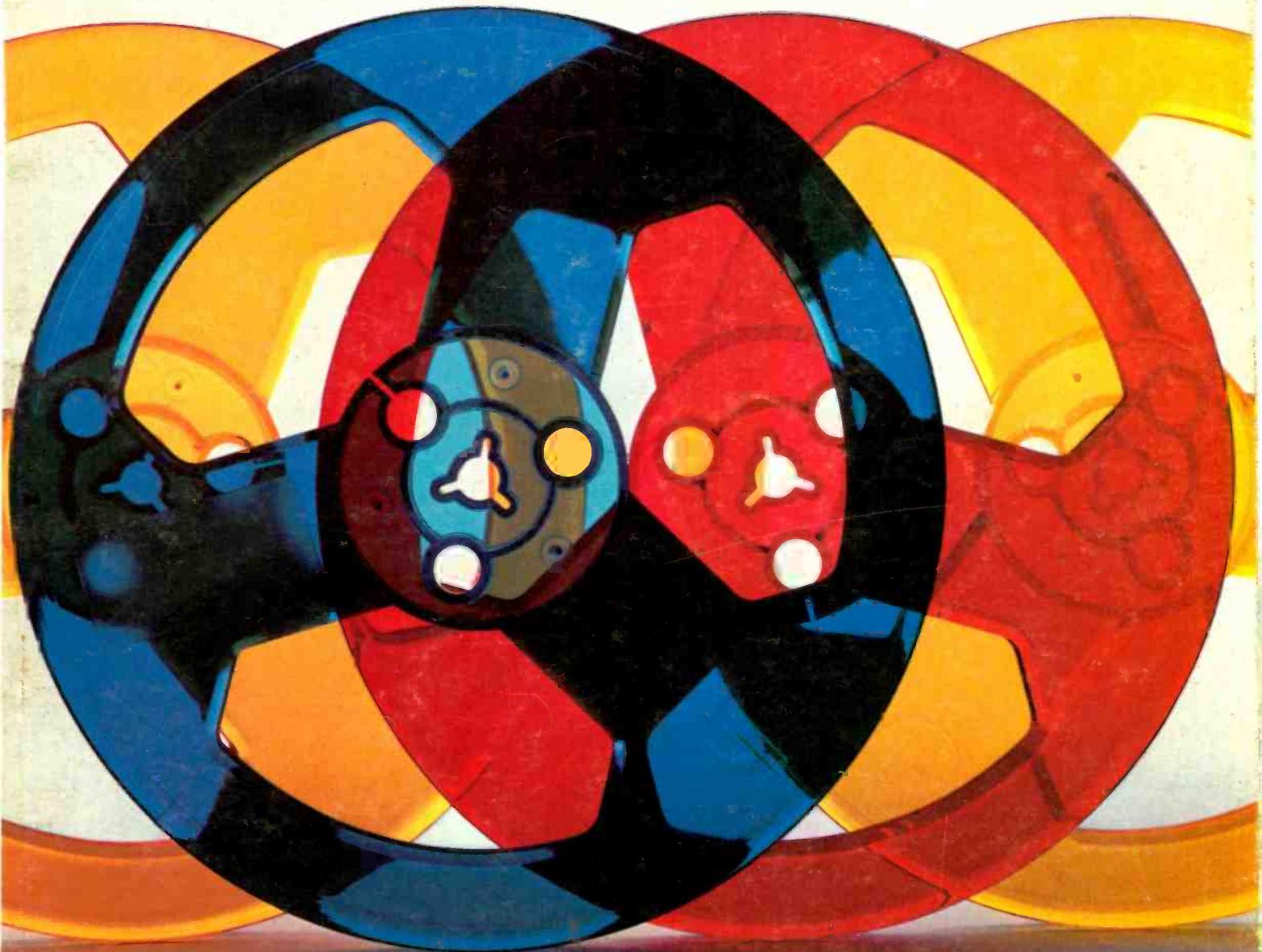
Directory of Stereo Tape Recorders, Decks, Accessories, Mikes

How to Select Tape * Taping and the Law * Tips on Maintenance

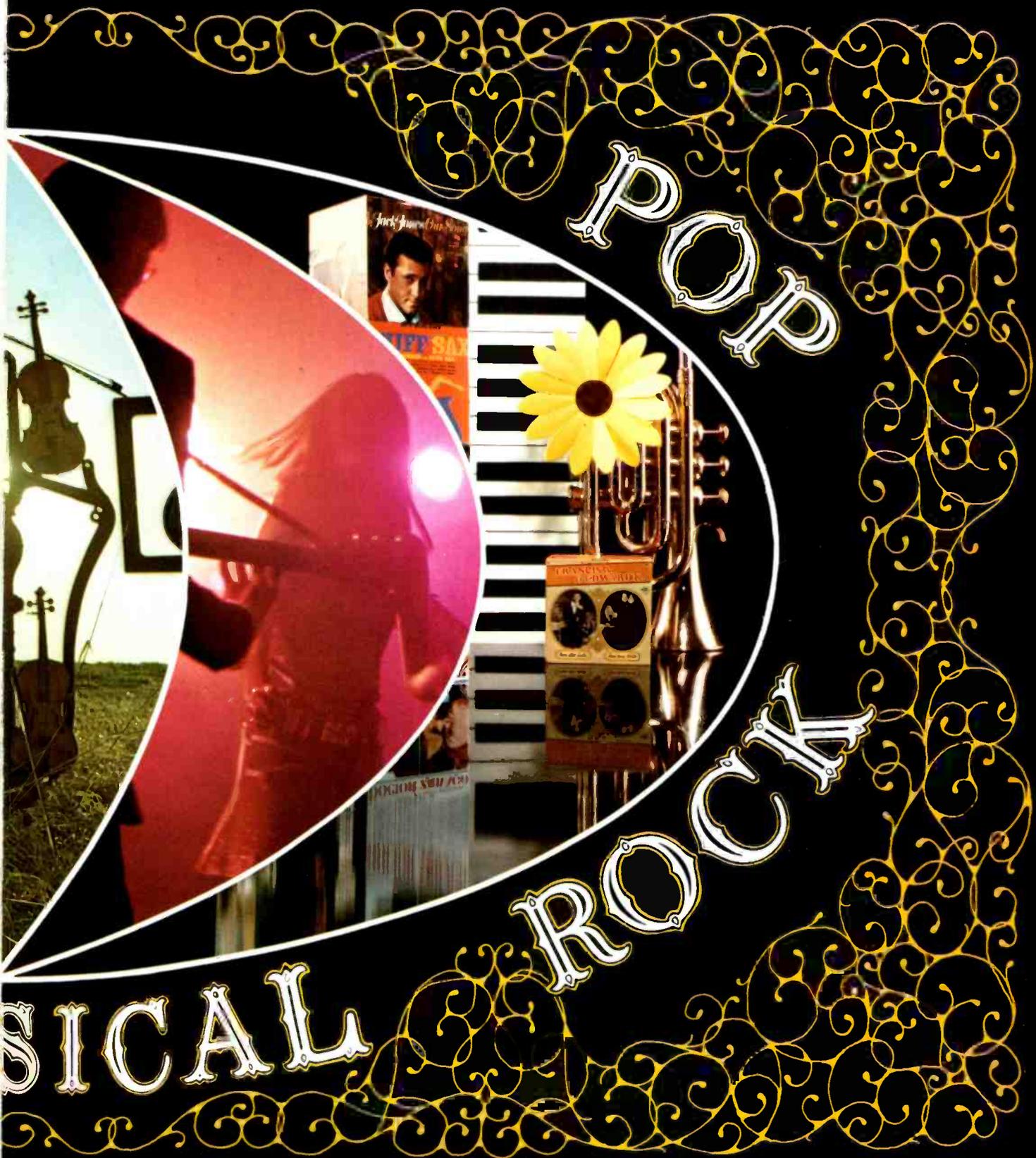
Recording Off the Air * Glossary of Tape-recorder Terminology

Pre-recorded Tape Roundup * Latest Developments in Video Tape

Choosing a Microphone * Taping Discs * Guide to Tape Editing



ON AN AMPEX STEREO TAPE



POP

ROCK

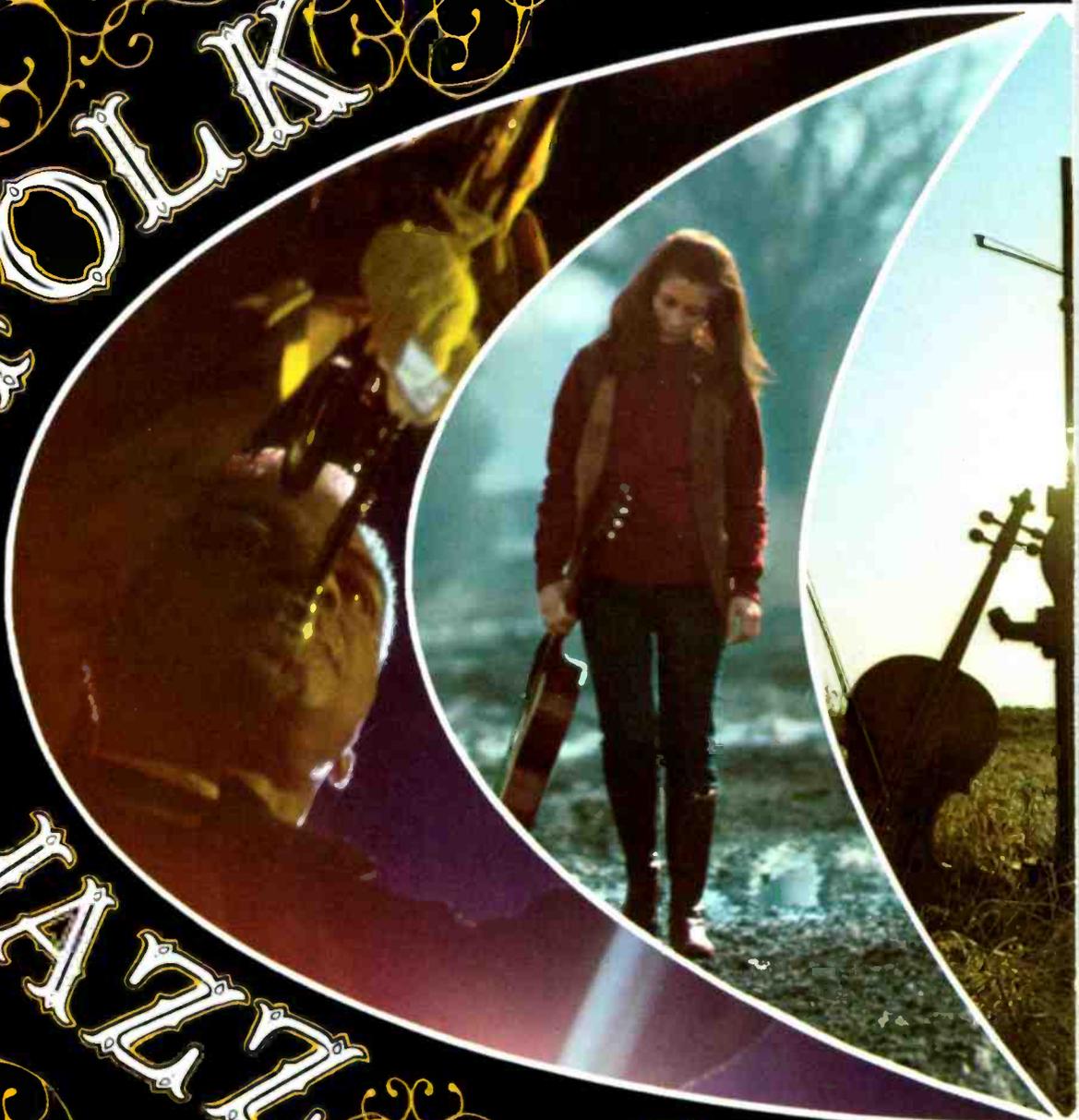
SICAL

THE WORLD OF MUSIC &

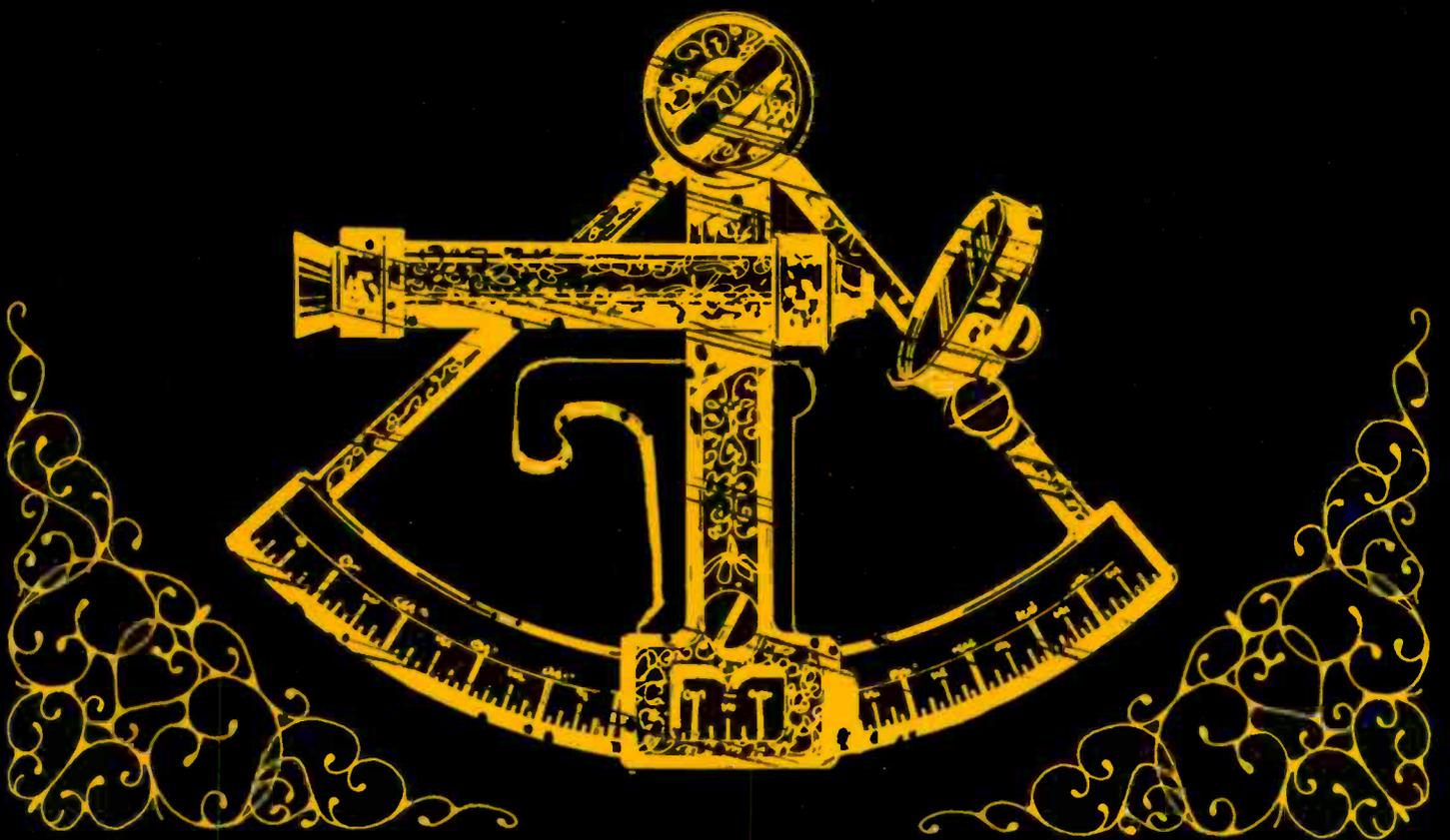
FOLK

SALE

CLASS



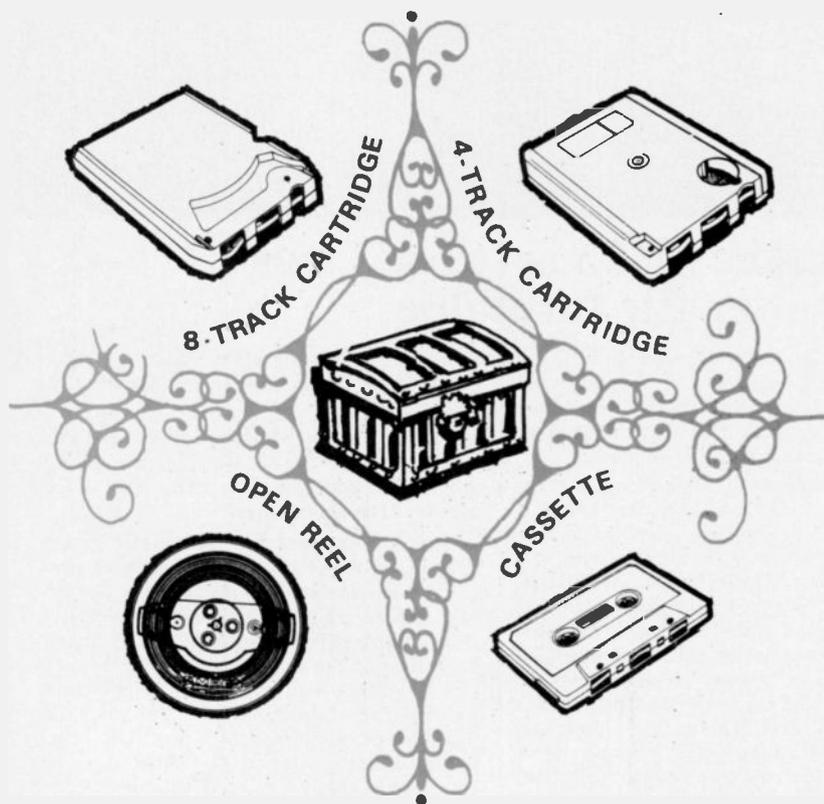
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The ultimate in listening enjoyment

Journey with us to a new horizon of sound, where all your favorite music—the classics, soundtracks, showtunes, folk songs, jazz, rock and popular releases—suddenly come alive with amazing brilliance and exceptional clarity.

Ampex brings you the most complete library of pre-recorded stereo tapes available—on open reel, 4-track cartridge, 8-track cartridge and cassette. Every major artist, every type of music is on stereo tape... well over 4,000 outstanding selections from more than 65 different recording labels. And, all skillfully reproduced from the original studio master for the listener who knows the difference between the ordinary and the excellent.



Ask your music dealer for our new stereo tape directory—"Stereo Tape '68"... or send 25¢ to: Ampex Stereo Tapes, 2201 Lunt Avenue, Elk Grove Village, Illinois 60007

AMPEX
STEREO TAPES

AMPEX CORPORATION 2201 LUNT AVENUE • ELK GROVE VILLAGE, ILLINOIS 60007



Feature by feature, the SL 95 is today's most advanced automatic turntable

An investment of \$129.50 in an automatic turntable cannot be taken lightly. When you're ready to buy, compare carefully—feature by feature. You will find that Garrard's SL 95 meets your every requirement since it offers all the innovations that distinguish a superlative instrument plus the assurance of years of flawless performance. Here's why:

Synchronous motor: Look for a synchronous motor, the only type which can really guarantee constant speed regardless of voltage, record load, warm up and other variables. By *locking in* to the fixed 60 cycle current (rather than varying voltage), this type of motor guarantees the unwavering pitch and distortion-free record reproduction you should insist upon in a top-notch record playing unit. Garrard's revolutionary new Synchro-Lab Motor™, which powers the SL 95, is not only synchronous...it also offers the advantages of the induction type motor—instant starting, high driving torque and freedom from rumble.

Light, kinetically matched turntable: The SL 95's synchronous motor has obsoleted the heavy turntable which was developed because of the need to override fluctuation in the speed of induction motors, through fly-wheel action. The relatively light (3 pounds), but magnificently balanced turntable, precision matched to the kinetic energy of the

motor, now relieves weight on the all-important center bearing and reduces wear and rumble in this most critical area. Furthermore, its full-sized 11½" diameter gives your records maximum edge support.

Low-mass tonearm: Look for tracking capabilities which can only be obtained through light weight and low resonance damping, combined with rigidity and advanced pivoting. The SL 95's distinctive, dynamically balanced one-piece arm of Afrormosia wood and aluminum is mounted within a gyroscopically gimbaled assembly which permits it to float virtually friction-free on jewel-like needle pivots. The need for plug-in shells is eliminated by a new cartridge clip which insures flawless alignment. It is compatible with the latest, most compliant pick ups and the arm will track them perfectly down to the smallest fraction of a gram specified.

Permanently accurate anti-skating control: Look for a control that relies on a counterweight and is not affected by wear or temperature. The SL 95's patented control, which neutralizes side pressure on the stylus, is adjusted by a simple sliding weight rather than springs.

Convenient, gentle, cueing control: The SL 95 features single action cueing—one control is used to start the motor and lift and lower the tonearm. Its location at the

front of the unit plate facilitates the safeguarding of your records in manual and automatic play.

Accurate audible/visible stylus force adjustment: The SL 95 combines accurately calibrated visual positions with detents for positive ¼ gram settings.

Two-point support for automatic play: It has been found vital to have positive support of records at center and edge. The SL 95's center spindle dropping mechanism guarantees perfect operation at all times, regardless of the condition of center hole or size or thickness of records. A unique support platform telescopes into the unit plate when the SL 95 is used as a manual player. Patented automatic spindle handles up to six records safely; manual spindle rotates with record, has durable, friction-free Delrin® tip.

The Garrard Line. There are seven Garrard models this year, priced from \$37.50 to \$129.50, less base and cartridge. We urge you to send for a complimentary Comparator Guide with full, feature by feature descriptions. Write Garrard, Dept. AY849, Westbury, N.Y. 11590.

Garrard[®]
World's Finest

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A copy of this Test Report on the Tandberg Model 64X Stereo Tape Recorder is yours for the asking:

EQUIPMENT TEST REPORTS

By Hirsch-Houck Laboratories

● The outstanding performance of past Tandberg recorders is a matter of record in our comments on the original Model 64 (HiFi Stereo Review, October, 1963). We pointed out that, almost alone among home tape recorders of that time, the Tandberg 64 at 7½ ips did not in any way change the sound of a recorded program, whether from discs or FM.

It is difficult to improve on this sort of performance, but Tandberg engineers have done so. The new Model 64X, externally identical to the older Model 64, is substantially better in its frequency response, particularly at the lower tape speeds, and has an even better signal-to-noise ratio than did the older model.

The Tandberg 64X has a separate amplifier for each of the four tape heads. A single channel play-back head has been changed to a stereo head. Each of the four heads is pressed into a lever in the tape deck which allows a separate tape to be played from each of the four separate outputs.

Pressing the play button on the other side of the machine will record and play back a program in stereo. The buttons are labeled "STEREO" and "MONO".

Such a study of fact that the original program sound recorded on the tape. The two effect the connection when a jack is plugged into the microphone level.

The tubes used in the 64X are of the "cathode ray" type, which are used to produce the line outputs (from low-impedance cathode followers) to the rear and is intended to be connected to a program source and amplifier system for record-playback. The recorder is supplied installed in a teakwood base.

The electronics of the 64X are hybrid in nature, using vacuum tubes for most functions. The bias oscillator and its associated output stages (which are separate for each track) are transistorized, as is the center-channel output amplifier that supplies 1 volt of mixed output signal to the rear jack.

Other differences between the new Model 64X and the older Model 64 include changes in the equalization at 3½ ips and a reduced recording-bias current at the 1½-ips speed. The most important change is the addition of a separate cross-field bias head facing the uncoated side of the tape opposite the recording head. This is largely responsible for the improved frequency response and signal-to-noise ratio of the Model 64X.

At 7½ ips, we measured the overall record-playback frequency response of the Tandberg Model 64X as an excellent +0.3, -2.5 db from 40 to 20,000 Hz. The play-back frequency response from the Ampex 31321-04 test tape was within 0.5 db of the original. The response was smoother than that of the Model 64.

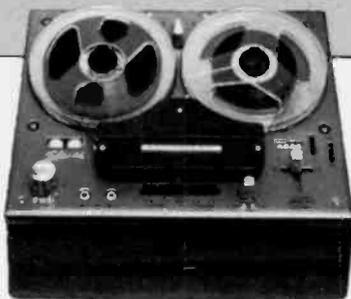
"The 64X offers the highest caliber of performance presently obtainable in a home tape recorder ... we could not find fault with it in any respect. The Tandberg 64X sells for \$549 and is well worth it."

*As appearing in
HI FI STEREO REVIEW
February 1968 issue*

Some consumers might be deceived into thinking they were hearing a 7½-ips machine with the Tandberg Model 64X operating at 1½ ips.

The 64X offers the highest caliber of performance presently obtainable in a home tape recorder. It is unquestionably a high-fidelity recorder at 3½ ips, which cannot be said for quite a few otherwise fine machines. We could not fault its performance in any respect. The Tandberg 64X sells for \$549 and is well worth it.

HI FI STEREO REVIEW



Hear this superb 4-track stereo tape deck for yourself. Any authorized Tandberg dealer will be happy to give you a live demonstration.

NOW AVAILABLE!

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*for better, clearer,
more natural sound...*

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PELHAM, NEW YORK 10803

Model 64X features 4 separate tape heads for record, playback, erase, bias; FM stereo multiple, sound-on-sound, echo effects, add-a-track, direct monitor, remote control. \$549.00

DIRECTORY OF MANUFACTURERS

The following is an alphabetical listing of manufacturers whose products are described in this volume. Addresses are furnished for your convenience should you care to write for further information.

ADMIRAL90

3800 W. Cortland St.,
Chicago, Ill. 60647

AIWA—Selectron International
Co., Inc. 65,90

4215 West 45 St.,
Chicago, Ill. 60632

AKG—Microphone-Headphone
Division of North American
Philips Co. 111,117

100 East 42nd St.,
New York, N. Y. 10017

ALLIED RADIO CORP. . . . 65,66,90

100 N. Western Ave.,
Chicago, Ill. 60680

ALTEC LANSING—Div. of
LTV Ling Altec, Inc. 111,112

1515 S. Manchester Ave.,
Anaheim, Cal. 92803

AMERICAN GELOSO
ELECTRONICS INC. 114

251 Park Ave. S.,
New York, N. Y. 10010

AMPEX CORP. 66,68,90,105

401 Broadway,
Redwood City, Cal. 94063

ARISTO INDUSTRIES—Div. of
Aristo Tone Electronics, Inc. . . . 68

240 Fifth Ave.,
New York, N. Y. 10001

ARVIN INDUSTRIES, INC.—
Consumer Products Div. 90,93

Columbus, Ind. 47201

AUDIOTAPE—
Audio Devices, Inc. 105,108

235 East 42nd St.,
New York, N. Y. 10017

AUDIOTEX—Div. of
GC-Hydrometals, Inc. 108,112

400 S. Wyman St.,
Rockford, Ill. 61101

AUTOMATIC RADIO MFG. CO.,
INC. 93

2 Main St.,
Melrose, Mass. 02176

BASF—Computron, Inc. 105

Crosby Drive,
Bedford, Mass. 01730

BELL & HOWELL CO. . . . 68,93,94

7100 McCormick Rd.,
Chicago, Ill. 60645

BEYER—Elpa Marketing Industries,
Inc. 112

Thorens Bldg.,
New Hyde Park, N. Y. 11044

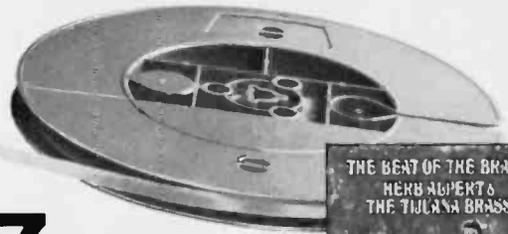
(Continued on page 8)

Columbia Stereo Tape Club

now offers you

ANY 5 STEREO TAPES FOR ONLY \$2.97

if you join the Club now, and agree to purchase as few as five additional selections during the coming year, from the more than 300 to be offered



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HONEY
ANDY WILLIAMS

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HOW THE CLUB OPERATES: Each month you'll receive your free copy of the Club's magazine which describes and displays tapes for many different listening interests and from many different manufacturers. You may accept the regular selection for the field of music in which you are primarily interested, or take any of the scores of other tapes offered you, or take no tape at all that month.

TAPES SENT ON CREDIT. Upon enrollment, the Club will open a charge account in your name . . . and that means that you'll pay for the tapes you want only after you've received them and are enjoying them. The tapes you want will be mailed and billed to you at the regular Club price of \$7.95 (occasional Original Cast recordings somewhat higher), plus a small mailing and handling charge.

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SEND NO MONEY NOW! Just fill in and mail the coupon today! Your free take-up reel and your five tapes will soon be in your home for you to enjoy for years to come!

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A.P.O. F.P.O. addressees: write for special offer

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COLUMBIA STEREO TAPE CLUB
Terre Haute, Indiana 47808

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Please enroll me as a member of the Club. I've indicated at the right the five tapes I wish to receive for \$2.97 plus postage and handling. Include the self-threading take-up reel FREE.

My main musical interest is (check one):
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Name: (Please Print) First Name Initial Last Name
 Address: _____
 City: _____ State: _____ Zip Code: _____

434-7/08

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<p>GARY PUCKETT & THE UNION GAP Featuring YOUNG GIRL 10 MORE COLUMBIA</p> <p>6480. Includes: Money, The Mighty Quinn, Lady Madonna, etc.</p>	<p>ANDRE KOSTELANETZ and his Orchestra Scarborough Fair 11 MORE COLUMBIA</p> <p>6511. Plus: I'll Get By, Love Is Blue, The Look Of Love, etc.</p>	<p>SIMON & GARFUNKEL PARSLY, SAGE, ROSEMARY & THYME Homeward Bound The Dangling Conversation 10 MORE COLUMBIA</p> <p>3442. Also: A Poem on the Underground Wall, Cloudy, etc.</p>	<p>JOHNNY CASH AT FOLSOM PRISON Jackson 15 MORE COLUMBIA</p> <p>6415. Folsom Prison Blues, The Long Black Veil, The Wall, etc.</p>
<p>(SOUNDTRACK) THE GRADUATE Songs Performed by Simon & Garfunkel 11 MORE COLUMBIA</p> <p>6313. "Like the movie, a hit album" — Billboard Magazine</p>	<p>PAUL MAURIAT and his orch. MAURIAT MAGIC Love In Every Room 11 MORE PHILIPS</p> <p>6606. Plus: The World We Knew, Michelle, The Last Waltz, etc.</p>	<p>BURT BACHARACH REACH OUT I Say a Little Prayer Allie 9 MORE MONUMENT</p> <p>5829. Plus: The Look Of Love, Lisa, Bond Street, 11 in all</p>	<p>BARBRA STREISAND Simply Streisand 11 MORE COLUMBIA</p> <p>5896. Stout-Hearted Men, When Sunny Gets Blue, Lover Man, etc.</p>
<p>SERGIO MENDES & BRASIL '66 LOOK AROUND 10 MORE POLYDOR</p> <p>6340. Also: Like a Lover, The Look Of Love, Roda, etc.</p>	<p>BERT KAEMPFERT and his Orchestra AFRIKAAN BEAT Stardust Where or When 10 MORE POLYDOR</p> <p>3755. Also: Dancing In The Dark, Moon-glow, 12 in all</p>	<p>BOOTS RANDOLPH Boots With Straps The Shadow of Your Smile Michelle 10 MORE MONUMENT</p> <p>3747. Plus: Oar Heart, Yesterday, Un-chained Melody, etc.</p>	<p>The 5th Dimension UP, UP AND AWAY Go Where You Wanna Go 9 MORE SOUL CITY</p> <p>5588. Also: Learn How To Fly, Poor Side Of Town, etc.</p>
<p>HOROWITZ ON TELEVISION 11 MORE COLUMBIA</p> <p>6550. Program taken from performances at the Moll</p>	<p>WES MONTGOMERY A Day in the Life 11 MORE COLUMBIA</p> <p>5788. Plus: Windy, Eleanor Rigby, The Joker, 10 in all</p>	<p>BERNSTEIN'S GREATEST HITS NEW YORK PHILHARMONIC 11 MORE COLUMBIA</p> <p>5236. España, On The Trail, Waltz Of The Flowers, etc.</p>	<p>PERCY FAITH Today's Themes For Young Lovers Can't Take My Eyes Off You Windy 11 MORE COLUMBIA</p> <p>5420. Plus: Mary In The Morning, Release Me, etc.</p>
<p>BEETHOVEN Moonlight Appassionata Pathétique SONATAS Glenn Gould 11 MORE COLUMBIA RECORD CLUB</p> <p>5883. A sensitive and illuminating performance.</p>	<p>BOB DYLAN'S GREATEST HITS Mr. Tambourine Man Blowin' in the Wind It Ain't Me Babe I Want You 6 MORE COLUMBIA</p> <p>3858. Plus: Rainy Day Women, Like A Rolling Stone, etc.</p>	<p>JOHNNY MATHIS LOVE IS BLUE • Plus • By the Time I Get To Phoenix 6 MORE COLUMBIA</p> <p>6343. Also: I Say A Little Prayer, Walk On By, etc.</p>	<p>Golden Greats by THE VENTURES Walk, Don't Run Telstar 10 MORE LIBERTY</p> <p>5584. Plus: Apache, The Lonely Bull, Wipe-Out, 12 in all</p>
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Schumann: Concerto
in A Minor
VAN CLIBURN
CHICAGO SYMPHONY
FRITZ REINER

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plays
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One Dozen New Delights



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The Genoa, GT-840S. \$219.50 Mfrs. Sugg. Retail Price.



THE INTERNATIONAL ONE

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The first four track tape deck designed to outperform any other in its price range as well as those two and three times the price. (This was determined by an independent consumer laboratory survey, not us.)

Uher 7000 offers more than great

music. No more scratched records, or worn out grooves. And you save money with tapes.

In addition, there are two speeds to give you hours and hours of enjoyment on one tape; sound on sound and full fingertip control for complete ease of operation.

These are just a few of the reasons why more and more music lovers are going with Uher. As for those record lovers, "Times they are a changin'."

Hear the 7000 at a franchised dealer or write for literature.

Uher 7000 by Martel

The easy-to-love tape deck

Martel Electronics Inc. Sole U. S. Importers. 2339 S. Cotner Ave., L. A., Calif. 90064; New York. Chicago.

Circle No. 22 on Reader Service Card.

BLAUPUNKT—Robert Bosch

Corp. 94

2800 South 25 Ave.,
Broadview, Ill. 60153

BORG-WARNER CORP.—

Spring Div. 94

Madison St. & 25th Ave.,
Bellwood, Ill. 60104

BURGESS BATTERY CO.—

Div. of Servel, Inc. 105

Freeport, Ill. 61032

CHANNEL MASTER CORP. ... 68,94

Ellenville, N. Y. 12428

CLARK, DAVID CO.,

INC. 117

360 Franklin St.,
Worcester, Mass. 01601

CONCERTONE, INC. 68,69,94

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N. Hollywood, Cal. 91605

CONCORD ELECTRONICS

CORP. 69,70,94,95

1935 Armacost Ave.,
Los Angeles, Cal. 90025

CRAIG PANORAMA, INC. ... 70,95

2302 East 15 St.,
Los Angeles, Cal. 90021

CROWN INTERNATIONAL 70

1718 W. Mishawaka Rd.,
Elkhart, Ind. 46517

CROWNCORDER

Crown Radio Corp. 70,95,96

755 Folsom St.,
San Francisco, Cal. 94107

DYNACO, INC.—

Div. of Tyco Labs, Inc. . 70,71,112

3060 Jefferson St.,
Philadelphia, Pa. 19121

EDITALL—Elpa

Marketing Industries, Inc. 108

Thorens Bldg.,
New Hyde Park, N. Y. 11044

ELECTRO VOICE,

INC. 112,113,114

Buchanan, Mich. 49107

FARGRAM—Fargo Co. 114

1162 Bryant St.,
San Francisco, Cal. 94103

GENERAL ELECTRIC CO. ... 71,96

2200 North 22 St.,
Decatur, Ill. 62525

GRUNDIG—Grundig-Triumph-

Adler Sales Corp. 71,96

355 Lexington Ave.,
New York, N. Y. 10017

HARMAN-KARDON, INC. ... 71,96

55 Ames Court, Plainview, N. Y. 11803

HITACHI SALES CORP. ... 71,72,96

48-50 34th St.,
Long Island City, N. Y. 11101

IRISH RECORDING TAPE—

Div. of Morhan National

Sales Co., Inc. 106

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New York, N. Y. 10013

(Continued on page 12)

TAPE RECORDER ANNUAL



If the personal symbol on the card attached matches a symbol on the chart below—
YOU HAVE ALREADY WON A FABULOUS PRIZE

If Your Symbol Is				
YOU HAVE WON:	THE EXCALIBUR new sports car, in classic antique style (or \$7,500.00 in cash).	\$2,500 in Cash a giant windfall for the lucky winner.	RADIO'S GREAT MOMENTS Rare collector's L.P. album Casey Stengel interviews other celebrities; famous radio flubs, JFK, RFK, more!	Genuine RACCOON COAT the coat that put the roar in the Twenties!

NOW—HAVE A DISCOUNT RECORD STORE IN YOUR OWN HOME!

Save up to 55% on every record you ever want to buy! No obligation to buy any records

The Longines Symphonette's new service, THE CITADEL RECORD CLUB gives you any record, any artist, any label at savings up to 55% off manufacturer's suggested price. No obligation to buy any records • Jet Speed Service • See details below • Special Money-Back Membership—Just Like a Free Trial!

You've seen the 'tricky' ads in this and other publications: Get 10 records FREE they say. Then in smaller print, if you agree to buy 10 or 11 more in just one year. They give you your choice of from 30 to 90 records...and that is not free choice, for the Schwann Catalog lists more than 30,000 long-play records now available to you. The extra records you have to buy no matter what choice is offered you are part of the "trick". More records you really don't want. And did you ever try to turn down a record club selection of the month? It's tough—and you have to move fast. This kind of club forces you to buy records you don't want.

THERE IS A BETTER WAY: The Longines Symphonette's New Citadel Record Club gives you a huge "Discount Record Store" in your own home... acts like a "record buyers cooperative".

The honest sincere CITADEL CLUB way is quite simple. There are no hidden contracts, no obligation to buy any records at all, and you have your FREE choice of any record available today at discounts of up to 55%, with a minimum of 35% guaranteed. Here's how easy it is to start saving on the records you buy:

- 1 ANY RECORD, ANY ARTIST, ANY LABEL, ANY KIND OF MUSIC!** What do you prefer? Popular? Classical? Broadway Show? Rock and Roll? Movie or TV themes? Order Elvis Presley, Arthur Fiedler, Herb Alpert and The Tijuana Brass, Doctor Zhivago, Bobbie Gentry, Ray Conniff, Beatles, Diana Ross and The Supremes, Aretha Franklin, Eddy Arnold, Sergio Mendes & Brasil '66, any original Broadway Cast... you name it, if it's in print, you have it at a guaranteed 35% off manufacturers list price... often as high as 55%. Even includes imported labels and hard-to-find specialities.
- 2 YOU ARE NOT REQUIRED TO BUY ANY RECORDS AT ALL!** Buy as many or as few records as you need—records of your choice!
- 3 IRON CLAD GUARANTEE: FACTORY-FRESH RECORDS, MOST SEALED IN PLASTIC.** Any record that passes our inspection team and is imperfect, is replaced without additional cost to you.

TYPICAL CITADEL RECORD CLUB SUPER-BARGAINS

Performer	Normal List Price	Citadel Special Price	Performer	Normal List Price	Citadel Special Price
FRANK SINATRA	5.79	3.19	HERB ALPERT AND		
MANTOVANI	4.79	2.59	THE TIJUANA BRASS	4.79	2.49
CONNIE FRANCIS	4.79	2.29	BARBRA STREISAND	4.79	2.59
LAWRENCE WELK	4.79	2.29	HARRY BELAFONTE	4.79	2.59
AL HIRT	4.79	2.29	LEONARD BERNSTEIN	5.79	2.99
ARTHUR FIEDLER	5.79	3.19	NAT KING COLE	4.79	2.59
RAMSEY LEWIS	4.79	2.59	EDDY ARNOLD	4.79	2.29
BOBBY DARIN	4.79	2.29	HENRY MANCINI	4.79	2.59
TONY BENNETT	4.79	2.39	GUY LOMBARDO	4.79	2.29
COUNT BASIE	4.79	2.29	ROLLING STONES	4.79	2.29
STAN GETZ	4.79	2.29			

HOW THE SWEEPSTAKES WORKS. The symbol on the claim certificate attached tells you what prize you have won. To claim your prize, simply return the certificate. Your prize will be sent along with your membership kit.

Entries must be received by January 15, 1969. Employees of the Citadel Record Club, its media and suppliers shall not be eligible. Note: if you win a first, second or fourth prize, return your claim certificate by registered mail.



4 24 HOUR SERVICE IN MOST CASES! Your orders filled promptly... mostly within 24 hours. The fastest service in the industry.

5 FREE MEMBERSHIP KIT INCLUDES 300-PAGE SCHWANN CATALOG PLUS TWO OTHER BIG BOOKS! As a member you get the famous SCHWANN catalog which lists more than 30,000 long-play records now available. Same book used by the biggest stores... tells you the manufacturers' suggested prices and other information. And you get two BONUS BIG BOOK CATALOGS listing special bargains and current top sellers. All FREE with your membership.

6 "MONEY-BACK" MEMBERSHIP—JUST LIKE A FREE TRIAL! In order to introduce you to the tremendous advantages of membership in The Citadel Record Club, we invite you to accept a three-month trial for just \$1. And—we will even give you a Record Bonus Certificate worth \$1 when you become a lifetime member... just like a FREE trial. AND—we'll even bill you later for the small \$1 fee. Remember—every Citadel Club membership is for the entire family. Your children can order and save. Any member of your family can order records... and save. But—try us out. Mail the card or coupon for the special three-month trial for only \$1.

SEND NO MONEY—MAIL CARD OR COUPON TODAY!



CITADEL RECORD CLUB

Symphonette Square, Larchmont, N.Y. 10538

Enroll me in the club for all the privileges described in the advertisement. I get FREE kit including SCHWANN catalog plus two bonus big books. I AM NOT OBLIGATED TO BUY ANY RECORDS... but save up to 55% on those I really want, any artist, any label. Bill me for the \$1 trial membership and send the \$1 Record Bonus Certificate which I can use toward my first purchase.

MR. _____
 MRS. _____
 MISS _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

I have enclosed my \$1.00 now—Do not bill me later. Refund guaranteed if not delighted.

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 Chicago, Ill. 60638

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 JVC America Inc.
 50-35 56th Rd.,
 Maspeth, N. Y. 11378

KALOF ELECTRONICS 97
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 Van Nuys, Cal. 91406

KINEMATIX, INC. 97
 2150 W. Lawrence Ave.,
 Chicago, Ill. 60625

KLH RESEARCH AND DEVELOPMENT CORP. . . 72,73
 30 Cross St.,
 Cambridge, Mass. 02139

KNIGHT-KIT—Allied Radio Corp. 73
 100 N. Western Ave.,
 Chicago, Ill. 60680

KOSS ELECTRONICS INC. . 117,118
 2227 North 31 St.,
 Milwaukee, Wis. 53208

LAFAYETTE RADIO ELECTRONICS CORP. 73,74,97,98
 111 Jericho Turnpike,
 Syosset, N. Y. 11791

LEAR JET INDUSTRIES, INC.
 Stereo Div. 98
 13131 Lyndon Ave.,
 Detroit, Mich. 48227

MAGNECORD—Div. of The Telex Corp. 74
 9600 Aldrich Ave. S.
 Minneapolis, Minn. 55420

MASTERWORK AUDIO PRODUCTS
 Columbia Records Sales Corp.,
 Div. of Columbia Broadcasting System, Inc. 74,98
 51 West 52 St.,
 New York, N. Y. 10019

MERCURY RECORD CORP. . . 100
 35 E. Wacker Drive, Chicago, Ill. 60601

NORDMENDE—Sterling Hi-Fidelity, Inc. 74
 22-40 40th Ave.,
 Long Island City, N.Y. 11101

NORELCO—North American Philips Co., Inc. . . 74, 76, 100, 101
 100 East 42 St.,
 New York, N.Y. 10017

NORTRONICS CO., INC., THE 108, 110, 111
 8101 Tenth Ave. N.,
 Minneapolis, Minn. 55427

ORRTRONICS, INC. 101
 P.O. Box 864,
 Toledo, Ohio 43601

PANASONIC—Matsushita Electric Corp. of America . . 76, 101
 Pan-Am Bldg., 200 Park Ave.,
 New York, N.Y. 10017

PLAYTAPE, INC. 102
 1115 Broadway,
 New York, N.Y. 10010

PML—Ercona Corp. 114, 118
 432 Park Ave. S.,
 New York, N.Y. 10016

RADIO CORPORATION OF AMERICA 76, 102
 30 Rockefeller Plaza,
 New York, N.Y. 10020

REVOX—Elpa Marketing Industries, Inc. 77
 Thorens Bldg., New Hyde Park,
 N.Y. 11044

RHEEM CALIFONE—Div. of Rheem Mfg. Co. 77
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 Los Angeles, Cal. 90016

ROBERTS—Califone/Roberts Electronics Div., Rheem Mfg. Co. 77,78
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SANSUI ELECTRIC CO., LTD. 118
 34-43 56th St., Woodside, N.Y. 11377

(Continued on page 14)

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ON EVERY CARTRIDGE TAPE
4-TRACK, 8-TRACK AND CASSETTE

Here's your chance to SAVE big money on tapes... every 4-track, 8-track and cassette available... a complete library of over 6,000 to choose from... all at savings of at least 1/3 off list price. These savings are yours only as a member of the Cartridge Tape Club of America. And, there's still more. You get reduced prices on home and auto tape players. A bi-monthly magazine with complete tape listings, feature stories, news, photos, tape reviews, top selling tapes, etc. Monthly top tape and new release newsletters. Bonus offers. Special gifts. Nothing is ever sent unless you want it. No minimum purchase required. There's no other club of its kind. No other club offers you the complete choice of tapes. Write for complete details. Or join today. Send just \$5 for a lifetime membership plus the members cost of any tapes you might order from the sample listing... receive a special FREE gift and our complete catalog. If coupon is missing, write Cartridge Tape Club of America, 1509 S. Michigan, Chicago 60605.

NO.	TITLE	8-Track		4-Track	
		Retail	Members	Retail	Members
563	FOR ONCE IN MY LIFE—Tony Bennett	7.98	5.33	6.98	4.66
564	BERNSTEIN'S GREATEST HITS—Leonard Bernstein/N.Y. Philharmonic	7.98	5.33	NA	NA
565	GREATEST HITS—Dave Brubeck	6.98	4.66	5.98	3.99
567	GREATEST HITS—The Byrds	6.98	4.66	5.98	3.99
462	GREATEST HITS, VOL. 1—Johnny Cash	6.98	4.66	5.98	3.99
568	THE TIME HAS COME—The Chambers Brothers	6.98	4.66	5.98	3.99
569	SONGS OF LEONARD COHEN	6.98	4.66	5.98	3.99
323	THIS IS MY SONG—Ray Conniff	6.98	4.66	5.98	3.99
570	SORCERER—Miles Davis	6.98	4.66	5.98	3.99
571	JOHN WESLEY HARDING—Bob Dylan	6.98	4.66	5.98	3.99
572	A LONG TIME COMIN'—The Electric Flag	6.98	4.66	5.98	3.99
573	FOR THOSE IN LOVE—Percy Faith	6.98	4.66	5.98	3.99
574	GREATEST HITS—Eydie Gorme	6.98	4.66	5.98	3.99
575	ON BROADWAY—Robert Goulet	6.98	4.66	5.98	3.99
576	ROMANTIC WALTZES BY TCHAIKOVSKY—Andre Kostelanetz	7.98	5.33	NA	NA
577	TODAY'S GREATEST MOVIE HITS—Andre Kostelanetz	6.98	4.66	5.98	3.99
578	LOVE IS BLUE—Johnny Mathis	7.98	5.33	6.98	4.66
579	WOW—Moby Grape	6.98	4.66	5.98	3.99
580	GOIN' TO MEMPHIS—Paul Revere & the Raiders featuring Mark Lindsay	6.98	4.66	5.98	3.99
366	MARTY'S GREATEST HITS—Marty Robbins	6.98	4.66	5.98	3.99
581	BOOKENDS—Simon & Garfunkel	7.98	5.33	6.98	4.66
582	THE GRADUATE—Original Soundtrack	7.98	5.33	6.98	4.66
583	THE UNION GAP—featuring Gary Puckett	6.98	4.66	5.98	3.99
566	LOVE ANDY—Andy Williams	7.98	5.33	6.98	4.66

PRICES

NO.	TITLE	8-Track		4-Track	
		Retail	Members	Retail	Members
563	FOR ONCE IN MY LIFE—Tony Bennett	7.98	5.33	6.98	4.66
564	BERNSTEIN'S GREATEST HITS—Leonard Bernstein/N.Y. Philharmonic	7.98	5.33	NA	NA
565	GREATEST HITS—Dave Brubeck	6.98	4.66	5.98	3.99
567	GREATEST HITS—The Byrds	6.98	4.66	5.98	3.99
462	GREATEST HITS, VOL. 1—Johnny Cash	6.98	4.66	5.98	3.99
568	THE TIME HAS COME—The Chambers Brothers	6.98	4.66	5.98	3.99
569	SONGS OF LEONARD COHEN	6.98	4.66	5.98	3.99
323	THIS IS MY SONG—Ray Conniff	6.98	4.66	5.98	3.99
570	SORCERER—Miles Davis	6.98	4.66	5.98	3.99
571	JOHN WESLEY HARDING—Bob Dylan	6.98	4.66	5.98	3.99
572	A LONG TIME COMIN'—The Electric Flag	6.98	4.66	5.98	3.99
573	FOR THOSE IN LOVE—Percy Faith	6.98	4.66	5.98	3.99
574	GREATEST HITS—Eydie Gorme	6.98	4.66	5.98	3.99
575	ON BROADWAY—Robert Goulet	6.98	4.66	5.98	3.99
576	ROMANTIC WALTZES BY TCHAIKOVSKY—Andre Kostelanetz	7.98	5.33	NA	NA
577	TODAY'S GREATEST MOVIE HITS—Andre Kostelanetz	6.98	4.66	5.98	3.99
578	LOVE IS BLUE—Johnny Mathis	7.98	5.33	6.98	4.66
579	WOW—Moby Grape	6.98	4.66	5.98	3.99
580	GOIN' TO MEMPHIS—Paul Revere & the Raiders featuring Mark Lindsay	6.98	4.66	5.98	3.99
366	MARTY'S GREATEST HITS—Marty Robbins	6.98	4.66	5.98	3.99
581	BOOKENDS—Simon & Garfunkel	7.98	5.33	6.98	4.66
582	THE GRADUATE—Original Soundtrack	7.98	5.33	6.98	4.66
583	THE UNION GAP—featuring Gary Puckett	6.98	4.66	5.98	3.99
566	LOVE ANDY—Andy Williams	7.98	5.33	6.98	4.66



Cartridge Tape Club of America
1509 S. Michigan • Chicago 60605
 Dept. 10 P

Please Specify:
 4-track 8-track

Here is my check for \$_____ covering the \$5 lifetime membership fee plus the _____ tapes I have ordered and circled.

323 568 576
 366 569 577
 462 570 578
 563 571 579
 564 572 580
 565 573 581
 566 574 582
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Name _____
 Address _____
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 State _____ Zip _____

For technical sound recording everything points to Revox

Separate spooling motors of original high torque low weight construction.

Sealed mains input section and cabinet safety link socket.

Fully electronically stabilised power supply circuit.

Capstan motor servo control panel maintaining speed accuracy to better than 0.2% and incorporating electronic speed change from 7½ to 3½ ips.

Read head of capstan motor.

Plug-in power amplifiers (optional).

Capstan motor of patented construction, cool running, low current consumption and wow and flutter better than international broadcast requirements.

Tape transport logic control circuit panel.

Professional practice glass-fibre panel with integral gold-plated switch contacts.

Plug-in relays controlling all functions and eliminating damage from inadvertent mis-handling.

Unique multi-bank micro-switch unit, providing on-off, speed and spool size/tension variations on one control.

Plug-in record relay.

Plug-in 120 Kc/s bias oscillator obviates multiplex interference.

Plug-in audio input/output amplifiers.

New from the Willi Studer Factory comes the revolutionary Model 77 incorporating design developments based on experience gained in the broadcast field with the 37 and 62 Series Studer machines. The 77 is a studio quality machine compactly presented and offering features unique in this price class including total

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Write or call for further information —

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"SCOTCH" TAPES—The 3M Co. .106

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SHARP ELECTRONICS

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Cedar Rapids, Iowa 52402

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Los Angeles, Cal. 90064

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1. Any LP or tape on every U.S. or foreign label available. Columbia—Capitol—RCA—London & 350 more. No exceptions.
2. You save a minimum of 35% on LP's; 33% on tapes and 25% on books.

LP's LIST	uniCLUB
\$1.98	\$1.35
2.98	1.95
3.79/98	2.49
4.79/98	3.09
5.79/98	3.79

3. You can save even more by taking advantage of the regular extra discount "Specials." Save up to 80% off list price. Right now, for example, the entire RCA Red-Seal catalog is \$2.75 mono; \$3.25 stereo. The Vox \$4.98 series is \$1.75 mono and stereo.

4. Never a requirement to buy. No monthly "stop-order" forms to return. You receive just what you order.

5. LIFETIME MEMBERSHIP

The club membership fee is \$5. This is for lifetime privileges which are increasing all the time.

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Members regularly receive "uniGUIDE" advising them of the latest releases, recommended best-buys and extra discount "Specials." When you join you receive a free 300-page Schwann record catalog listing every available record and its price. You receive a free Harrison tape catalog if you specify.

7. FASTEST SERVICE ANYWHERE

Your orders are not only processed but shipped the same day we receive them. This unique service is possible because your orders are picked from an inventory of over 250,000 LP's & tapes. You get factory-new sealed albums and tapes only. Defects are fully returnable at no charge.

8. SAVE UP TO 50% ON STEREO GEAR

Individual components or complete systems—

uniCLUB supplies hi-fidelity equipment of virtually every manufacturer at tremendous savings. This month's "Hi-Fi Special" is a Garrard SL95 turntable; List \$129.50, to members only \$83.00.

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The Book Division—only uniCLUB has it—offers members at least 25% off on any book in print.* You get only original publishers' editions. uniGUIDE lists best-sellers, just-published works and book "Specials."

*Texts are reduced 10%.

10. FOUR CLUBS IN ONE

uniCLUB is really a time-saver. It makes joining many clubs unnecessary. Now you can buy all your records, tapes, auto-cartridges, books and stereo-gear from one convenient source. We hope you'll join today!

SAVE MONEY EVEN ON YOUR MEMBERSHIP FEE

Give gift memberships with full lifetime privileges for only \$2.50 each. Splitting the cost with one other person lowers cost to \$3.75; enrolling five at a time brings cost down to only \$3 each.

Send my Free Schwann catalog; order blanks & uniGUIDE by return mail. \$5 enclosed guarantees me:

1. LIFETIME MEMBERSHIP in uniCLUB
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3. No requirements ever to buy anything. Nothing will ever be sent until I order it.

I must be delighted with uniCLUB or within 30 days I will let you know and receive a full refund.

uniCLUB Inc.
255 West 42nd Street DEPT. TA 69
New York, N. Y. 10036

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____

- Send gift memberships at \$2.50 each to names and addresses listed on attached sheet.
 I am also interested in pre-recorded tapes.

Circle No. 39 on Reader Service Card.

DIRECTORY OF MANUFACTURERS

Circle No. 40 on Reader Service Card. →
TAPE RECORDER ANNUAL

Ask anyone who really knows about hi-fi to recommend an automatic turntable.

Pick out an audio engineer, hi-fi editor, record reviewer or hi-fi salesman at random, and ask him which turntable is the best.

Chances are he'll say Dual. Because he probably owns one.

In fact, 19 out of 20 people whose living depends on hi-fi own Duals. Nineteen out of twenty.

As you might expect, there are good reasons why the experts agree Dual is so good.

It performs quietly and smoothly. With less rumble, wow and flutter than whatever equipment they previously owned. With one record or ten.

The platter (not just the motor) maintains accurate speed, even when

the voltage varies from 80 to 135 volts. And the Dual continuous-pole motor is quieter and more powerful than any comparable synchronous type.

The Dual tonearm is friction-free. That means it can track flawlessly at a stylus force as low as half a gram (about one-fifth the weight of a U.S. dime). No other automatic has an arm that achieves this. And the Dual arm is accident and jam-proof. (A slip-clutch guards it against damage.)

Tonearm settings for tracking force and anti-skating are simple and precise. You just dial them.

And there are, of course, many other facts about Dual that the experts appreciate.

(Like the ultra-gentle cueing control and variable pitch control, for example.)

As for the people who own other brands of turntables, let's just say that they're not the audio engineers, hi-fi editors, record reviewers and hi-fi salesmen.

Most likely, they are all nice people. But would you trust any of them to recommend a turntable?

(For the complete Dual story, ask an expert to show you his Dual, or write for our booklet containing over a dozen complete reviews).

United Audio Products, Inc.,
535 Madison Avenue, New York, N.Y. 10022.)



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\$74.50

Dual 1019
\$129.50

Dual 1015F
\$39.50

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Hear it like it is!

Now from RCA...tape recorder/players
from the people who know sound the best



RCA's finest stereo recorder/player. 3 speeds. "Sound-plus-Sound."
Public address switch. Pause switch. Two VU meters.
Pushbutton controls. Automatic level control. Two 8" speakers, 2 tweeters in
removable enclosures. 2 microphones. *The Legislator (YLG 48)*

Stereo 3-speed recorder/player.
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Pause switch. Pushbutton controls.
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level control. Two 6" oval side-
mounted speakers. With 2 micro-
phones. *The Bystander (YLG 43)*



Our best mono recorder/player. 3
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Monitor output jack. Public address
switch. 7" speaker. Earphone, micro-
phone. *The Jurist (YLH 35)*

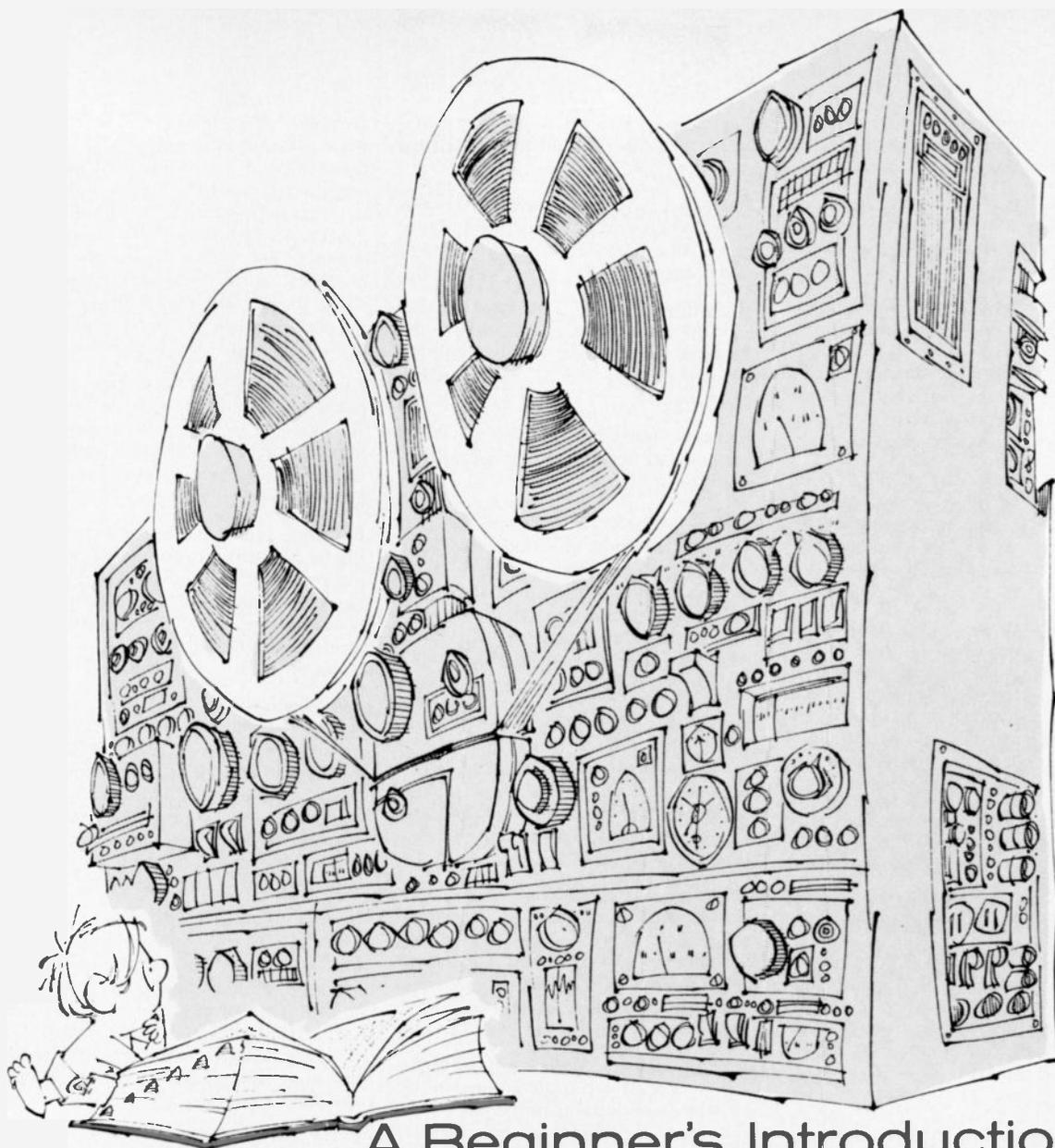


RCA Mark 8 stereo tape cartridge player. Auto-
matic 8-track table model plays auto tapes at
home. You get up to 80 minutes of continuous
music. Turns on as cartridge is inserted, turns off
when cartridge is removed. Track selection is
automatic. Two 5" oval speakers. *(YLD 42)*



RCA

Circle No. 28 on Reader Service Card.



PAUL COVER, JR.

A Beginner's Introduction to **TAPE-RECORDER TERMINOLOGY**

THE TAPE RECORDER, possibly because it has both mechanical and electrical aspects, is for the novice one of the most difficult audio components to understand. Describing the combination of mechanical and electronic features that go into a recorder is a task requiring a large, sometimes obscure vocabulary. If you don't learn just what the special jargon is all about, it is difficult, at this point in tape-recorder history, at least, to choose intelligently the one recorder that will best meet your specific needs. The task is further complicated by the tremendous versatility of the modern tape recorder. Almost any tape recorder can do a lot, but different machines can do different things. Without understanding the special language, you cannot be sure of just what a machine can do, or whether it has

the features you need. It may be reassuring to know that a particular recorder has "sound-on-sound" facilities, but if you're not quite sure what sound-on-sound *means*, knowing it exists is not much help. If you think that a "dropout" or a "head" is some kind of hippie, and that "squeal" is something that informers do, then it would be a good idea to study the short glossary of tape terms that follows. Adapted by STEREO REVIEW's technical editors from *101 Terms: A Glossary of Tape Recording Terms*, published by the Magnetic Products Division of the 3M Company, it may not only save you some money when you go recorder shopping, but will also give you a better idea of what it is you're buying and how to get the most out of it.

—William Wollheim

Acetate Base—The transparent cellulose-acetate plastic film that forms the backing for many magnetic recording tapes.

Acoustic Feedback—The echo, howling, or reverberation caused by a system's microphone(s) picking up the sound output from its own speaker(s).

Automatic Reverse—The ability of some four-track stereo tape recorders to play the second pair of stereo tracks automatically (in the reverse direction) without the necessity for interchanging the empty and full reels after the first pair of stereo tracks is played. (See also *Four-Track Recording*)

Automatic Shut-Off—A device (usually a mechanical switch) incorporated into most tape recorders that automatically stops the machine when the tape runs out or breaks.

Azimuth Adjustment—The mechanical adjustment of a magnetic head whereby exact alignment of the head gap with a standard tape-recorded magnetic pattern is achieved. Of prime importance for optimum high-frequency performance and recorder-to-recorder playback compatibility. (See also *Head Alignment*)

Azimuth Loss—The signal loss caused by lack of alignment between the playback-head gap and the signal recorded on the tape.

Backing or Base—The flexible material, usually cellulose acetate or polyester, on which is deposited the magnetic-oxide coat that "records" the taped signal.

Bias—A constant signal or tone added to the audio signal during recording to circumvent the inherent non-linearity of magnetic systems. The best (and most commonly used) bias is a high-frequency (usually 50,000 to 100,000 Hz) alternating current fed to the recording head along with the audio signal to be recorded.

Bulk Eraser or Degausser—A hand-held (or larger) device used to erase an entire reel of magnetic tape without removing it from the reel. It generally produces a strong alternating magnetic field that neutralizes all previously recorded magnetic patterns on the tape.

Cartridge—A sealed plastic container that holds tape of 1/4-inch or narrower width. Designed to eliminate manual tape threading, cartridges operate on either the continuous-loop (single hub) principle or the reel-to-reel (double hub) system. Cartridge machines are usually smaller and simpler to use than ordinary open-reel units. (See also *Cassette*)

Capstan—The driven spindle or shaft in a tape recorder—sometimes the motor shaft itself—which rotates against the tape (which is backed up by a rubber pressure or pinch roller), pulling it through the machine at constant speed during recording and playback modes

of operation. The rotational speed and diameter of the capstan determine tape speed.

Cassette—A type of tape cartridge operating on the hub-to-hub principle and now coming into wide use in portable and some home machines.

Cps—Abbreviation for "cycles per second," the units for expressing frequency. The term "cps" is now obsolete and has been replaced by "hertz." (See also *Frequency* and *Hz*)

Crosstalk—The undesired mixing of signals between the adjacent tracks recorded on a tape.

Decibel—Abbreviated "dB" or "db," it is a relative measure of sound intensity or "volume." It expresses the ratio of one sound intensity to another. One dB is about the smallest change in sound volume that the human ear can detect. (Also used to express voltage and power ratios logarithmically.)

Deck, Tape—A tape recorder designed specifically for use in a high-fidelity music system. It usually consists only of the tape-transport mechanism and preamplifiers for recording and playback. It does not include power amplifiers or speakers.

Distortion—Any difference between the original audio signal and that reproduced by a recording machine. Distortion takes many forms, and although it can never be completely eliminated, it can be reduced to a very low level in a good recording and reproducing system.

Dropout—During playback, the instantaneous loss of a recorded signal resulting from imperfections in the tape. These may take the form of non-magnetic foreign particles imbedded in and flush with the tape's surface. However, these imperfections are most commonly high spots on the tape surface that push the tape away from the magnetic head, thereby increasing the area affected (the "umbrella" effect). Small dropouts have less effect on low-frequency than on high-frequency signals. Also, full-track recordings are less sensitive to dropouts than are the narrower track widths. High-quality sound recording tapes are practically free of dropouts.

Dual-Track Recorder—Usually a monophonic recorder with a recording-head gap that covers somewhat less than half the width of a standard quarter-inch tape, making it possible to record one track on the tape in one direction and (by turning the reels over) a second track in the opposite direction. Also known as "two-track" or "half-track."

Dub—A copy of another recording. Tape recordings are easy to duplicate with a minimal loss of quality by recording from one machine to another.

Dynamic Microphone—An electromagnetic pressure microphone that employs a moving coil in a magnetic field to convert sound pressure to electrical energy in a manner similar to that of an electric generator. Impedance and output are generally lower than those of the ceramic or crystal microphone types. Low impedance permits the use of longer connecting cables without high-frequency loss or hum pickup.

Dynamic Range—The voltage ratio (expressed in decibels) between the softest and loudest sounds a tape recorder or other device can reproduce without undesirable distortion in loud passages and excessive noise in soft ones.

Editing—The alteration of a tape recording by physical means to eliminate or replace undesirable portions, add portions not present in the original, or otherwise rearrange the original. Magnetic tape is unsurpassed for editing purposes, since it can be easily cut and spliced.

Equalization—The selective amplification or attenuation of certain frequencies. Also refers to recognized industry standards for recording and reproducing "characteristics" (such as the NAB Standard), the proper use of which can assure uniform reproduction of prerecorded tapes and improvement of a system's signal-to-noise ratio.

Erasure—The neutralization of the magnetic pattern on tape by use of a strong magnetic field, thereby removing the recorded sound from the tape. During recording, the erase head on a recorder automatically removes any sound previously recorded on the tape just before the tape reaches the record head. (See also *Bulk Eraser*)

Extra Play—Also called "long play" or "extended play." Refers to tape that gives 50 per cent more than standard playing time on a standard reel because it employs a thinner base together with a thinner but usually more responsive oxide coating.

Fast Forward—The provision on a tape recorder permitting tape to be run rapidly through it in the normal play direction, usually for search or selection purposes.

Feed Reel—Also called "stock," "supply," or "storage" reel. The reel on a tape recorder from which the tape is taken as the machine records or plays.

Flutter—Very short, rapid variations in tape speed causing pitch and volume variations that were not present in the original sound. A form of distortion.

Foot Switch—An electrical or mechanical foot-pedal device for stopping and starting a tape recorder without use of the hands. Useful for dictating and for transcribing. (Continued overleaf)

Four-Track or Quarter-Track Recording

—The arrangement by which four different channels of sound may be recorded on quarter-inch-wide audio tape. These may be recorded as four separate and distinct tracks (monophonic) or two related (stereo) pairs of tracks. By convention, tracks 1 and 3 are recorded in the "forward" direction of a given reel, and tracks 2 and 4 are recorded in the "reverse" direction.

Frequency—The repetition rate of cyclic energy, such as sound or alternating electrical current, expressed in cycles per second (hertz or Hz) or thousands of cycles per second (kilohertz or kHz). By convention, "bass" frequencies in music extend from about 20 to about 200 Hz. "Treble" sounds are at the high frequency extreme of the sound spectrum and may extend from 2 or 3 kHz to the frequency limit of audibility (about 18 to 20 kHz). "Middle" (or "mid-range") frequencies occupy the remainder of the spectrum, from 200 Hz to about 3 kHz.

Frequency Range—The span between the highest and lowest pitched sounds that a tape recorder or other sound-system component can reproduce at a usable output or volume level.

Frequency Response—Always specified as a range, such as 50 to 15,000 Hz; but in order to be meaningful it must be further defined in terms of decibel variation from absolute flatness over a specified frequency range (e.g., ± 3 dB from 50 to 15,000 Hz). An indication of a sound system's ability to reproduce all audible frequencies supplied to it, maintaining the original balance among the low, middle (or mid-range), and high frequencies.

Full-Track Recording—Applies to quarter-inch-wide (or less) tape only. It defines track width as essentially equal to tape width.

Gain—The voltage ratio of the output level to the input level for a system or component of a system. Usually expressed in decibels.

Gap—The effective distance between opposite poles of a magnetic head, measured in microinches or microns. Especially critical for playback heads in which gaps must be narrow in order to resolve (reproduce) high-frequency (short wavelength) recordings. Recording heads generally have wider gaps than reproducing heads.

Harmonic Distortion—Distortion characterized by the appearance in the output signal of spurious harmonics of the fundamental frequency. Usually expressed as a percentage of the output signal.

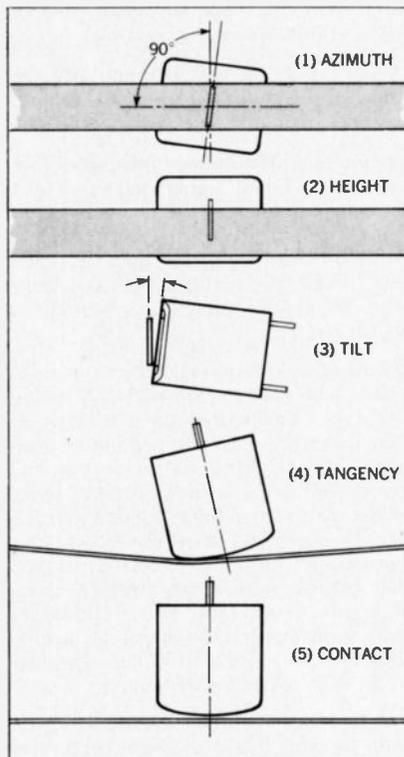
Harmonics—Overtones that are integral multiples of the fundamental frequency. In properly balanced a.c.-biased tape recorders, only the odd-order harmonics

(primarily the third) are generated by the recording process and these are very low in amplitude.

Head—In a magnetic-tape recorder, the generally ring-shaped electromagnet across which the tape is drawn. Depending on its function, it either erases a previous recording, converts an electrical signal to a corresponding magnetic pattern and impresses it on the tape (record function), or picks up a magnetic pattern already on the tape and converts it to an electrical signal (playback function). Most home recorders have a separate erase head, but combine the record and play functions in a single unit. Professional machines and those intended for the serious amateur have separate heads for erase, record, and playback.

Head Alignment—Includes all mechanical adjustments necessary to assure proper spatial relationships between the head gaps and the tape—or, more specifically, a properly recorded tape track. It may be separated into five attributes describing correct head attitude:

1. *Azimuth or skew*, in which the width dimension (corresponds to track width) of the head gap is at a precise 90-degree angle to the tape edge.



2. *Height*, in which the gap-width dimension is centered on the standard track location.

3. *Tilt*, in which the face of the head must be simultaneously tangent to the same degree with both edges of the tape and without distortion of either of the latter.

4. The adjustment to assure that the tape is tangent with, and contacting the

specific portion of, the head face containing the head gap, and remains so during the playing of the tape.

5. The adjustment toward or away from the tape to assure proper contact pressure ("wrap") between head and tape.

Head Demagnetizer or Degausser—A device used to neutralize possible residual or induced magnetism in heads or tape guides. Unless the recorder has an automatic head-demagnetizing circuit and non-magnetic tape guides, periodic use of a head demagnetizer may be necessary to avoid addition of hiss noise to, or even partial erasure of, prerecorded tapes.

Head, Hyperbolic—A tape-recorder head with faces so shaped that a minimum of tape tension is required to ensure good tape-to-head-gap contact.

Hz—The standard abbreviation (of hertz) which has replaced cps (cycles per second) as the term for the unit of frequency.

Impedance—The resistance to the flow of alternating current in an electrical circuit, generally categorized as either "high" or "low," but sometimes given in ohms or millions of ohms (megohms). Commonly used to rate electrical input or output characteristics of components so that proper "match" can be made when interconnecting two or more devices (such as a microphone, tape recorder, and loudspeaker). Power loss or frequency discrimination can result from a "mismatch" of impedances between two units.

Index Counter—An odometer type of counter that indicates revolutions (not feet of tape), usually of the supply reel, thereby making it possible to index selections within a reel of tape and readily locate them later on a given machine.

Input Signal—An electrical voltage embodying the audio information that is presented to the input of an amplifier, tape recorder, or other electronic component.

Input—The terminals, jack, or receptacle provided for the introduction of the electrical input signal voltage into an amplifier or other electronic component.

Intermodulation Distortion—Distortion that results when two or more pure tones produce new tones with frequencies representing the sums and differences of the original tones and their harmonics.

Inverter—Device to change one type of electrical current to another type. Frequently used to change 6- or 12-volt direct current to 120-volt alternating current for operation of an a.c. tape recorder in an automobile or boat.

Ips—Abbreviation for tape speed in inches per second.

Jack—Receptacle for a plug connector leading to the input or output circuit of

a tape recorder or other piece of equipment. A jack matches a specific plug.

kHz—Abbreviation for kilohertz, or one thousand cycles per second. For example, 19 kHz equals 19,000 Hz.

Leader and Timing Tape—Special tough non-magnetic tape that can be spliced to either end of a magnetic tape to prevent its damage and possible loss of recorded material. Either white or in colors, it usually has some type of marking that enables it to be used as a timing tape. It therefore can be spliced between musical selections to provide desired pauses in playback.

Level Indicator—A device on a tape recorder for indicating the level at which the recording is being made; it serves as a warning against under- or over-recording. It may be a neon bulb (now becoming obsolete), a "magic eye," or a meter. (See also *VU Meter*)

Loudness—Sound level as perceived by the average human ear, an organ more sensitive to "mid-range" frequencies than to low or high extremes, especially at low volume levels.

Low-Noise Tape—Magnetic tape with a signal-to-noise ratio 3 to 5 dB better than conventional tapes, making it possible to record sound (especially wide-frequency-range music) at reduced tape speeds without incurring objectionable background noise (hiss) and with little compromise of fidelity. Additional characteristics of most low-noise tapes include extremely good high-frequency sensitivity and a heavy-duty binder system for reduced ruboff of magnetic oxide and an increase in wear life over ordinary tapes.

Low-Print Tape—Special magnetic recording tape significantly less susceptible to print-through (the transfer of signal from one layer of tape to another), which results when tape is stored for long periods of time. These tapes are especially useful for "master recording" (making an original recording from which copies will be made) on professional-quality equipment.

Microphone—A sound transducer or device for converting sound waves into electrical energy of the same frequency.

Microphonics—A condition resulting from the mechanical vibration of some part (other than the microphone) within the electrical circuit of an amplifier, tuner, etc., that causes corresponding electrical disturbances in its output signal. It usually appears as a "bonging" sound.

Mil—One one-thousandth of an inch. Tape thickness is usually measured in mils.

Mixer—A device that allows two or more signal sources to be blended, balanced, and fed simultaneously into a tape recorder or amplifier.

Monophonic (Monaural) Recorder—Refers to single-channel recorders, as distinguished from stereophonic types. Current home recorders are almost all four-track stereo.

Monitor Head—A separate playback head on some tape recorders that makes it possible to listen to the material on the tape an instant after the recording is made and while the recording is still in progress.

NAB Curves—Standard tape-recorder playback equalization curves established by the National Association of Broadcasters. (See also *Equalization*)

Noise—Unwanted electrical signals produced by electronic equipment, heads, and also by rough or non-homogeneous oxide coatings on magnetic tape. Mostly confined to the extremes of the audible frequency spectrum where it occurs as hum and/or hiss, it may be reduced to negligible levels by good machine and tape design. (See also *Low-Noise Tape*)

Noise, Weighted—The noise measured within the audio frequency band using a measuring instrument that has a frequency-selective characteristic. The frequency sensitivity of the instrument is adjusted to correspond to that of the average human hearing response.

Octave—The interval between two frequencies of sound or electrical energy having a ratio of 2:1.

Output (also Maximum Undistorted Output)—The useful signal delivered by a recorder using a particular type of tape, usually at an arbitrarily fixed level of harmonic distortion (1 or 3 per cent) and relative to the performance of a tape with standard characteristics (such as Scotch No. 111).

Oxide—The ferro-magnetic particles which, when properly dispersed in a plastic binder and coated on a backing or base, form the magnetic portion of magnetic tape. Conventional oxide particles are chemically known as gamma ferric oxide, are brown in color, acicular (needle-like) in shape, and of micron length. Less conventional oxides have been developed that exhibit significantly different magnetic properties (and size). All oxides used in magnetic tape maintain magnetism induced in them until demagnetized by an external magnetic field.

Patch Cord—Sometimes called "signal lead." A short shielded wire or cable with a plug on either end (or with a pair of clips on one end) for conveniently connecting together two pieces of sound equipment such as a phonograph and tape recorder, an amplifier and speaker, etc. Not to be used for 120-volt current.

Pause Control—A feature of some tape recorders that makes it possible to stop the movement of tape temporarily without switching the machine from "play" or

"record" positions. Essential for a tape recorder used for dictation and generally helpful for editing purposes.

Playback—The reproduction of sound previously recorded on a tape. The opposite of *record*.

Playback Head—Magnetic head used to pick up a signal from a tape. Often the same head as is used for recording, but with its circuits changed by means of a record/play switch which also energizes the erase head. (See also *Head*)

Plug—A circuit connector that is inserted into a jack.

Polyester Base—A plastic-film backing for magnetic tape used for special purposes where strength and resistance to temperature and humidity change are important. (Mylar is a du Pont trade name for their brand of polyester.)

Portable Recorder—Originally, any tape recorder designed for easy mobility and requiring connection to a 120-volt a.c. supply for operation. Recently the term has been applied specifically to battery-powered units that do not require external power for operation.

Power Amplifier—An amplifier designed to produce sufficient power to operate a loudspeaker. (See also *Preamplifier*)

Power Cord—Cord for connecting the tape recorder to an external power source, such as a 120-volt a. c. line.

Preamplifier (also Preamp)—An amplifier that raises extremely weak signal levels (such as those from a microphone, magnetic playback head, or a phonograph pickup) to a level sufficient to drive a power amplifier. Some tape recorders combine the preamp and the power amplifier. Others—especially tape recorders designed for use as a built-in part of a high-fidelity music system—may include a preamplifier, but no power amplifier. The tape recorder's preamplifier usually includes the record and playback circuits.

Prerecorded Tape—Tape recordings that are commercially available and generally embody the same material that is available on phonograph records.

Pressure Pad—A device that forces tape into intimate contact with the head gap, usually by direct pressure at the head assembly. Felt or similar material, occasionally protected with self-lubricating plastic, is used to apply pressure uniformly and with a minimum of drag on the backing (non-coated) side of the tape.

Pressure Roller—Also called "pinch roller" or "capstan idler." A hard-rubber roller that holds the magnetic tape tightly against the capstan, permitting the latter to draw the tape off the supply reel and past the heads at a constant speed. (See also *Capstan*)

Print-Through—Undesired transfer of

magnetic pattern from layer to layer of tape on a reel.

Raw Tape—A term sometimes used to describe tape that has not been used for recording. Also called "virgin" or "blank."

Reel-to Reel—Designates those tape machines that do not use a cartridge or cassette. Also known as "open-reel."

Rewind Control—A button or lever for rapidly rewinding tape from the takeup reel to the supply reel.

Saturation—The condition reached in magnetic tape recording where output does not increase with increased input, and hence distortion increases significantly. Useful for defining reference output levels, since it is independent of bias current.

Sensitivity—As used to describe the capabilities of raw tape, it indicates the relative output for a given input in the linear (low-distortion) portion of a tape's magnetic transfer characteristic. Sensitivity data plotted as a function of frequency (or wave length) gives frequency response, usually relative to a standard reference tape.

Separation—The degree to which two stereo signals are kept apart. Stereo realism depends on the successful prevention of their mixture in all parts of a hi-fi or tape system. Tape systems have separation capability superior to that of disc systems.

Signal-to-Noise Ratio—The voltage ratio, usually expressed in decibels, between the loudest undistorted tone recorded and reproduced by a recorder, and the noise reproduced when the audio signal is reduced to zero.

Sound-on-Sound—A method by which material previously recorded on one track of a tape may be re-recorded on another track while simultaneously adding new material to it.

Splicing Block—A metal or plastic device incorporating a groove within which ends of the tape to be spliced are held. An additional diagonal groove provides a path for a razor blade to follow in cutting the tape. It makes splices very accurately using narrow-width ($\frac{1}{82}$ "") splicing tape. (See also *Tape Splicer*)

Splicing Tape—A special pressure-sensitive, non-magnetic tape used for joining two lengths of magnetic tape. Its "hard" adhesive will not ooze, and consequently will not gum up the heads or cause adjacent layers of tape on the reel to stick together.

Squeal—The audible noise caused by alternate sticking and release of tape. It may occur at heads, pressure pads, or guides where friction develops with the

face or back side of a magnetic tape. It is largely eliminated by regular cleaning of suspected surfaces and by using a tape employing a built-in dry silicone lubricant.

Takeup Reel—The reel on the tape recorder that accumulates the tape as it is recorded or played.

Tape Guides—Grooved pins or rollers mounted between and at both sides of the tape-head assembly to position the magnetic tape correctly on the head as it is being recorded or played.

Tape Lifters—A system of movable guides that automatically prevents the tape from contacting the recorder's heads during fast forward or rewinding modes of operation, thus preventing head wear.

Tape Loop—A length of magnetic tape with the ends joined together to form an endless loop. Used either on standard recorders, special "message-repeater" type units, or in four- or eight-track cartridge devices, it makes possible the repetitive playback of a recording without rewinding the tape.

Tape Monitoring—See *Monitor Head*

Tape-Transport Mechanism—The platform or deck of a tape recorder on which the motor (or motors), reels, heads, and controls are mounted. It includes those parts of the recorder other than the amplifier, preamplifier, loudspeaker, and case.

Tape Player—A unit that is not capable of recording and is used only for playing prerecorded tapes.

Tape Speed—The speed at which tape moves past the head in recording or playback modes. Standard tape speed for home use is $7\frac{1}{2}$ ips or half that speed ($3\frac{3}{4}$ ips). Speeds of $1\frac{1}{8}$ and $1\frac{5}{16}$ ips are found on some machines, but on reel-to-reel recorders are usually suitable only for non-critical voice recording. Some cartridge machines using special tape and circuits achieve very good results at the slow speeds. Professional recording speed (for making original master tapes of music, for example) is usually 15 ips and sometimes higher.

Tape Splicer—A device, similar to a film splicer, for splicing magnetic tape automatically or semi-automatically. Different models vary in operation, most using splicing tape; some professional units employ heat. (See also *Splicing Block*)

Telephone Pickup—Any of several devices used to feed telephone conversations into a tape recorder, usually without direct connection to the telephone line and operating by magnetic coupling.

Tensitized Polyester—A polyester tape backing that has been prestretched princi-

pally in the lengthwise direction for increased longitudinal strength.

Tone Controls—Control knobs on a tape-recorder amplifier used to vary bass and treble response to achieve the most desirable balance of tone during playback.

Track—The path on the magnetic tape along which a single channel of sound is recorded.

Triple-Length (or Triple-Play) Tape—An extra-long-play magnetic tape for maximum recording time on reels of a given size. It uses an ultra-thin but very strong 0.5-mil tensitized polyester base.

Two-Track Recording—On quarter-inch-wide tape, the arrangement by which only two channels of sound may be recorded, either as a stereo pair in one direction or as separate monophonic tracks (usually in opposite directions).

Uniformity—In terms of magnetic tape properties, a figure of merit relating to the tape's ability to deliver a steady and consistent output level when being recorded with a constant input. Usually expressed in decibel variation from average at a mid-range frequency.

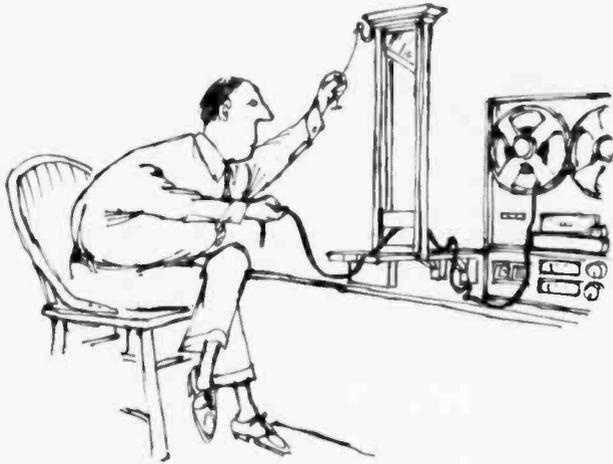
VU Meter—A "volume unit" meter that indicates audio-frequency levels in decibels relative to a fixed 0-db reference level. The meter movement differs from those of ordinary voltmeters in that it has a specified ballistic response adapted to monitoring speech and music. Used in many home and most professional recorders to monitor recording levels and maintain them within the distortion limits of the tape.

Wave Length—In tape recording (and referring specifically to the tape magnetization created by pure single-tone recording), the shortest physical distance between two points of the same magnetic polarity and intensity; also, when expressed in mils, the ratio of tape speed (in ips) to recorded frequency (in kilohertz).

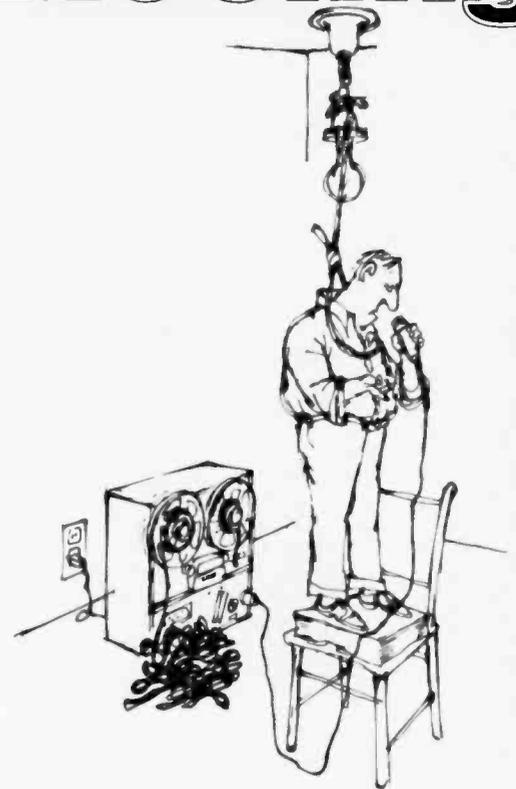
Weighting Characteristic—The shaped frequency-response characteristic of a measuring device used to produce more realistic indications of the subjective response of the ear than are obtained with unweighted (flat) measurements.

Wow—A form of distortion in sound-producing systems caused by periodic variation in the speed of the medium (such as tape) and characterized by its effect on pitch.

Wrap—The length of the tape's path along which tape and head are in intimate physical contact. Sometimes measured as the angle of arrival and departure of the tape with respect to the head. A "good wrap" means a good tape-to-head-gap relationship. (See also *Head Alignment*)



The Reeling

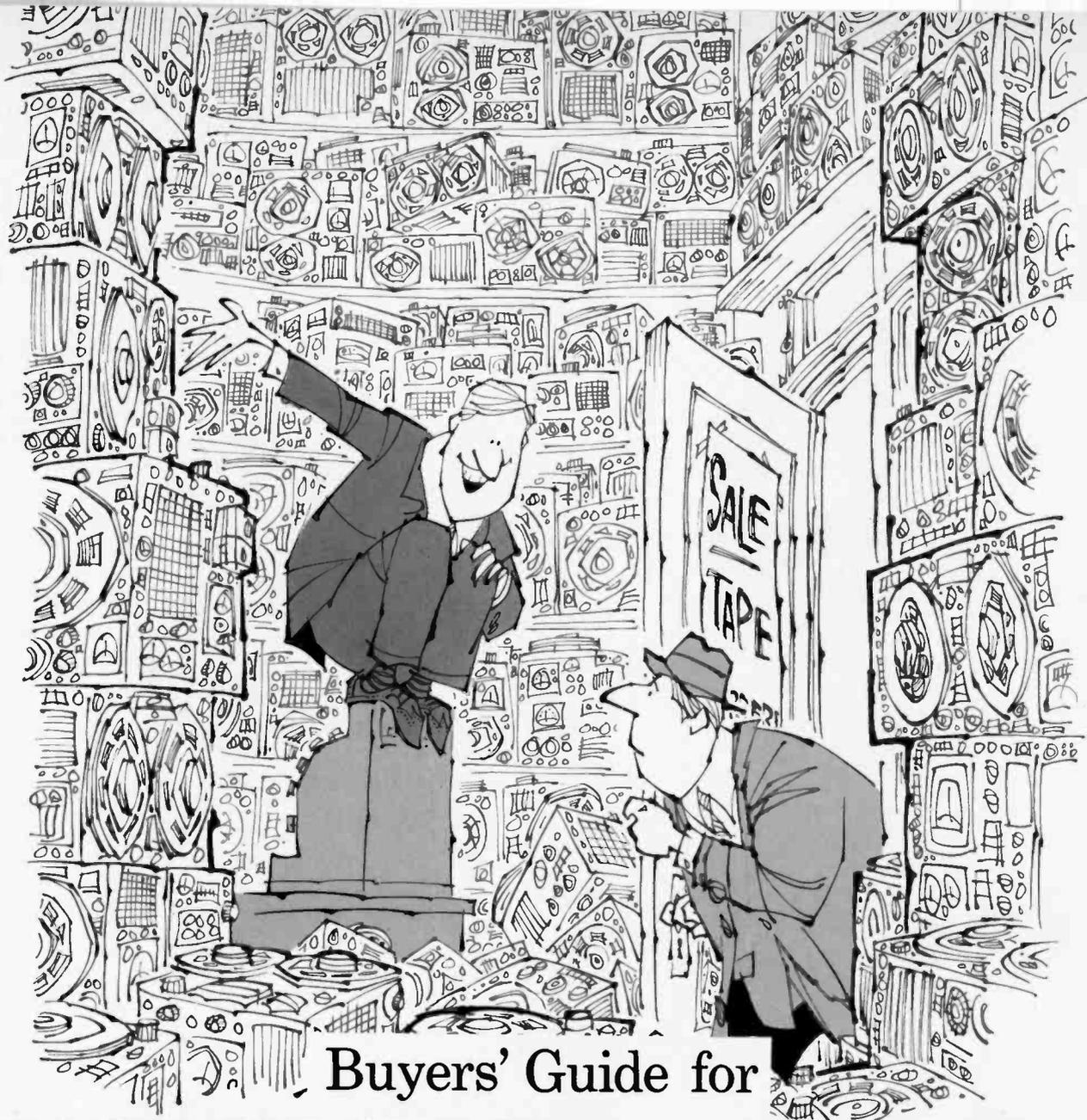




Mind

By Charles Rodrigues





Buyers' Guide for **TAPE-RECORDER SHOPPERS** **1. REEL-TO-REEL RECORDERS**

By Ernest Wayland

SHOPPING for a tape recorder can be a harrowing experience. If you approach the task lacking previous experience and elementary technical know-how, anything an audio salesman tries to tell you may simply result in confusion. With a little preparation, however, you can enter an audio store prepared not only to cope with a salesman's jargon, but also to make a wise selection from the almost limitless variety and brands of tape gear now available in all price ranges.

A good first step toward making an informed choice is a short survey of the basic types of tape machinery currently on the market. Beyond their

use of the same basic medium—magnetic tape—today's tape machines tend to have sharply divergent purposes, so let's start with a rundown of recorder types:

- *The All-Purpose Stereo Recorder:* The "standard" tape recorder is a completely self-contained machine that records and plays back stereo tapes, requiring no outside help beyond material to record and the microphones or shielded leads to do it with. It has a dual-channel (stereo) amplifier and two speakers (or sets of speakers); the speakers may be built in (usually facing outward from the left

and right sides of the machine), or detachable for greater stereo effect. Besides inputs for two microphones, the all-purpose machine generally has a pair of LINE or RADIO inputs for feeding in a signal from an external record player or hi-fi system for taping. It also has, more often than not, outputs for playing tapes back via a separate hi-fi system rather than through its own speakers.

- *The Tape "System":* Although some models look very much like the standard stereo recorder at first glance, the tape-system unit is meant to be something more. The tape system may be a three-piece affair consisting of a walnut center cabinet containing tape-transport mechanism, stereo amplifier, and controls, plus two separate speaker systems. The three pieces are intended to sit on a shelf or buffet—or to be mounted on a wall. What differentiates these systems from the all-purpose recorder described above is their intended role as the heart of a basic music system centered around tape. Instead of groups of outputs and inputs intended for connection to an external hi-fi set up, the modular tape system simply has provision for an auxiliary source such as an FM tuner (if it is not already built in) that can be played through the unit's centralized control facilities. Some modular systems have output jacks for feeding an external audio amplifier. This represents the manufacturer's way of hedging his bet. The tape compact system may include, in effect, a full stereo receiver. This makes it into a "stereo compact music system" that includes a tape mechanism rather than a record player.

- *The Tape Deck:* The polar opposite of the modular system is the tape deck, designed solely for connection to a component hi-fi system (or to a modular music system designed around a record player). The deck has no power amplifiers or speakers of its own. In its simplest version it is a playback-only unit, almost always with its own playback preamplifiers. It is used in connection with the tape input jacks on an amplifier or receiver. In its most complex form, the deck offers elaborate "professional" recording and playback features, and lacks only speakers and a power amplifier. At least one deck is now available with a small, high-quality stereo amplifier built in, but no speakers.

- *The Battery-Operated Recorder:* Made feasible by the transistor, the battery-operated portable recorder is decidedly a special-purpose machine that usually puts less emphasis on music (and fidelity) than on using a recorder camera-style for taping wherever you go. Not to be confused with the \$29.95 toys sold in the local drug store, the new generation of battery-operated machines (\$50 and up) offers respectable sound quality for recordings made away

from the comfort of your living room. Some of them have outputs for an external amplifier, and, when they use a standard tape speed (such as $3\frac{3}{4}$ or $1\frac{7}{8}$ ips) and provide a capstan drive, they often produce tapes that can be played back with good results on conventional living-room recorders. Unlike all the other types of machine discussed here, battery-operated portables are mostly two-track monophonic machines. However, there are a few reel-to-reel and cartridge stereo versions available.

- *The Cartridge and Cassette Machine:* Overlapping all the previous categories, the cartridge tape machines offer tape enclosed within a plastic cartridge rather than wound on a conventional open reel. You simply drop or push the cartridge in place, slide a lever or depress a button, and the machine takes over. The overall objective, of course, is to compete with the convenience of discs as a medium for sound reproduction. Aside from the battery-operated machines and the machines designed for use in cars, there are three major cartridge systems for home use at the moment. These are the eight-track, the four-track, and the cassette; all of which are discussed later in this article. Of the three types, you should be aware that the cassette units almost all have recording capability, while the four- and eight-track units seldom do.

If you find it impossible at this point to decide which of the foregoing basic types of recorder is the one for you, things are only as they should be. With the possible exception of the battery-operated machine, whose special purpose may well not be yours, all the kinds of machines mentioned are well worth seeing and hearing in operation before you choose one type over another. Each has decided strengths and weaknesses.

The modular or compact tape system approach implies that in the long run tape is more important to you than discs. If you are starting out with no record collection, this possibility may be worth considering. But in any case, a record player can be plugged into any of the systems. Based on the further assumption that you now own no audio equipment, the tape-system approach may save you both money and the extra space occupied by separate components. But it is in direct competition with equally appealing stereo-compact systems for playing discs, and it involves a good bit of possible extra expense if you decide later to upgrade your equipment.

The question of the deck *vs.* the all-purpose recorder is also worth careful consideration. The greatest appeal of the deck is in the lowest (\$100-\$200) and the highest (\$400 upward) price categories. In both price ranges, the deck allows you to make sure that every penny goes into features that won't

duplicate those you already have in your present hi-fi system. In the broad medium-price range, however, the complete machine is very often the better buy, since the fact that you can hear any tape you've made right on the spot encourages you to use the recorder outside the home as well as in conjunction with your regular audio system.

Whatever category of tape machine you ultimately decide to buy, you should be prepared in addition to take some time to look and listen for the best performance you can get for your money. There are many reliable ways to judge the quality of any machine that you should make yourself aware of.

One of the vital considerations in making tape recordings is how low a level of background noise you can achieve. This hinges on two factors: the recorder's inherent electronic and mechanical noise and its provisions for indicating maximum permissible recording level. Both factors can be judged only by making a recording in the store and listening to the playback over a wide-range audio system that will show up significant flaws. Aside from listening for a consistent noise problem of one kind or another, your main concern is to judge the effectiveness and ease-of-use of a machine's recording-level indicators, which should give a clear and reliable indication of how high you can set the gain without encountering distortion.

Although the "magic-eye" indicator is capable of the best reading of momentary peak signals, the level-indicating meter is most popular these days. There are excellent machines using either type of indicator, and you should not let the presence of a "professional" meter influence you toward the purchase of a machine that is otherwise not up to the level of some "magic-eye" machines. Exceptions to this rule are those machines that use a meter whose characteristics are accurately matched to NAB broadcast standards. If you are going to be recording for professional use, then a machine with real VU meters can be quite helpful. (Note, however, that the presence of the letters "VU" on a meter face does not make a VU meter. You may have to check with the manufacturer to determine how closely the meter actually conforms to the standard VU characteristic.)

If noise (usually hiss) seems too obtrusive in a machine that is otherwise appealing, or if you have difficulty in judging just how significant the noise really is, check against a machine that the salesman considers the best in the house. And when you encounter a machine that is mechanically noisy during play or rewind, be wary even if the noise is not audible over loudspeakers; there is a good chance that a variety of other problems will appear (some of them audible through the speakers) in the near future.

Another critical matter is a recorder's freedom from speed variations, particularly the short-term variations called wow and flutter. An "acceptable" amount of wow and flutter is the amount that you yourself cannot hear. To make the most of your critical faculties, you should record and play back on the same machine in order to do your listening, since the speed variations in both modes are added together in playback. And you should make a direct comparison with the music source (preferably a piano record) you are taping. Any amount of variation that is clearly audible is likely to be annoying when you get the recorder home, and you should not gloss over any audible difficulty in the store. Also check a machine's performance near the beginning and end of a reel, where any problems are likely to be aggravated and hence far more audible.

Overall sound quality is a function of frequency response and lack of distortion as well as an absence of the problems already mentioned, and it is often a matter of rather subtle judgments. In general, you can expect overall sound character to improve perceptibly as you move upward from one price class to another. The lowest-price recorders tend to have a slightly "grainy" or veiled quality that reflects somewhat uneven response and a degree of distortion at average recording levels. The medium-price machines are generally slightly restricted in frequency range (the restriction appears mostly in the high frequencies), but smoother in character. The expensive recorder should have an extremely transparent quality, with little or no audible difference between original source and tape in a direct comparison. A number of today's moderately priced machines can achieve this at 7½ ips, and some of the very best ones can do it at 3¾ ips.

One good index of quality is the presence of three separate heads, one each for erase, recording, and playback. The presence of separate heads for the recording and playback functions not only permits instantaneous comparison ("monitoring") between what is being put on the tape and the original program source, but insures that each head can be designed for optimum performance of its function. In comparing two machines of apparently similar quality, you may generally assume that the presence of three or more separate heads in one of them is a good indication of superiority.

In judging overall sound quality, an often-effective tactic is to compare the audible quality of a good commercially recorded tape and one recorded on the machine itself. If a machine seems to have good highs on its own recorded material but sounds dull and lifeless on commercial tapes, this is a good indication that the highs are artificially "peaked"

during recording to make up for a poor playback characteristic. Any marked difference between the two kinds of recordings usually indicates a non-standard frequency-equalization circuit in the recorder. As you go up the price ladder and seek out the subtlest sonic improvements, you should rely more heavily on the instantaneous and direct source-*vs.*-tape comparison.

Once you are beyond the lowest-price category, you should look closely at the way a recorder handles tape. It should start and stop smoothly at normal playing speeds, without spilling or jerking, and it should come to a quick stop from fast-forward or rewinding without breaking, stretching, or snarling tape. The more expensive the machine, the more you should insist on foolproof switching from one mode to another, with no spillage or breakage when it is reversed or thrown into the play mode from its highest speed. And, as mentioned earlier, you should consider significant mechanical noise at playing speed a portent of troubles to come.

One crucial difference between any two machines may be the ability to maintain initial quality. Inexpensive construction and light-weight materials may result in a recorder's top plate flexing or becoming permanently deformed, thus upsetting the critical alignment of tape to heads and guides and making correction of the misalignment extremely difficult.

This is but one of many problems that may develop because of inferior construction. Some compromises are inevitable in the construction of an inexpensive machine, but you can find surprising quality in some economy machines, and you should look for as much as you can find at any price level.

Once you have narrowed your choice to machines of apparently similar quality, you should look for convenience features that may make for greater utility or simply for more fun. Some machines, for example, offer self-threading, automatic playback reversing or automatic rewind at the end of a reel; others can change direction during playback or recording. Most stereo recorders offer sound-on-sound and virtually unlimited add-a-track facilities, while others have echo effects or slide-synchronization signals available. Many machines provide facilities for mixing of inputs and three- or four-speed operation. And at least one has a special noise-reduction circuit that enables the user to make exceptionally high-quality tapes at $3\frac{3}{4}$ ips.

Whether you are after a recorder of respectable but not ostentatious quality or one that makes hardly a concession to the mammoth used in the recording studio, you should be able to find it with a minimum of confusion and wasted shopping effort—provided you have armed yourself with a little knowledge before you walk into the showroom.

2. FOUR- AND EIGHT-TRACK RECORDERS

By Paul Edwards

FOUR-TRACK? Eight-track? How much will it cost? What about repertoire? Are my favorite performers available in cartridge-tape form? How expensive are the tapes? These are among the various questions a person might ask in weighing the purchase of a stereo tape-cartridge machine.

Initially, the four-track cartridge was king, simply because it was first on the scene. Today the picture is changing, with eight-track seemingly taking over. But for those who already have an investment in four-track cartridges, all is not lost, for there are a number of compatible machines that play both four- and eight-track cartridges.

Four-track equipment and cartridges are cheaper than eight-track. A four-track machine can be bought for as little as \$29.95, installed with two speakers for an additional \$20, on the West Coast; the same machine and installation will cost perhaps \$10 more on the East Coast.

According to Joe Wally, a partner in Wally's Stereo Tape City, a New York City sales and instal-

lation firm for tape-cartridge equipment, the lowest price for a "worthwhile" name-brand eight-track tape player is about \$100, installed with two speakers. Compatible (both four- and eight-track) name-brand machines start at \$130 installed. Wally admitted that there were lower starting points in the eight-track and compatible machines, but claimed that the equipment was not fully reliable. He pointed out that although the compatible machines cost more, the difference could be amortized in time by the purchase of lower-priced four-track cartridges. Four-track cartridges start at \$4.95, with some selling for \$5.95. Eight-track cartridges start at \$6.95 for popular music and \$7.95 for show albums. Classical music is \$8.95. Twin-packs—double-length tapes—cost \$9.95.

Proponents of the four-track system insist that four-track tapes sound better than eight-track because the individual tracks are wider in four-track. Proponents of the eight-track approach insist that their tapes sound better than four-track because of

better quality control. To my ears, any theoretical advantage that the four might have over the eight—or *vice versa*—are cancelled by road and motor noises when the tapes are played in a car. Theoretically, four-track tapes should give a better signal-to-noise ratio. However, there are many problems in the mass-production duplication of the tapes. One of them is the factor of the quality of the blank tape, which can vary within one manufacturer's line and from manufacturer to manufacturer. The question of top sound quality in cartridge form is not critical, however, because most people who want this format are aware that the highest-quality sound is obtainable only from open-reel tapes. They buy the cartridge for its greater convenience and ease of handling in the car and in the home.

What about the availability of prerecorded tapes in the two formats? There is an abundance of both types. Perhaps eighty per cent of the music in cartridge form is available in *both* four and eight track, though you are more likely to find off-beat rock-and-roll groups on small independent labels in the four-track format. On the other hand, RCA does not produce four-track cartridges; people who want RCA artists in cartridge form *must* buy eight-track.

So much for the merits of the two formats. What about choosing a playback machine? There is a broad selection, covering auto players, double-duty auto/home machines, portable battery-operated eight-tracks, and machines designed for home use exclusively. They range from simple decks (meant to be plugged into a hi-fi system) on up to three-piece ensembles (tape player and two speakers).

The amount of space you have available is the first consideration in buying a cartridge player for your car. Some units are relatively bulky, while others are quite compact. You may find that the former appeal to you for reasons of price or appearance, but that the latter are more appropriate for your particular car. The extra inch of depth required by a bulky machine may mean bruised knees, snagged nylons, and other minor tragedies or discomfort.

A second consideration is price. As noted above, four-track sets start at about \$50 installed, eight-tracks begin at \$100, and compatibles start at \$130. In general, you get what you pay for. Avoid what appear to be super bargains. There are many fly-by-night concerns importing cartridge-tape players, and once they make a "killing" by distributing their products on a blanket basis around the country, they vanish from the scene, leaving dealers and consumers alike with no place to get the units serviced. Deal with a retailer or installer who handles "legitimate," well-known, major brands that have a good reputation behind them.

Service is a major consideration. Can the retailer you bought the machine from provide the follow-up service? At present, few players are perfect—they all may break down in any one of a variety of ways. Remember, a tape player is both an electronic and mechanical device, which doubles its potential for malfunction. One value of a national brand name is that the manufacturer of the national brand is likely to provide service all over, not in just a small area of the country, as some lesser brands do.

If the retailer cannot install the machine, can he recommend a reliable installer? Some installers are regular auto-service garages that have taken on installations as a sideline. The quality of their work may range from excellent to bad. The nature of the industry is such that an organization specializing in player installations is a better bet than the sideliner. A full-time installer is in close contact with both industries, knowledgeable about changes taking place in player equipment, and aware of how auto producers are modifying their products. Structural changes in a later-model car can lead to complications for the uninformed installer who operates on a sideline basis.

What should one look for in an auto player? Most have major features in common and operate in a similar manner. With the eight-track machines, you push a tape cartridge into a slot after flipping a switch, and—presto!—out comes music. The music continues until all four pairs of tracks have played, and then the tape begins to repeat itself. With a four-track machine you slip in a cartridge, engage a lever, and the unit plays through the first pair of tracks. Then you flip a lever, and the machine plays the second side. Some units have lighted indicators to show which stereo tracks are playing, as a means of determining what selections are upcoming. All of the machines have a balance control to obtain proper stereo effects, and they all, of course, have a volume control. The better instruments also have a tone control. Some units have a track-selector that enables you to set the next upcoming pair of tracks into operation.

The foregoing are the basics. Some deluxe machines have a track-aligning device, which in some models is called a "fine-tuning" control. This permits the user to line up the playback heads perfectly with the sound tracks, to eliminate the bugaboo of crosstalk, common in eight-track operation. Some machines, both low- and high-priced, have a cartridge-slot cover to keep out dust when the set is not operating. This feature is important where the car is operated under dusty driving conditions.

As a safety measure, it is wise to seek a machine with softened or rounded edges. As for looks, this is a

personal matter. In regard to size, the slim-line models will generally do the trick if space is at a premium. But you might also consider the possibility of "mini" units that can be fitted into a glove compartment (at the expense of this very useful storage space, of course).

Virtually all of the players come with two speakers and the required installation assemblies. Two speakers are adequate for most cars, but many drivers like four for a heightened stereo effect and "sound-all-around," front and back. All of the sets have more than enough power to handle the speakers. There are at least a half dozen companies producing compatible auto players that handle both four- and eight-track cartridges. These generally have the same basic characteristics as the individual four- or eight-track units.

The array of products for those seeking a cartridge player for the home is substantial. There is a greater selection available with instruments in deck, ensemble, and portable form, and a few even offer recording capability. The home machines are virtually all eight-track or compatible types and feature the same basic operating characteristics and controls as the auto players. The only real difference is that the home units operate on the 120-volt a.c. house current instead of batteries, and they are usually installed in wooden cabinets.

Eight-track decks start at \$59.95, and run to about \$139.95 for a compatible unit. There is one four-track model at \$99.95. These decks operate through an existing hi-fi system. There are also a few eight-track decks with built-in amplifiers on the market. These require only auxiliary speaker systems to be operational. They range from about \$99.95 to \$259.95.

Complete ensembles operating from house current begin at \$99.95 for an eight-track outfit and range up to \$159.95 for a compatible set. This group includes auto/home players that plug into the cigarette lighter of the car or the a.c. outlet in the home. In auto use the sets straddle the transmission hump in the front of the car. The ensembles include two separable speaker systems. These sets all have enough output to fill a living room satisfactorily. There are a few table-top models in this range with built-in speakers. There are also a few component-type eight-track ensembles on the market containing record players. They range in cost from about \$260 to over \$500 for units with built-in stereo tuners.

For the venturesome, there are a couple of sets that offer recording capability. One such deck unit, Kinematix Model KX900, at \$169.95, permits both four- and eight-track recording. The Model KX1000 can record and play back eight-track cartridges in mono or stereo and has input jacks for a stereo tuner, microphones, and a stereo phono cartridge. It sells for \$299.95. Sony's TC-8, which sells for \$129.50, can record or play back eight-track cartridges. Two models from Roberts, one at \$389.95 and the other at \$429.95, offer eight-track recording and playback as well as four-track stereo open-reel recording and playback capability.

A handful of the eight-track auto players are also available with built-in AM or FM tuners, at somewhat higher cost (from \$20 to \$40). Such sets are generally a bit bigger in one or more dimensions. Gaining popularity are plug-in tuners, which fit into the cartridge slot. These same tuners can make a home or auto player into a radio-tape player combination. The tuners start at about \$49.50 and are available in AM, FM, and stereo FM versions.

3. CASSETTE RECORDERS

By Felix Prinz

BACK IN THE autumn of 1964, Norelco put a cassette recorder, the Carrycorder Model 150, on the American market. At first, the machine was pooh-poohed as just another cartridge machine. Then, suddenly, everyone was talking about the little unit. Overnight the tape-recorder industry moved a giant step forward, and it has been moving swiftly ever since. Although there was only a single cassette recorder model four years ago, there are over a hundred on the market today.

The main appeal of the cassette system is that it is such an easy way of handling magnetic tape. (Incidentally, "cassette" is the word used to differen-

tiate the Philips type of tape cartridge from the others that are currently available.) In operation you put the cassette into place in the recorder (or playback unit), push a button or flip a lever—and presto, you're in business. When the tape has run through, it stops by means of a combination of tension and a frictionless clutch assembly. For play to continue, you remove the cassette and flip it over. After the second side runs through, the machine stops again. Each side of the tape plays for thirty, forty-five, or sixty minutes, depending on the cassette tape length you select. Flipping the cassette to hear the other side is a cinch—it can be done in

hear the other side is a cinch—it can be done in less than five seconds. It is no wonder that lots of people suspect that if the phonograph record is ever to be replaced it will be replaced by the tape cassette.

Also appealing is the small size and light weight of the cassette recorders. Single-channel, monophonic pocket recorders weigh as little as three pounds, and there is one specialized instrument at a mere one pound and three ounces. They can be as small as $3\frac{1}{2} \times 1\frac{1}{2} \times 5\frac{1}{2}$ inches, a true coat-pocket size. You can take them virtually everywhere and be ready to do an effective recording job, on the sly or in the open. They are ideal working tools for people in many different occupations, an ideal aid in education, and an amusing instrument for the average person.

A third attractive feature of cassette recorders is

their compatibility between the monophonic and the stereo modes. Because of their unique track layout—with stereo tracks running in adjacent pairs—a prerecorded stereo cassette can be played back monophonically on a mono machine, and, conversely, a half-track mono tape can be played back (in mono) on a stereo machine. Thus a person might do his taping on a little portable and play the tapes back on a home stereo machine. Or a person might take along a handful of prerecorded stereo tapes to play on his mono cassette portable at the beach.

Cassette players and recorders come in a variety of small, medium, and large sizes. You can buy a name-brand playback-only unit for as little as \$30, a name-brand mono portable recorder for as little as \$50, or you can move all the way up the price scale to almost \$500 for a component stereo-compact ensem-

CARTRIDGES: 4-TRACK, 8-TRACK, AND CASSETTE

By Larry Klein

AN INSIGHT into some of the reasons for the popularity of the cassette-type tape cartridge can be gained by examining the physical and electrical features that distinguish it from the four- and eight-track cartridges. (Incidentally, the term "cassette" was apparently simply to differentiate the Philips-developed cartridge from the other available types.) One of the most significant factors, to my mind, is the relative physical sizes of the cartridges: the cassette measures approximately $\frac{3}{8} \times 2\frac{1}{2} \times 4$ inches, as contrasted to the size of the four- and eight-track cartridges, which measure approximately $\frac{7}{8} \times 4 \times 5$ inches. The contrast is pointed up by the fact that four cassettes will fit physically into the space occupied by one of the other types. The radically smaller dimensions of the cassette are significant not only in respect to advantages in storage and handling, but also in that it allows the machine that plays the cassette to be similarly compact.

The hub-to-hub arrangement of the tape in the cassette—as opposed to the continuous-loop setup used in both the four- and eight-track cartridges—has certain mechanical tape-handling advantages. For example, unlike the four- and eight-track machines, cassette units incorporate a fast-forward and rewind function. This makes it possible to find a desired selection on the tape with about the same ease as with a reel-to-reel machine. (In this respect, all cassette machines would benefit enormously from having an index counter, but unfortunately this feature is not yet standard.) By contrast, only a few of the four- and eight-track machines have a fast-forward or "wind" function, mostly because of the mechanical difficulty inherent in pulling the tape rapidly from the center of the reel and wrapping it around the outside of the reel as is required by the continuous-loop format.

Another, and equally significant, factor in the rapid

growth of the cassette medium is the cassette's ability to record. Very few of the cassette machines lack a recording function. Even fewer of the four- and eight-track machines have it. This results partly from the difficulty of home recording in the eight-track format where the problems of crosstalk and track-location accuracy are difficult, although not impossible, to solve.

In respect to playing time, there is little to choose from among the three cartridge types. Since, as has been indicated, the four- and eight-track machines rarely have recording capabilities, there is not much point in discussing that aspect. In respect to prerecorded commercial tapes, the manufacturers in general provide the equivalent of one disc album per cartridge.

At this point in time, it is hazardous to state what the relative fidelities of the three systems are—or predict what they could be. On the face of it, the four-track format (which has about the same tape-track width as the standard reel-to-reel four-track stereo prerecorded tapes) should theoretically provide the best signal-to-noise ratio in playback because of its wider track in comparison with the eight parallel tracks on quarter-inch tape used in the eight-track cartridges and the four tracks on $\frac{1}{8}$ -inch tape used in the cassette. The situation is further complicated by the fact that both the four- and eight-track cartridges operate at $3\frac{3}{4}$ ips, whereas the cassette runs at $1\frac{7}{8}$ ips.

It is also difficult to make valid comparative listening tests among the various types because of the variability in fidelity of the recorded material. None of the prerecorded cartridges has achieved the sound quality—in respect to noise, frequency response, and dynamic range—that is usual in prerecorded reel-to-reel tapes. In general, it seems fair to state that the average fidelity of all three of the prerecorded cartridges is at

ble featuring a cassette tape mechanism, record player, and AM/stereo FM tuner—all of which creates decision problems for someone who wants to buy a cassette machine.

One of the first questions you'll have to ask yourself is "What do I intend to use it for?" If it is to play prerecorded cassettes only, you can buy a coat-pocket-size playback-only unit for \$29.95. These sets are simple, battery-operated affairs with only two controls—combined on-off switch/volume control and a mode control (play, fast forward, and rewind).

If you want to record on the go, free of the power cord, then a battery-operated monophonic portable under \$100 might be the right machine for you. Such a machine with a major brand label will cost you around \$49.95 at the bottom of the price scale. You may run across one offered as a sale "special" for a few dollars less, especially if you live in or near

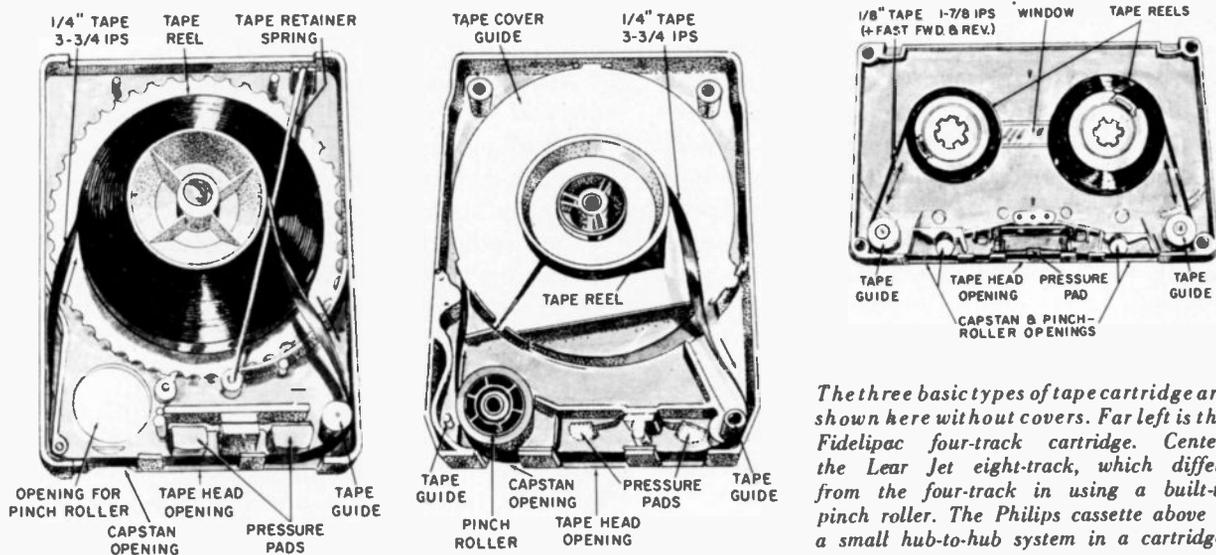
a big city. For \$10 more you can buy a similar set that will also play on house current, or for about the same \$10 (and even less) you can pick up an adaptor that will enable your battery portable to play on house current to save drain on the batteries. This type of machine is basic, offering relatively good quality of sound in playback (related, of course, to the power of its internal amplifier and the size of its built-in speaker), and it will do a good job of recording as well. Virtually all machines in this group come with a remote-control microphone, handy if you use the set for dictation or stop-and-go recording. If you are buying one of this group mainly for dictation, check how quickly it starts and stops and if there is any time lag between the start of tape movement and the time recording actually begins. If there is a noticeable time lag, it might call for conscious timing in use, which is distracting

about the point that reel-to-reel was as of five years ago. Some of the fidelity problem is undoubtedly a product of the duplication process, and some results from inadequate heads or electronics in the machines, but it is difficult to apportion the blame precisely. In my opinion, none of the systems is presently suitable for high-quality reproduction of classical music. The wow and flutter characteristics of the machines become disturbingly apparent on piano works, and their hiss level is obtrusive during quiet passages. The compression of the dynamic range applied to the four- and eight-track cartridges to make them suitable for automobile-player use (this has been discussed in my STEREO REVIEW column) degrades the sound excessively on classical material. And, of course, there is the loss of the very highest frequencies as mentioned in the accompanying report.

None of the above criticisms is particularly pertinent

when applied to cartridge recordings of pops or rock material. Since, in general, the dynamic range of such music is compressed during the original recording process and quiet passages are few, all three of the cartridge systems appear to do equally well in reproducing non-classical material. For a dance party, for example, the eight-track machine with its automatic sequencing of tracks is ideal.

That, in brief, is the status of tape cartridges at the moment; it is too soon to attempt a precise prediction as to where they are going. I expect all three systems to improve significantly—that is, if, in the minds of the manufacturers, public acceptance warrants further investment in research and development. As of now, they have a fascinating potential and many valid uses, but for those concerned with attaining the *best* in high-fidelity music reproduction, the cartridge machine is not yet the answer.



The three basic types of tape cartridge are shown here without covers. Far left is the Fidelipac four-track cartridge. Center, the Lear Jet eight-track, which differs from the four-track in using a built-in pinch roller. The Philips cassette above is a small hub-to-hub system in a cartridge.

when you want to concentrate on what you are saying.

In the foregoing group, which runs up to \$100, some of the more expensive sets are larger, have bigger speakers, are of better overall quality, and have better frequency response and signal-to-noise ratios. Some have automatic-level control (ALC) which eliminates fiddling with the volume control in a live recording situation. There might also be a tone control or a cassette ejector, which makes cassette removal easier. Most people find that a machine with piano-type keys or pushbuttons provides maximum ease of operation.

If you intend to use your cassette recorder only indoors, you might consider a larger-size self-contained table-top unit. Sets of this type run from about \$100 to \$140 as monophonic machines. Some of these come in typical portable housings of plastic, but a number of them also come in attractive walnut wood enclosures and fit into almost any decor. Some also include a tuner to permit recording off the air with a mere flick of a switch. Many businessmen use table/desk model recorders in their offices for dictation or for recording conferences.

If you want to be able to play and record in stereo on the go, consider the self-contained battery-operated stereo cassette recorders. These begin at about \$140 and range to about \$160. They also include an external adaptor or built-in circuitry that permits operation from house current. Most such units have detachable wing speaker systems that can be positioned for optimum stereo effect. There's at least one battery machine for under \$200 that includes an AM/stereo FM tuner, which permits recording off the air.

For those who want to record and play stereo at home only, there are many straight non-portable a.c.-operated table-model ensembles to choose from. Most come in wooden housings and have separate speaker systems in matching woods. A few models come in matched plastic housings. Such systems permit recording from auxiliary sources, and have input jacks for such use. The ensembles have speaker systems quite adequate for non-critical use, or these can be connected to a hi-fi system if more volume and higher quality are desired. Sets in this category range from \$160 to \$270. Two or three higher-price units incorporate a cassette changer, and a few ensembles also contain built-in AM/stereo FM tuners for direct recording of radio programs. These systems are easily mounted on bookshelves or in room dividers.

There are a handful of deluxe ensembles available in the \$400 to \$500 range for those who want an all-in-one table-model compact music system. Such

systems consist of an AM/stereo FM tuner-amplifier with a built-in record changer and cassette recorder plus a pair of matched speaker systems.

If you already own a stereo hi-fi system, you can easily and inexpensively add a stereo cassette playback deck ("deck" means no speakers or amplifier) or stereo record/playback deck to enlarge the system's capabilities. Just hook it in via two or four patchcords in a matter of minutes. Stereo playback-only decks are priced in the \$50 to \$60 range. At least two companies sell playback-only changers, priced at about \$130, which handle up to six cassettes, playing them automatically one after the other.

Cassette decks with record and playback capabilities begin at around \$110 and range to about \$140. These permit full operation, using the hi-fi system's amplifier and speaker systems as well as tuner if it contains one.

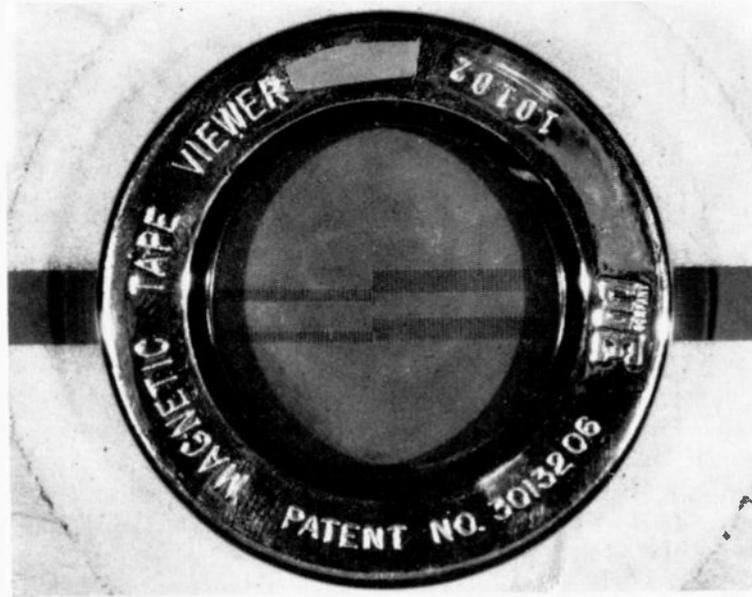
You can have a cassette recorder in your automobile too. Some firms that sell battery portables have a mounting bracket that makes it possible to use their machines in an automobile, playing through either the recorder's speaker or the existing radio speaker in the car. A handful of companies sell cassette recorders made specifically for auto use in both mono and stereo. One mono outfit sells for \$69.95. For \$119.95 to \$149.95 you can get units that offer stereo playback and also permit monophonic recording.

Among recent developments in the field are cassette radio tuners. These devices, the size and shape of a tape cassette, are actually miniature tuners that utilize the amplifier and speaker portions of a cassette recorder to convert it into a radio/cassette recorder. They fit into the player in place of the cassette, operate on a miniature dry cell, and have a claimed frequency response of 80 to 12,000 Hz. Prices start at \$11.95.

Another development is automatic reversing at the end of a side. This feature will no doubt be adopted by many manufacturers, and it promises to make the cassette recorder an even more popular electronic home-entertainment product.

One company is offering a \$99.50 portable recorder that is designed to be used with a home-movie camera to provide accurately synchronized sound tracks. The unit can also be used as a conventional cassette recorder.

A final note: as with other commodities, you get what you pay for in cassette recorders. A general rule of thumb is that if a given trio of recorders have the same features, the highest-priced of the three will be the best in terms of overall performance. It is also more likely to perform for a longer period before it needs maintenance.



The difference between the track widths of a half-track recording and two tracks of a four-track recording are illustrated by 3M's tape viewer placed over a spliced length of quarter-inch magnetic tape. Minute iron particles in suspension in the viewer trace out the magnetic modulations on the tape.

RECORDING TAPE: A SHORT PRIMER

EXPLORING THE QUESTION OF WHICH TAPE TO USE
FOR VARIOUS RECORDING PURPOSES

By WILLIAM H. MADDEN

FOR SOME people, tape recording becomes fraught with mystery and confusion the moment they have to buy a new reel of tape. Should they choose acetate or polyester base? Which reel size? Which length or thickness—300, 600, 900, 1,200, 1,800, 2,400 or 3,600 feet; ¼, ½, 1, or 1½ mil? And should it be low-noise, all-purpose, high-output, low-print, master, standard, extra-strength, double-length, or triple-length? Tensitized, nontensitized, or lubricated?

Despite the profusion of lengths and types, there is no real mystery connected with magnetic tapes. In order to answer the question "What kind of recording tape should I buy?" it is helpful to be aware of some basic tape facts. All tapes have three things in common: (1) the "active" recording medium, or oxide; (2) a flexible backing (or base); and (3) a binder to join the oxide to the backing.

The question of which backing is best has been argued nearly as long as tape recording has existed. A tape's backing determines its physical characteristics—resistance to tearing or stretching, ability to bend and flex, and reaction to temperature and humidity. The first crude German tapes and those first introduced in the United States in 1947 had paper backings. While easily torn, paper backing was relatively immune to the effects of temperature and humidity. But its surface could not be made

smooth enough to permit an even coating of oxide. Nor could it be made thin enough to accommodate more than about 20 minutes of recording time (using a large reel of tape at the very fast 60 or 30 ips speeds required in those days).

About a year later, the first *plastic* base was developed. Today this is known as cellulose acetate or, more popularly, just acetate, and many inexpensive or all-purpose tapes are now generally backed with acetate. Some recordists prefer it because of its non-stretch, clean-break characteristics, which make it easy to splice. Since all tapes stretch before breaking, it is more correct to say that they have a yield (or stretch) point as well as a breaking point. How much force it takes to reach these points is a function of the tape's strength. Obviously, the yield point of any tape should be such that the rewind, fast-forward, and stop modes of a normally adjusted recorder will not stress it unduly.

Acetate backings have a yield point at about 5 per cent elongation, which means that tape stretched to this degree (or below) will return to its normal length without any effect on the tape's performance. Stretched beyond this point, the tape becomes permanently distorted and breakage will occur at about 25 per cent elongation (stretching), depending on the relative humidity.

Acetate backings have a plasticizer that causes

Uneven dispersion of the oxide particles in a tape coating (shown in the photomicrographs to the right) results in high hiss levels that reduce the available dynamic range of the tape. This problem can also lead to high-frequency losses in both recording and playback.



them to absorb more moisture under conditions of high relative humidity. This results in greater flexibility and more stretch before breaking; conversely, acetate tapes become brittle under conditions of low humidity. Excessive brittleness, or "aging," is really the loss of the plasticizing agent brought about by storage under conditions of low humidity or high temperature.

The effect of humidity on acetate can be illustrated with an extreme example: if the relative humidity were to drop from 90 to 30 per cent, a 1,200-foot roll of tape with acetate backing would shrink almost 11 feet. If the reel were tightly wound (and it shouldn't be), this could cause cupping or other physical distortions of the tape surface, rendering it useless.

Enter polyester. Nearly 85 per cent of all types of magnetic tapes (including computer and video tapes) are now manufactured on polyester backings. (The term "Mylar," a proprietary name, refers to only one brand of polyester backing in current use.) Polyester backings have two substantial advantages: stability and strength. Like acetate, polyester becomes permanently distorted (and useless) when stretched beyond the 5 per cent yield point—but it takes twice as much tension to reach this point, compared to acetate. Unfortunately, polyester will elongate anywhere from 90 to 150 per cent before it breaks. To minimize the effect of this characteristic, some tapes are "tensitized," that is, evenly prestretched during manufacture to prevent further stretching during normal use. The strength of polyester backings has made possible the production of extremely thin tapes. Obviously, the thinner the tape, the more tape—and hence recording time—can be accommodated on a reel of a given size. These thinner tapes are known variously as double-length (or double-play), triple-length, and so forth.

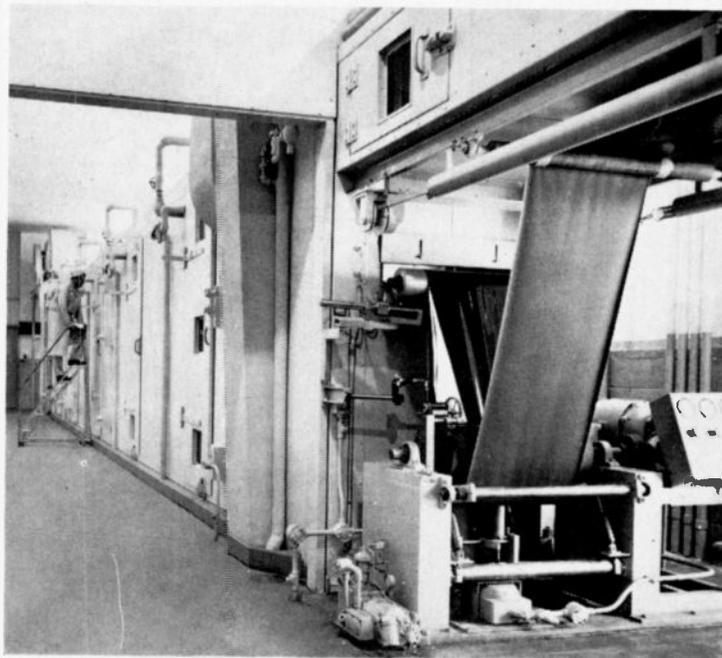
Temperature affects both backings in about the same way, although acetate is somewhat more sensitive. In general, the higher the temperature, the more flexible each backing becomes. Humidity, on the other hand, does not affect polyester tape. This

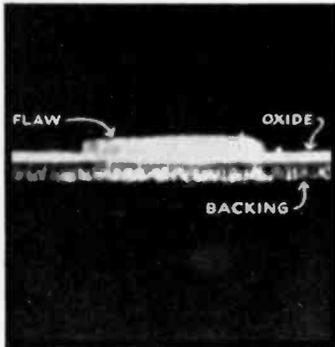
kind of backing requires no plasticizing agent and suffers no apparent aging, which makes it ideal for long-term sound storage.

The second constituent all tapes have in common, the binder, is a formulation that holds the oxide particles to the backing and insulates them from each other. A good binder will not become stiff, brittle, or sticky under extremes of temperature and humidity. It should also have the same properties of expansion and contraction as the backing so that the tape will not cup or curl and will pass smoothly over the recorder's heads and tape guides.

Plasticizers and lubricants are added to the binder mixture during manufacture rather than later. Lubricants prolong the life of the tape and of recorder parts that come into contact with it. They also eliminate annoying squeal, caused by the tendency of a tape to alternately stick and slip as it passes over a head. The dry silicone lubricant used in some tapes actually leaves a minute protective coating on re-

Finished tape emerging from the end of an automated magnetic-tape coater at the completion of the oxide-coating process.





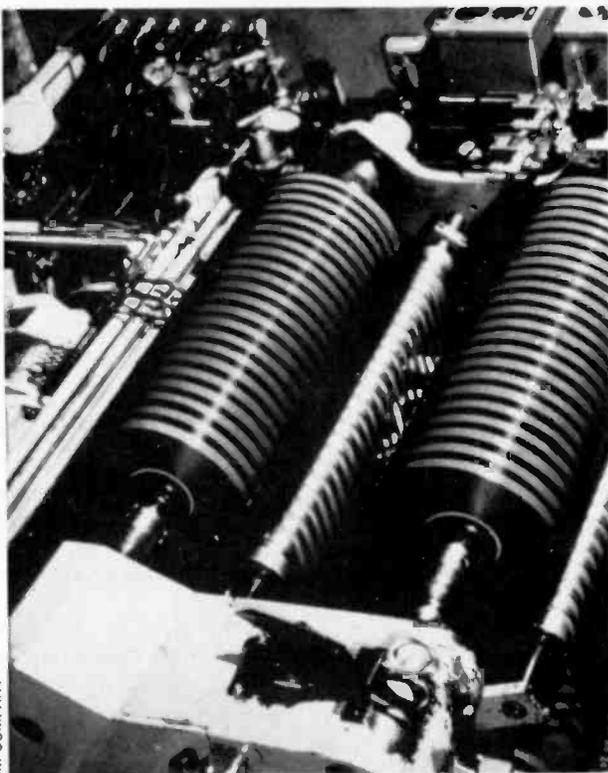
Dropouts can be caused by an oxide clump in the tape coating, shown in frontal (left) and cross-sectional (center) photomicrographs. A blister in the tape backing (right) is reflected in the coating and can cause not only dropouts, but also oxide flaking.

corder heads as the tape is played, and lasts for the life of the tape.

Magnetic-tape oxides determine the electrical characteristics of a tape—its performance in the areas of recording, storing, and reproducing signals. The oxide itself is composed of minute iron-oxide particles in a uniform coating held to the backing by the binder. Ideally, an oxide formula should provide uniform output and should be magnetically "soft." A magnetically soft tape is one that can be easily erased or re-recorded but nonetheless retains its magnetic properties during storage.

The first oxides, developed for paper-backed tapes, provided good reproduction but were difficult to erase—the old signal would come through even when the new material was recorded over it. The reddish oxide formulations developed for the first plastic bases resulted in tapes that could be easily erased, but they had to be recorded and played back at high speeds in order to reproduce a full range of

The tape is slit to the desired width and wound on hubs by a machine that must be accurate to within $\pm 2/1,000$ of an inch.



frequencies. Better oxides—with smaller particles dispersed more uniformly—have since been developed, enabling a machine to record at speeds of $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, and even $15/16$ inches per second and still produce a usable signal.

Two special oxide formulas—dark green and black in color—have been developed to solve certain recording problems. The first, a high-output oxide, has a signal output that is 6 dB greater (for a given record-head signal input) than the now-standard red oxide. Therefore, tape with high-output oxide is particularly useful with recording equipment that has excessive noise or hum, because it is possible to achieve a desired signal strength with less playback-amplifier gain than is needed by standard oxide, and decreasing amplifier gain decreases the noise. The high-output oxides are also able to accommodate sudden loud signals or surges without overloading (distorting). Conversely, they are especially sensitive to weaker sounds.

The latest oxide development (intended originally for use in professional mastering at speeds of 15 ips and higher) resulted in low-noise tape. This special oxide, which is black, has reduced background tape hiss or noise by 6 db. Low-noise tape also has a built-in high-frequency boost that helps maintain a wide frequency response at the slow tape speeds. Although such tape is premium priced (it costs perhaps 30 per cent more than all-purpose tape), its ability to record twice the material per reel at slower speeds—without serious sacrifice of reproduction quality—becomes an economic consideration for the home recordist.

THE properties of various types of tape are important in deciding which kind to buy; the other big consideration is obviously the purpose for which you intend to use it. A visit to any well-stocked electronics outlet will prove that there is literally a tape for every purpose, as evidenced by the profusion of types and brand names.

If you intend primarily to make recordings of speeches, interviews, and the like, in which wide

range response is not important, a standard or all-purpose tape is best from the standpoint of economy. If a long conference is in the offing, try one of the thinner double- or triple-length tapes at the slower recording speeds.

For music, an all-purpose tape on the average machine can provide good results at the $7\frac{1}{2}$ -ips speed, and a low-noise tape can offer equivalent fidelity at $3\frac{3}{4}$ ips. Tapes are offered in various lengths on reels of different sizes, so it would be wise to consult a recording-time chart to pick the one closest to the length of the selection or selections to be recorded. If the music has a wide dynamic range—that is, contains extremes of loud and soft passages—or if you are copying a second- or third-generation tape, perhaps a high-output tape might be best. Both high-output and low-noise tapes will keep background noise to a minimum.

When long life is a factor, select a polyester backing with a low-print oxide. Through special formulation of the oxide, the various low-print tapes tend to minimize print-through “echo,” either before or after, which is actually the recorded signal of one layer impinging on adjacent layers.

For tape correspondence, tiny 3-inch reels are offered in varying tape lengths. Normally these tapes come packed in special mailer boxes that require only an address label and a stamp.

Splicing tape is in a category by itself. The need for the first splice occurred immediately after the first piece of tape broke or required editing. Eventually every recordist experiences a similar need. Although whole articles in this magazine and elsewhere have been devoted to the subject of editing and splicing, a few guidelines can keep the new home recordist, his tapes, and his equipment out of trouble.

- Make splices only with tape that is specified as *splicing tape*. Other transparent pressure-sensitive tapes may hold the ends of the recording tape together, but some of the adhesive will probably ooze around the splice, damaging the oxide or causing stickiness between layers on the reel. The adhesive may also get onto the heads and make them sticky.

- Cover the entire splice area—and then some—with the splicing tape, making sure that the ends of the recording tape meet, but do not overlap.

- Use some kind of splicing block or jig. Through long practice, professional tape editors can make splices with no mechanical aids other than scissors, but most of us are not so adept. A good splice, produced in a block, will pass smoothly and inaudibly through tape guides and over heads.

- Use a 30- or 45-degree cut where the tape ends join to eliminate the audible pop that frequently results from 90-degree splices. Mechanical splicers are designed to cut at the proper angle.

You should consider the recording tape you buy as another link in your sound system, and remember that the contribution a given tape can make to high-fidelity sound reproduction depends on other components in your installation. For example, a premium tape may produce no audible improvement when used with a low-quality recorder that cannot take advantage of its low-noise and extended high-frequency characteristics. In such a case, premium tape would be a waste of money, since an all-purpose type would serve just as well. If you are in doubt about whether your machine warrants the use of premium tape, buy a roll and judge for yourself whether improvement is audible.

Many people spend hundreds of dollars on a recorder and then try to economize by buying cheap tape. By using the so-called “white-box” tape, they frequently not only get poor results but sometimes even damage the recorder. They then blame the manufacturer of the recorder for the time and money they have to spend on repairs that otherwise would have been unnecessary. White-box or off-brand tapes are frequently end-of-run, reject products not up to a reputable manufacturer’s specifications. They may also be products actually intended for the bargain counter and manufactured without regard for quality control in the areas of slitting, oxide uniformity, splices within the reel, or dropouts. Many of these products have an abrasive effect on tape heads and guides, actually wearing them down measurably after only a few playings. Although some white-box tapes may provide high-quality sound recording, you can never predict quality from reel to reel, or even within the same reel. Branded merchandise from a respected manufacturer carries his guarantee of quality or replacement. And the quality in terms of output level, frequency response, distortion, and noise is maintained within rigid standards from reel to reel.

ASSUMING you have selected your recording tape, you will naturally want it to continue to give optimum performance. Many of the rules for handling and storing tape have to do with protecting the oxide. Since the oxide “contains” the recorded signal, dust and dirt or physical damage to this surface will result in the kind of signal loss called a “dropout.” A signal loss can also occur if the tape is bent or kinked, preventing it from passing smoothly over the recorder’s heads. Here are some rules for preserving the quality of your valuable tape recordings:

- Store tape in its original box to protect it from dust or damage.

- Stand the tape boxes on edge like books, rather

than flat in piles. This will prevent warped reels and damage to the edges of the tape.

- Avoid storage in areas of extremes of temperature or humidity. Tape experts recommend room temperature with a relative humidity of 40 to 60 per cent. If the tape is cold, let it warm up to room temperature before playing. For long-term storage, use low-print, polyester-backed tape, and store it in metal cans sealed with pressure-sensitive tape.

- Avoid the build up of excessive tension within a reel of tape by rewinding it occasionally. If your recorder tends to produce tightly packed tape in the rewind or fast forward mode, have it adjusted.

- Avoid exposure to magnetic or electrical fields such as are produced by motors and some speakers.

- Clean the recorder heads and tape guides regularly to eliminate any dust or oxide flakes that could later rub off on a tape and produce dropouts.

Unlike phonograph records, which (under usual playing conditions) wear a little with each playing, tape does not wear significantly if it is properly cared for. Laboratory tests have shown that with good care and storage conditions, tape should last at least one hundred years.



WHITE-BOX TAPE

A FEW WORDS TO THE WISE

By PAUL EDWARDS

TAPE HOBBYISTS—generally considered to be human—are subject to all the foibles of the race. One of these is the perpetual search for a bargain. Retailers are aware of bargain hunters and consider them adversaries in a subtle game of “Who is going to get the better of the bargain?” In the case of the retailer versus the tape-recorder hobbyist, “white-box” tape and money are the factors in the game.

The customer expects to give a minimum amount of money for a maximum amount of performance. But he rarely wins the game. Nine times out of ten, he will lose by buying white-box tape. When tape is sold at a bargain price, substantially below that of premium tape, it stands to reason that tape quality must be inferior in one or more ways. A regular, name-brand premium tape is manufactured to meet standards making for optimum performance when recording and reproducing audio information on a tape machine. This is rarely so in the case of bargain-price white-box tape. The name itself is a giveaway. White-box tape is packaged in a plain white box to indicate anonymity. The white box is actually a disclaimer of origin or, if you will, ownership.

All you ever see on such a white box is a footage figure and the words “acetate,” “Mylar,” or “polyester.”

There is, however, a *disguised* white-box tape which is branded with an individual store name, or that of a member of a chain-store group, or with fancy words like “Concerto,” “Allegro,” “Symphony,” “Classic,” “Harmony,” “Melody,” and so forth. And none of these carries the name of a *manufacturer* either—anonymity again.

This is all understandable. What manufacturer wants to put his name on something that is generally a rejected, second-rate product that will yield less than top performance? What manufacturer wants to admit that all of his products are not perfect? Corner a big-name tape manufacturer and he will reluctantly admit that he sells a by-product that is packaged more often than not in white boxes. “If we didn’t sell the reject stuff, we’d have to charge a lot more for our good stuff,” one producer stated. “We just can’t afford to junk the rejected tapes,” another said. “We’d like to, but it’s a matter of getting all the other manufacturers to do the same thing. And they won’t. So why should we be altruistic? It would work against us competitively.”

Basically, there are several forms of white-box tape, and each presents certain problems. Some so-called "bargain" tapes are rejects of premium tape that failed to meet specifications, and others are rejects of computer or video tape. In the case of computer tape, which is made with an emphasis on high-frequency response, the mid-range and bass performance may suffer. With video tape, the needle-shaped magnetic particles of the coating are oriented cross-wise rather than lengthwise, and there may be loss in output when such tape is used for audio purposes.

The reasons for rejecting audio tape are many. The most frequent are signal drop-outs resulting from improper slitting and uneven oxide dispersion on the tape base. In the latter case, you will hear momentary "dead" spots peppered throughout the tape after it is recorded. Improper slitting affects the contact between the tape and the recording heads, especially on quarter-track recorders. It leads to a higher noise level and generally erratic recording in which one channel may sometimes go dead for varying intervals.

Another kind of rejected tape is that from outside cuts. Oxide is generally applied to 18- or 24-inch widths of base material which is then slit into standard quarter-inch widths for audio use. Since most imperfections in coating are likely to occur along the two outer edges, the better manufacturers eliminate them automatically from their production runs. The less-scrupulous repackage this scrap as white-box tape. There are three common imperfections in outside-cut tape: dropouts, potential edge stretching or irregularity, and uneven coating which leads to erratic recording and reproduction. This kind of tape is likely to produce poor fidelity, especially when used for stereo recording.

Not all white-box tape is rejected tape, however. Some is specifically made for the low-price market by taking short cuts in the manufacturing processes. For example, in making high-quality tape, a slowly revolving cylinder is used for the milling process which finely disperses the oxide particles in the binder. There are machines used to speed this process, to achieve dispersal quickly through a hammering process, but this tends to affect both the magnetic and physical properties of the coating adversely. A tape made in this fashion may have reduced output and increased tendency toward oxide shedding. One producer candidly stated: "I can tell you how it's done: cheap oxides, no primer, no surface treatment, *etc.* It is made cheap by reducing the integrity of the product."

The low-price tape made for white-box sale has a limited high-frequency response and is somewhat

harder on recorder heads and other parts than premium tape is. Some of the low-price 0.5-mil tape is not tensilized and has a tendency to stretch. Also, such tape is not always properly lubricated, and it eventually squeals when played, especially after it has "aged" for a few months.

The foregoing tapes are of doubtful quality, by and large. We now come to a category of white-box tape that has *some* potential for the bargain hunter. It is spliced, prime-quality tape packaged in white boxes. This is tape supplied to retailers by companies that process prerecorded tapes using first-class raw tape supplied by major manufacturers. The big catch is that most spliced tape is sold on small reels—three-, four-, or five-inchers—although a small amount is sold on seven-inch reels. Another catch is that a single reel may contain tape of two thicknesses—1-mil and 1.5-mil. Further, it may contain tape made by two or more manufacturers! If used in critical applications, such as quarter-track stereo, there may be differences from section to section in frequency response, volume, noise level, and so forth, because the bias requirements will vary with each type of tape.

There is still another form of white-box tape: used tape. This will probably carry the lowest price tag of any of the white-box products. Some of this tape comes from radio stations and commercial studios who used it for some time, then bought newer formulations or more modern, state-of-the-art tapes. Some of it may be quite old, dating from a time when tape was not as good as now, and, if it has an acetate base, it may be devoid of the original lubrication and flexibility. The results may be squeal, excessive abrasion of the recorder heads, oxide shedding, and so forth. Polyesters, on the other hand, remain in good condition. Such tapes might be a good buy since radio stations use prime-quality tape.

A final form of white-box tape is returned merchandise. This is tape returned by dealers to distributors or manufacturers and diverted into white boxes. This tape will most certainly have grab-bag characteristics. And, unfortunately, like other categories of white-box tape, there is no way of detecting what it actually is.

Although I do not recommend white-box tape *per se*, it can be used for certain purposes. For example, it can be used effectively for tapes of speech where sound quality is not the first consideration. It can be used in noncritical monophonic recording with half-track machines where drop-outs are not as noticeable. It can be used for "knock-around" purposes such as recording pop songs that will soon be erased to accommodate newer tunes, or for "party

fun" where the tapes will be erased afterward. But always avoid using white-box tape where any element of permanency is a consideration.

To some, the foregoing caveats may represent a challenge. "Perhaps I *can* find a good roll of tape in a white box," a recordist may insist. Well he *might* find a roll or two And so we offer the following checkpoints for such optimists:

To check on poor slitting, which shows up as "cupping" or "curling," unreel a length of the tape and let it dangle almost to the floor in a breezeless area. Any physical distortion of the tape will be readily apparent, in that it will look ruffled or wavy. Another check for poor slitting is to lay a 4- or 5-foot length on a flat surface (the store counter for example). If it is all right, it will lie perfectly flat, touching the surface at all points evenly.

Splices in a roll of acetate-base tape can often be detected by holding the reel of tape up to a strong light. The light should shine evenly through the windings of the tape. Splices will show up as small dark areas, and if there are many of them, they will make the tape appear to be unevenly wound.

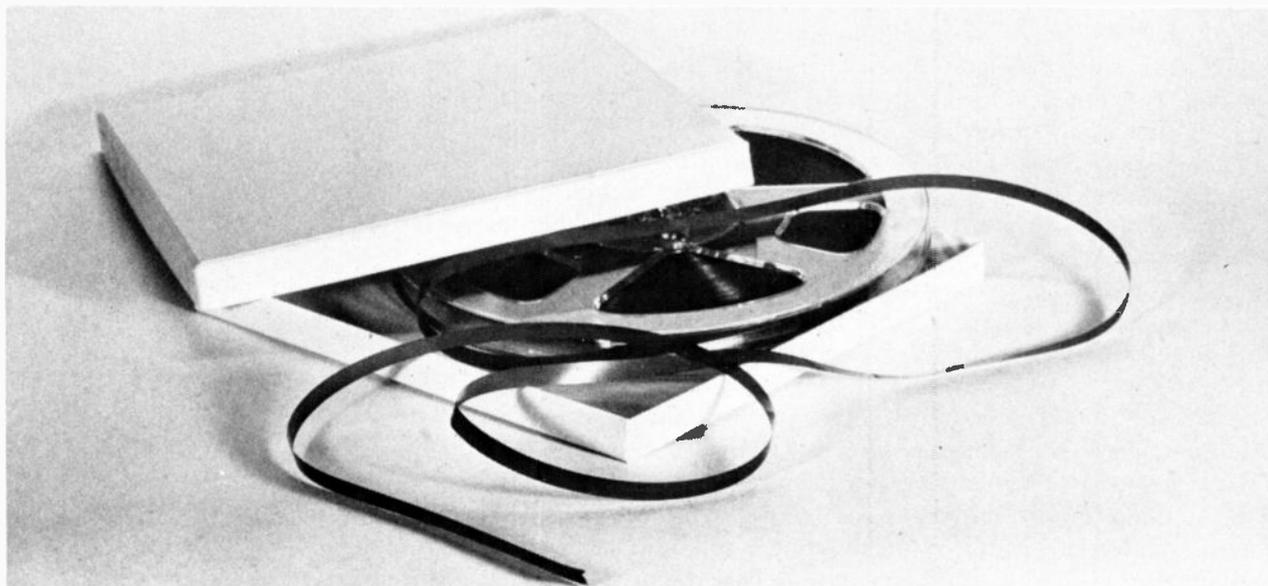
Oxide flaking is easy enough to detect. Unreel a length of the tape on a flat surface with a sharp edge, then with the oxide up, pull the tape over the edge. Look for small telltale indications on the surface, and on the tape, that oxide has chipped off. Another test is to scratch the surface of the tape with your fingernail. If the tape flakes badly, forget it. Premium-quality tapes, no matter how well made, shed *some* oxide, but second-quality tapes may shed so much that the naked tape base will be exposed. Loose oxide can cause all kinds of trouble for the recorder, causing slippage, overall signal loss, high-

frequency loss, and squeal. The loose oxide can also act as an abrasive, leading to early head wear and a poor signal-to-noise ratio.

Poor adhesion of the oxide may be a result of economies in production. It shows up as massive flaking or oxide shedding. To test for a good bond between the oxide and the plastic backing, press a strip of pressure-sensitive cellophane tape over the oxide, then pull it away. If the oxide comes off in patches, don't buy.

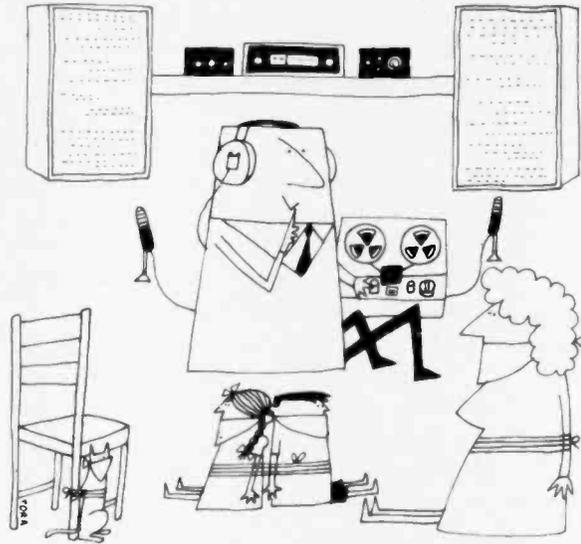
Some of the boxes, in which secondary tapes are packaged are of thin cardboard—all part of the economics of marketing white-box tape. If these tapes are piled high in storage, the pressure on boxes at the bottom of the pile may cause them to crumple, and then pressure is exerted on the reels, often causing warpage. Put a pencil through the reel hub to check for this condition. If, when the reel is spun, it turns evenly, fine. If it runs akilter, don't buy.

I'd like to repeat: let the buyer beware. Consider the following paragraph in a letter from an executive of 3M Company, manufacturers of Scotch brand sound tape: "In answer to your question . . . while there may be an apparent advantage in purchasing so-called 'white-box' tapes, either for their price or intended use on inexpensive equipment, they do not carry the guarantee of a reputable manufacturer. These tapes are not of first-line quality and could not pass the rigid quality control checks we give our own nationally advertised Scotch brand magnetic tapes. Broadly speaking, 'white-box' tapes are not recommended for such critical performance applications as the recording and playback of stereo music—to say nothing of the possible damage to equipment that could result." They ought to know.



TAPING OFF THE AIR

By Bill Little



ONE OF THE easiest and most rewarding activities for tape hobbyists is recording FM broadcasts. Programs are available to suit every taste, and there are continual opportunities to capture on tape everything from Broadway musicals to live opera, from UN debates to once-in-a-lifetime political conventions.

You can make high-quality recordings off the air by following some simple rules. The only right way to record radio programs, in either stereo or mono, is by direct electrical connection between the tuner or receiver and the tape recorder. You can also record the sound portion of TV programs from the earphone jack on the set, but avoid attaching clips across the speaker terminals or volume control, as these can present a dangerous shock hazard for a non-technical person.

In almost all installations, the tuner will connect directly to the amplifier (or preamplifier, if a separate preamplifier and power amplifier are used) and the recorder will take its signals from the amplifier's tape-output jacks. Consult the instruction books of both your recorder and amplifier for details on this.

To an off-the-air recordist, the fact that the playing time of a four-track stereo tape can be doubled by switching the reels and recording in the other direction is not too important—unless, of course, he has one of the recorders that will record in both directions without reel switching. With a non-reversing machine it is important to know how long the tape will run in *one* direction without interruption, because broadcasters won't stop the music to let you flip the reels. To estimate the playing time of a musical composition, look it up in the Schwann record catalog and figure a maximum of thirty minutes per 12-inch disc side. Some stations note the

exact playing time of each selection in their program booklets, but if the information is not available, you may be able to estimate the length of an unfamiliar work by taking the total time scheduled for the concert and subtracting the approximate length of the more familiar selections. The most convenient approach, however, is to obtain a copy of *Timetable for Classical Repertoire*, a booklet that lists the playing times of over 2,000 compositions. It is available for 25c postpaid from Martel Electronics, 2339 S. Corner Ave., W. Los Angeles, California 90064 (Attn: Timetable).

If it is evident that you can't fit the whole program on one reel, plan to change reels during a pause between movements. These pauses, particularly in live concerts, will usually be long enough to permit a quick change. Have the fresh tape pre-threaded onto an extra take-up reel; then all you have to do is lift off the reels that are on the recorder, drop the fresh ones on, guide the tape into its travel path, and start the recorder running again. With a little practice, you should be able to complete a reel change in under five seconds. Use the same brand and type of tape for these quick changes or you may find that there is an audible change in frequency response or signal level between reels.

Always load up with more tape than you think you will need. It is easy enough to clip off the blank excess later and use it for something else, but if your tape runs out before the end of the program, nothing can be done about it. You can use thinner tape to give you up to three times the capacity of a reel of standard-play tape. The Tape Timing Chart later in this article makes it possible to estimate the amount of one-direction stereo recording time you can get from a variety of standard tape lengths.

If the program you want to record starts at 8:30, you'd better be on the job by 8:10 at the latest. Turn on all your equipment to give it time to warm up and stabilize. Station tuning and antenna adjustment is quite critical for optimum stereo reception, so tune carefully. During the warmup, use the preceding broadcast for setting the proper recording level and checking the balance between channels. By the time the clock creeps around to 8:28, everything should be warmed up; then check the tuner one last time for on-the-nose tuning.

Once the program is under way, keep an eye on the record-level indicators. If they seem a bit low or high, resist the temptation to make adjustments for a while, because the station engineer may correct the level at the studio. If level adjustments must be made, though, make them very gradually, and try to follow the expressive contours of the music. For instance, if you must raise the level, wait for a *crescendo* and then slowly turn up the control along with the swell of music. Remember that the best-engineered recordings are those that show the least evidence of technical tampering.

When the music finishes, let the announcer start talking before shutting off the recorder. This avoids

shearing off the tail end of the music. You can easily backtrack and erase or edit out the voice later. Live-performance broadcasts, in which the dying echoes of the last note are often inextricably merged with a rising surge of applause while the announcer's voice comes in simultaneously, present a special problem. In such a case there is no moment of silence, no clean break in continuity to serve as a convenient place for a cut-off. The best way to handle this is to allow a few seconds of the applause to come through at normal volume and then quickly fade out both channels together by turning down the record-level control. The trick is to reach zero volume before the announcer's voice comes on.

After your recording session is over and you have made some prize tapes, what can you use them for? As far as the law is concerned, you can use them for anything you see fit, as long as you do not (1) play them before a public gathering, (2) charge admission to listen to them, or (3) copy them for resale purposes. It isn't illegal to record radio programs, but if a musician's union or a record company caught you using their creations to make money, you would certainly be sued, and you would probably lose the case.

TRANSFERRING DISCS TO TAPE

By Fred Petras



“**Y**OU'RE re-recording your records on tape? What for?”
“LPs are cheap—why bother putting them on tape?”

“You haven't gotten rid of your old 78's yet? You're doing what—putting them on tape? You're nuts!”

The above remarks are typical of many I have heard in the past few years on the subject of transferring phonograph records to tape. Many of the others

were along the same lines, reflecting puzzlement, disbelief, contempt, and a variety of other attitudes and feelings. Suffice it to say that I have withstood them all, and continue to dub away.

I have a strong respect for records, be they ancient one-sided 78's, “orthophonics,” early electrics, late electrics, mono LP's, or stereo LP's. I believe they should be heard in optimum condition—even though in the case of 78's the condition I found them

in was often less than optimum.

And, like millions of others, I too have space problems. A collector with a variety of interests is always pressed for room. My tape recorder is invaluable both for preserving my records and for making it possible to live in my current surroundings comfortably. I have been taping for twelve years—and I expect to continue.

Further, taping records is a highly creative activity, quite satisfying to someone who is not always pleased with what record manufacturers do in packaging their products. Must I accept their couplings of music on a given disc? No, I need not. I can put together whatever selections I want, in the sequence I want them, according to my own superior whims. I find it gratifying to "collect" the past in record form and preserve it for enjoyment down through the coming years. It pleases me to think that I can play my tapes of precious sound material without wearing out the originals, which are safely stored elsewhere.

You may have some or all of the above reasons for dubbing, plus others of your own. And the physical approaches to the subject are also quite varied, determined by what is being preserved, the sequence of the materials, the equipment being used, and the actual recording techniques. What follows is what has worked for me, my friends, and some acquaintances. It is intended as a suggested guide, not as the final word.

One of the first considerations is the relationship of what you want to put on tape and the length of tape required. Through experience I have found that ten 78-rpm records neatly fill a 1,200-foot reel of tape, recorded at $7\frac{1}{2}$ ips. The same size reel accommodates almost twenty 78's when recorded at $3\frac{3}{4}$ ips. More material could be squeezed into the same length by keeping the time between selections to an absolute minimum, but I prefer at least four to six seconds between selections on a reel containing 78's. This strikes me as a natural time interval in playback, and this pause facilitates locating a desired selection, but permits easy correction later without destroying adjoining material. I may, for example, tape a 78 that is not in good condition, hoping that at some point I may find—or borrow—a better copy. If the spacing between selections was very close, dubbing in the subsequent better copy might result in overlap.

With L.P.'s the problem is somewhat different. They vary much more in length than the average three-minute 78 side. There are a number of ways to determine the length of an L.P. One, check the album cover to see if the time length is given—and it frequently is on more recent records. Two, play the

record through and time it. Three, if the record is of classical music, get a copy of a guide to playing times for standard classical compositions from Martel Electronics, 2339 S. Cotner Ave., W. Los Angeles, Calif. 90064 (Attn.: Timetable). It costs 25c. The guide is reasonably accurate, but does not reflect variations in the playing times caused by the fact that individual conductors may take a few minutes more—or less—to play a given work.

Generally, an 1,800-foot reel recorded at $7\frac{1}{2}$ ips accommodates one full LP nicely on each side. Many major concertos and symphonies run from 25 to 45 minutes. A 25-minute work can easily be dubbed in stereo on one side of a 1,200-foot reel at $7\frac{1}{2}$ ips. That speed, incidentally, was at one time the only one recommended for recording classical music. However, many of today's recorders will do an excellent job at $3\frac{3}{4}$ ips. If you are in doubt as to which speed to use, simply try the slower speed and see how well—or badly—it does the job. If you tape monophonically on two tracks, the program time will be the same. If you tape monophonically on four tracks, you will get twice as much playing time from a tape as you would in stereo, but you may find that the inconvenience in relocating a selection isn't worth the tape saved.

Often it is not possible to record each side of a tape fully. It is a silly "economy" to juggle playing times in order not to waste a few minutes of tape. Accept



TAPE TIMING CHART

Length in feet	Recording Time		
	1 7/8	3%	7%
150	16	8	4
225	24	12	6
250	26	13	7
300	32	16	8
350	38	19	10
375	42	21	10
400	44	22	10½
450	48	24	12
500	52	26	13
600	1:04	32	16
625	1:07	33	16
850	1:30	45	22
900	1:36	48	24
1200	2:08	1:04	32
1250	2:12	1:06	33
1500	2:36	1:18	39
1700	3:00	1:30	45
1800	3:12	1:36	48
2000	3:28	1:44	52
2300	4:05	2:02	1:01
2400	4:16	2:08	1:04
2500	4:24	2:12	1:06
3000	5:12	2:36	1:18
3280	5:49	2:55	1:27
3600	6:24	3:12	1:36
4800	8:32	4:16	2:08

Note: The times shown are for a single pass through the recorder in one direction and should be multiplied by 2 for half-track mono or quarter-track stereo, and multiplied by 4 for quarter-track mono.

the fact that a certain amount of waste tape is inherent in the process. When you think of the value of your time and efforts, you will find it is cheaper not to bother trying to fill a tape to the last inch. At the end of this article is a chart of playing times for given lengths of tapes, which should be useful in your taping work.

What you put on a specific tape is a personal matter. Some may want a full-hour tape of Sinatra, or Crosby, or Sammy Davis, Jr., or a full tape of flamenco or polka music. Others may find a whole tape of one personality or type of music more than they can stand at one listening. For me, a half hour of any one performer or type of music is about right, except, of course, for classical music. In my early days of recording I made many one-and-a-half-hour tapes of pop orchestras and performers, only to redub them

later in shorter lengths when I discovered that I could not listen to even a forty-five-minute side without tiring. Others with whom I have discussed the matter of program times have had quite similar reactions.

There should be a certain amount of preparation of the records to be transferred. For optimum results they must be clean. The best way to clean records—shellac or vinyl—is to use warm water and a mild liquid detergent. Scrub each side *gently* with a soft brush, rinse, and let drip dry.

Warping of records is a bit harder to handle. In the case of 78's, you might place them between panes of heavy glass, on a flat surface, in a warm spot. The warmth will eventually soften the shellac of the record enough to straighten it under the weight of the glass. An additional weight, such as a few books, placed on the glass may help. But if the record is badly warped, do not put weight other than the glass on it until it has straightened a bit, otherwise it might crack. Vinyl records can be similarly handled.

Cracks are a nuisance in 78's. If they are small, carefully rub a wax crayon into them. If they are quite noticeable, rub crayon into the grooves along the lower side of the crack to deaden the thumping sound the stylus would make in playing the record. Make sure you clean the stylus after playing a crayed disc. There is little you can do about a crack or a bad scratch in an LP. Buy a new record or forget about taping it.

I've talked about tape lengths. Now a word about tapes themselves. I strongly recommend the use of standard major brand tapes. Remember, you are recording for the long haul. Poor-quality tape could mean the loss of many hours of time and effort. And possibly, if the original recordings were not saved, the loss of priceless program material. Also, second-rate tapes are hard on recording heads and other parts of a recorder. (Elsewhere in this issue is an article on white-box tape. Read it before you start your taping project.)

A few words about tape types. Acetate tapes are the least expensive and are quite adequate for recording in the 1.5-mil thickness. However, when it comes to thinner tapes and longer lengths, such as 1,800 or 2,400 feet or more, I recommend polyester (Mylar) at somewhat greater cost, but with the advantage of greater strength and resistance to adverse climatic conditions. Polyester tapes are not as likely to break at the ends, nor are they likely to flake off. They are made for long-term storage.

As for equipment, this, again, is largely a personal matter. Some of you already have equipment that will do a nice job; others may consider buying a whole new setup. It is possible to record from a por-

table or console phonograph into a tape recorder by connecting a patch cord to the speaker leads of the phonograph. You will then be able to control tone, volume, balance, and so forth from the playback source. This will enable you to compensate for variations in the program material—as, for example, in 78-rpm records, to boost bass or treble notes, cut excessive bass, boost volume, and mask surface noise as needed.

You should be sure to disconnect the leads from the speaker as soon as you are finished to avoid any chance of short circuiting them and possibly damaging the phonograph amplifier. In addition, recording from the speaker terminals in a so-called a.c./d.c. set can be a dangerous process. The fact that these sets may have one side of the speaker lead connected directly to the a.c. line can turn your tape recorder into a shock hazard if not a death trap. It's best to have the wiring checked by a competent electronics man to be sure that you won't run into trouble.

For those owning a component hi-fi amplifier or receiver, recording from the tape output into the recorder is the ideal technique. For especially noisy records, it's sometimes preferable to tape from the speaker terminals in order to make use of the amplifier's tone controls and filters.

The record-player is a vital link in the recording chain. The unit I use permits varying the speed a bit faster or slower; this is ideal when taping old 78's, which often are not actually 78's (they may have been recorded at speeds anywhere from 75 to 83 rpm). Many of today's high-quality stereo cartridges have interchangeable plug-in styli, and you should use a 2.5- to 3-mil diamond stylus to get the most sound out of 78's. A turntable equipped with a cueing lever for lifting or setting down the tone arm gently is a boon when working with short segments such as are found on 78-rpm records. However, your existing equipment may be perfectly adequate, particularly if you like the "feel" of it.

The importance of the tape recorder is quite obvious. The machine you now have may be excellent for dubbing, but if you are contemplating buying a new recorder for taping records (as well as other purposes), make sure it has some sort of locking pause control to permit stopping the instrument without taking it out of the recording mode. This is almost a necessity when transferring short-play programs, such as 78-rpm records. And it is also especially useful in recording radio programs because it enables you to achieve with ease the split-second timing required to cut out commercial interruptions. And in many other kinds of recording the pause control will make your work much easier.

The *modus operandi* of recording, is, again, a personal matter, and depends a lot on the kind of equipment you have. I have worked with several different setups in the past, and I find it's largely a matter of getting used to a given group of components. Good results are possible with less than top-notch equipment once you get the feel of handling it.

After loading the recorder with tape, and the player with a record, do some preliminary taping to get the controls properly set. Note which levels on the recorder's meter(s) produce the best taped sound. Sometimes recording so that the meter needle rarely dips into the red is best. With other recorders the meter needles can go well into the red area on peaks without causing distortion. When taping 78's you may have to readjust the recording-level controls between records for an even-sounding tape. This is especially true with pre-electric discs where the sound level on the record not only varies from brand to brand, but also within a company's own products.

It may seem odd, but your records may sound somewhat better—or worse—when transferred to tape, depending on the frequency-response characteristics of your recorder. Of course, a "perfect" recorder will exactly duplicate the sound of the record, but the average recorder may boost or cut the highs or lows, which may slightly improve or degrade the sound of the dubbed record. Some 78-rpm records played on a modern turntable may sound "thin," or lacking in "body." Assuming that you are using a stylus of the proper size, this can result from inadequate tracking force (needle pressure) or the fact that the tonal "equalization" applied during recording is much different from today's standard. To solve the first problem, adjust the tone arm for greater pressure or temporarily tape a coin at the end of the pickup arm to get extra force. The second problem you will simply have to live with.

In operating the equipment, determine the best way to get the particular time-spacing you want. I start a record from the outer groove and count off the seconds to the beginning of the music. I then start it again, and, after estimating three seconds before the music starts, start the tape moving. When the record ends, I allow two or three seconds more before stopping the recorder. You may want a shorter break, or perhaps a longer silence between selections.

If you find that your turntable produces clicks or annoying electronic blips of sound between selections, have it serviced to eliminate the noises. In many cases the noise may simply be the result of shaky lifting of the tone arm at the end of the record. Another technique is to start fading out the sound using the record-level control right at the point at

which the music ends. This has the additional advantage that surface noise is reduced during the intervals between selections.

It's easy to find a given selection on a reel of tape by using your recorder's digital tape counter. Set the counter to zero before you record, and as you catalog the selections you are taping jot down the counter number at the beginning of each selection. When you play the tape back, reset the counter at zero, and you should find that the numbers line up pretty well with your notations. However, some counters tend to slip a little when you are winding or rewinding, and if you do this very much during the recording process, simply do your dubbing and then after everything is finished, play the tape through and make your digital-counter notes.

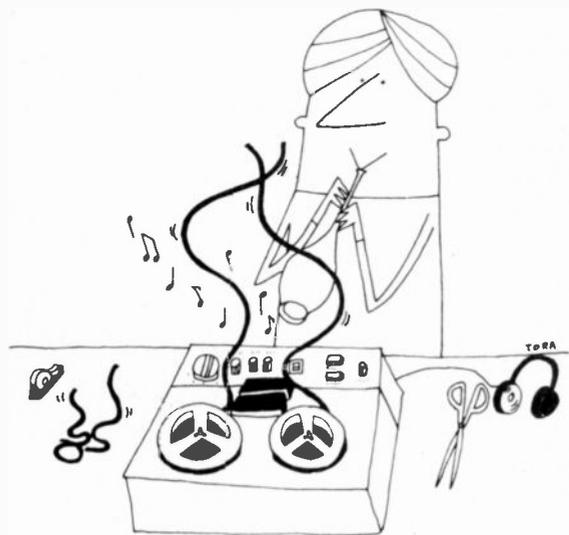
After dubbing a tape you should label it for easy relocation of its contents. At your local stationer's

you will find a variety of suitable self-stick labels. One useful type measures $\frac{9}{16}$ of an inch by $3\frac{1}{2}$ inches, which provides enough room to type in a general heading for the contents of one or both sides of the tape. This label peels off a master sheet and is merely pressed onto the edge of the tape box. Some recordists merely number their tape boxes—and list the complete contents in a separate catalog.

I splice several feet of leader tape to the beginning and end of each dubbed tape. The leader prevents torn ends and also provides an area on which you can identify the tape by writing in a title. And let me caution you that it is not enough simply to label the box; to prevent misfiling, the reel itself must also contain some identification relating it to the box. Trying to locate a misboxed tape in a large collection is like trying to track down the last echo of the lost chord.

A brief introduction to TAPE EDITING

By Harvey Fondiller



AN essential part of the tape art is editing. As with a motion picture or portfolio of photographs, the effect of the final product is enhanced by judicious rearrangement and selection of content. Editing enables you to shape the raw material. You can excise the commercials from musical programs recorded off the air, or add music and narration to documentary tapes by splicing in additional segments. Try to make each tape a work of art—or at least a pleasant listening experience for your friends.

Make certain that all tapes you intend to edit are recorded in one direction only. To edit a four-track stereo tape, it is necessary to re-record each set of tracks on a single-direction tape, edit this tape, then re-record it on a four-track stereo tape. (You needn't

follow this procedure if you don't mind losing the program material on one set of tracks, of course.)

Here's what you will need:

- *A splicer*—a device that holds two pieces of tape in the correct position to be trimmed and joined together. There are perhaps a dozen different types on the market. Professionals prefer to use a tape-splicing block and a single-edged razor blade. Audiophiles usually find a splicer with built-in cutting and trimming blades easier to use.

- *Splicing tape*—a polyester material with a special non oozing adhesive.

- *Leader tape*—colored tape that is spliced to the beginning and end—or between segments—of a reel of tape to provide protection or identification of the recorded material.

There are two aspects of tape editing: the

mechanical and the creative. The mechanics are simple; splicing technique can be learned in a few minutes. The creative aspect, however, could be studied for a lifetime. Creative editing is the master key that enables talented individuals to produce a variety of results from the same raw material—in this case, lengths of recorded tape.

A creative tape editor can produce an artistic entity from a series of unrelated sounds—a sort of audio collage. (A film editor performs a similar function by assembling seemingly unrelated film clips.) By themselves, the pieces may appear meaningless, but spliced end to end they comprise a coherent whole. Each piece of tape, like every shot in a movie, is a link in a dynamic chain.

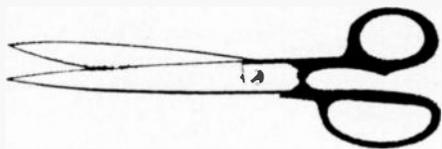
Tape can be spliced even more easily than movie film. The editing process makes possible both the *selection* of relevant material and *control* of how it is ordered—in effect, artistic freedom to produce a composite embodying the desired effect.

Audio tapes broadcast by the networks often appear to be—and are—patchworks of various segments. Here an announcer's fluff has been removed; there one sound effect has replaced another. The objective is audio perfection, the strategy is editing, and the tactics necessarily include a formidable weapon—the splice.

A good splice is the *sine qua non* of tape editing. It must produce neither noise nor any interruption of the program material. The tape ends are cut at a 45-degree angle because square ends may produce noise. The ends must be precisely aligned—otherwise pitch fluctuations could result when a splice passes the recorder's playback head.

A tape splicer should be used, but if one is not available, scissors or a razor blade can do the job. Hold the tape segments parallel, with the two ends overlapping, then make a 45-degree cut at the desired point. (This procedure makes it possible to splice the ends without a gap between them, since the cutting angle is the same for both.) Apply the splicing tape parallel to the cutting angle, then trim off the excess tape, cutting ever so slightly into the edges of the recording tape. This eliminates the possibility of splicing-tape adhesive sticking to the leads when the tape is played back.

The playback head in most non-professional recorders is enclosed by a protective cover. This



makes it difficult to ascertain the exact point on the tape where a cut should be made. If possible, remove the cover; otherwise find a convenient point, such as one of the tape guides, to use as a marking spot. Measure the distance between that point and the playback head and then mark the same distance on to your splicer. The idea is that with the mark on the tape lined up with the mark on the splicer, the tape will be cut at just the point originally lined up with the head. With professional recorders, it is possible to move the tape back and forth by hand until it is at the desired position for cutting.

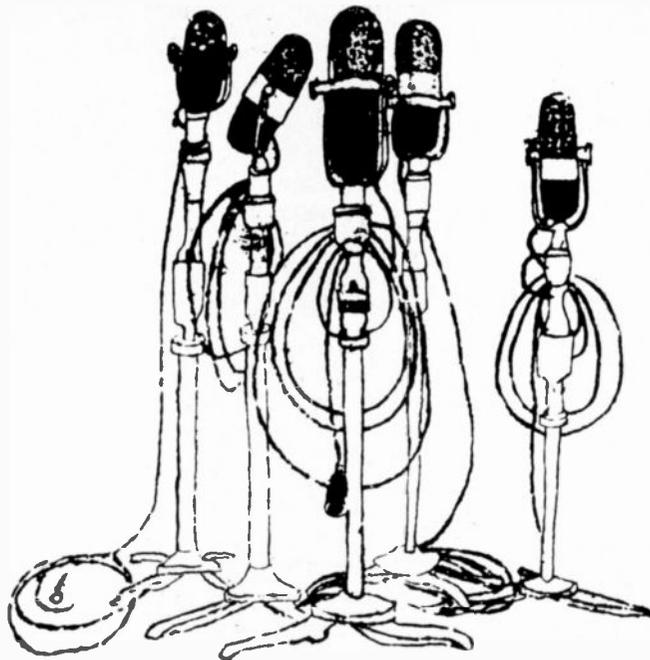
Editing invariably improves a voice track, but if you want to "clean up" a person's speech, don't be an extremist. If you eliminate every cough, stammer, and slip of the tongue, you are likely to end up with a soundtrack that sounds unnatural.

When you're editing, be especially conscious of background sounds. Cutting out a piece of tape may produce an abrupt change of background sound at the splice, making the excision all too evident. Several years ago, I found myself in a predicament while editing tapes for NBC Radio's *Monitor*. The subject was Haiti's military forces, which I discussed with a U. S. Marine officer who trained them. A military band played as we talked. Midway in the interview, my sleeve touched the edge of the recorder's supply reel, so a few words—as well as about a second of band music—were not recorded. An *hour* of intensive effort was required to edit the tape so that the officer's condensed remarks still made sense and the music sounded continuous.

It is possible to "edit" tapes in a rough way without a splicer, provided you have a second recorder. Place one end of a patch cord into the output jack of recorder A and insert the other end in the input jack of recorder B. To transfer portions of a tape, play recorder A until you hear the part that you want to re-record. Press the pause button, start recorder B, then release the pause button. When the re-recorded portion has been completed, stop both machines. Repeat the process for subsequent segments. The result, on recorder B, is an "edited" re-recorded tape.

The faster the recording speed, the easier it is to edit tape, since a given sound will take up more space on the tape. Even at the usual home recording speed of 7½ ips, however, it is difficult to split musical phrases or cut between notes unless you're an expert. The aural result of most such attempts offends even untutored ears.

Tape recordings aren't accepted as evidence in law courts—they're too easy to fake—but they *could* prove beyond a reasonable doubt that you have mastered the art of editing. Are you ready to face the music?



By Craig Stark

HOW TO CHOOSE A MICROPHONE

ANYONE who shops for a tape recorder soon learns that, as a general rule, the higher the cost of the machine, the less likely it is to come with microphones. Further, except for extremely inexpensive machines, when microphones are included, they are almost never of high enough quality to match the recorder's capabilities completely. This is easily explained: high-quality microphones are expensive, and the decision of which is the "best" type depends on the intended use. Therefore, it would be foolish for a manufacturer to put any considerable portion of the cost of his recorder into supplying good microphones of one type, when a potential customer might need an entirely different kind of mike.

This means that the choice of microphones is left to the user. Unfortunately, however, while professional recordists are familiar with the considerations that go into judging proper microphone selection for a given purpose, the average purchaser of a recorder is not. Having mastered the jargon pertinent to other components, he finds himself confronted with a bewildering array of new terms when it comes to microphones: "cardioid," "volts/microbar," "low-Z," and so forth. However, when approached systematically and logically, the choice of a proper microphone is not as difficult as it may appear at first glance.

Unhappily, the first thing that most of us have to think about is cost. While there is a general correlation between quality and price, in shopping for mic-

rophones be sure that what you are considering is the actual cost to the buyer and not an artificially high "list price." For example, I find one popular microphone from a reputable manufacturer "listed" at nearly \$85, but it is easily available for less than \$50. The best way to avoid being misled by an inflated list price is to check it against that given in the catalogs of electronic parts houses (Allied Radio, Lafayette Electronics, Radio Shack, and so forth).

Having avoided this pitfall, the audiophile must make at least a preliminary decision on the uses to which he intends to put his microphones before deciding how much he will have to spend for them. Strict price limits cannot be provided, but perhaps the following guide will be helpful:

1. For dictation and simple documentation of intelligible speech, where the recorder will be operated at $3\frac{3}{4}$ ips or slower, a microphone with restricted frequency response (about 100 to 6,000 Hz) will suffice. Most crystal and ceramic microphones are in this category and their general price range is \$6 to \$15 each. Microphones that sell for less than this are likely to be worse than those that are supplied with low- and medium-priced recorders.

2. Most audiophiles should probably consider microphones in the \$25 to \$60 category. While this is a wide price range, considerations other than cost will help narrow the field, and this is the general price range for good "public-address" microphones. Here you can expect wider and smoother frequency response, adequate for very realistic speech recording and, at the higher-price end, good music recording as well. I have made broadcast-quality organ recordings (including an audible 16-Hz pedal note!) using a popular \$60 microphone. From reputable manufacturers, an otherwise unspecified fre-

quency-response claim is likely to be within a tolerance of approximately ± 5 or 6 dB. Dynamic microphones dominate the middle-price category, even though they are available at all price and quality levels.

3. Above about \$60 per microphone, you are in the range of professional or "broadcast" equipment. Highest-quality music recordings are almost invariably made with "condenser" or "capacitor" microphones, whose prices usually begin at about \$100. Ribbon microphones are also usually limited to the expensive class. Only audiophiles who own studio-quality tape machines are likely to derive sufficient benefit from such microphones to justify their cost.

Knowing, in general, what to expect from microphones in various price categories, the audiophile can now turn his attention to specifics of performance. The most technical factor to be considered in selecting a microphone, and one of the most important, is its rated *impedance*. There are three "standard" impedance ranges: (1) 50- to 100-ohm microphones are classified as low impedance (lo-Z); (2) 150 to 250 ohms is, technically, medium-Z, but for all practical purposes the audiophile should consider such microphones also as low impedance; (3) high-impedance (hi-Z) microphones usually have a nominal value of 50,000 ohms, though a few as low as 10,000 ohms are classified as hi-Z. Thus, "lo" vs. "hi" impedance becomes the audiophile's choice. (Note: there are a few microphones available with non-standard impedances—for instance, 3,000 ohms. These are often designed to be used with specific recorders whose input circuitry has been specially tailored to match them. Before buying such a non-standard mike, you should query the manufacturers of both the microphone and of your recorder.)

The choice between hi-Z and lo-Z microphones has little to do with the quality of the microphone *per se*, but depends instead on the length of cable required between the microphone and the recorder. With cables less than 15 to 20 feet long, hi-Z microphones are perfectly adequate, and on all but genuinely professional recorders they can be directly connected to the recorder. For recording school orchestras and plays, a daughter's piano recital, or speakers in a large convention room where the recorder can't be placed close to the lectern, cables longer than 20 feet

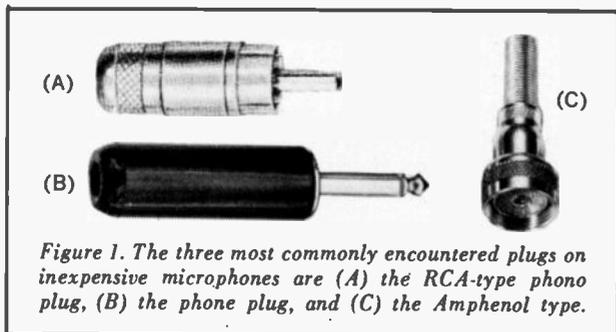


Figure 1. The three most commonly encountered plugs on inexpensive microphones are (A) the RCA-type phono plug, (B) the phone plug, and (C) the Amphenol type.

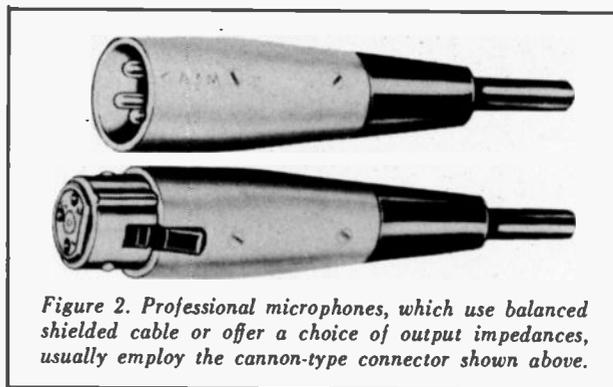


Figure 2. Professional microphones, which use balanced shielded cable or offer a choice of output impedances, usually employ the cannon-type connector shown above.

will be required, and here lo-Z microphones, usually with matching transformers, are mandatory. If in doubt, an audiophile is best advised to select microphones which offer switchable impedance options, as do many of the units available in the middle-price category.

To explain why the microphone cable should play such a critical role in selecting hi-Z or lo-Z microphones, a brief digression is necessary. The input stage of a recorder's microphone preamplifier is almost invariably what is called a "single-ended" or "unbalanced" circuit. This is simply to say that it "wants" to be fed with single-conductor shielded cable, comparable to that which audiophiles use in hooking up hi-fi equipment. Secondly, when the microphone is connected, the input stage wants to "see" (looking at the microphone through the length of its cable) a high impedance (for example, 50,000 ohms). Both of these requirements can be met by using a hi-Z microphone and single conductor shielded cable, which can thus be directly connected to the input stage, typically through one of the three kinds of plugs shown in Figure 1.

Long cables, however, spell trouble for this simple arrangement. In the first place, the higher the impedance of a circuit, the more likely it is to pick up hum. Since the output signal of a microphone is normally extremely small (less than that of a magnetic phono cartridge), an overly long cable will almost inevitably pick up enough hum in a high-impedance circuit to be distinctly annoying. In the second place, *any* shielded cable acts like a small capacitor, whose value increases with its length. With high-impedance circuits, not many feet of cable are required before the high audible frequencies begin to be bypassed to ground by this unwanted "capacitor," and thus they never reach the input circuit of the recorder.

Lo-Z microphones and cables reduce both of these problems, and to make them even less susceptible to hum, they are invariably run as "balanced" lines—that is to say, there are two conductors within the shielded cable, terminating in the kind of plug

shown in Figure 2. But lo-Z "balanced" lines are not compatible with a hi-Z "unbalanced" input, and for matching purposes a "microphone line transformer" is used, connected at the recorder (*not* at the microphone) end of the cable. Professional recorders whose microphone-input jacks match the connector shown in Figure 2 already have the required transformer built in; for lo-Z operation most audiophiles will have to buy special cable transformers, which cost between \$10 and \$12 each.

If you already have a good high-impedance microphone and a tape recorder with a high input impedance and you want to use extra cable lengths between them, the job can be done by using an in-line matching transformer at the output of the microphone (which steps down the microphone to a low impedance suitable for long cables) and then using another transformer at the recorder to step up the impedance to the required high value. However, considering the relatively high cost of good transformers, it might be wiser to invest in new microphones with the proper impedances.

Having looked into the matters of wide, smooth frequency response, and having resolved the question of microphone impedance, the next basic choice concerns the directional characteristics desired. There are three basic pick-up patterns from which to select: omni-directional (or nondirectional); bi-directional (or figure eight); and unidirectional (or cardioid). Bidirectional microphones are rare. Their primary use is in studio interview shows, where two guests sit on opposite sides of a table, sharing the same mike, or in making studio recordings of two-instrument music, where background noise is not a consideration. The rather sharp figure-eight pick-up pattern (see Figure 3) tends to make bidirectional microphones difficult for the average audiophile to use, so his normal choice is the omnidirectional or the cardioid.

Where several speakers or performers must share a single microphone, an omnidirectional type is the easiest to position properly. In theory, as the name suggests, a nondirectional microphone has a spherical pick-up pattern, being equally sensitive to sounds coming from any direction. Actually, at high frequencies, such microphones tend to be more

sensitive to sounds coming from the front (see Figure 4), but for recording a small group of people around a table (or an unaccompanied soloist, string quartet, and so forth), the easiest placement will be achieved with omnidirectional pickups. The same consideration applies where it is necessary to cover a wide stage with the smallest possible number of microphones. Against these advantages, however, must be balanced a basic difference between a microphone and the human ear.

The human hearing mechanism is, roughly, omnidirectional in its pick-up pattern, but nature's microphones have a built-in feature which the "ears" of a tape recorder do not: selective attention. Even across a crowded room, with conversations going on all around one, it is usually possible to focus on the words of a desired conversation, ignoring all others as so much extraneous noise. Microphones do not have this ability, and omnidirectional types will pick up unwanted as well as wanted sounds from any direction. Thus, if one is recording a school glee club, orchestra, or play, for example, and omnidirectional mikes are placed toward the front edge of the platform, they will pick up considerable audience noise—coughs, program rustlings, and seat squirmings. Or, at a cocktail party, the voice of a slightly boisterous guest will frequently drown out that of the desired speaker if the latter is slightly farther away and speaking more moderately.

Thus, to help the recordist discriminate wanted from unwanted sounds, the unidirectional or cardioid microphone was developed. While tending to become less and less directional at low frequencies, at middle and high frequencies cardioids have the roughly hemispheric, almost heart-shaped, pick-up pattern shown in Figure 5. ("Cardioid," like "cardiac," comes from the Greek *kardia*, meaning "heart.") They reject a significant amount of sound from behind the microphone, while giving a relatively wide frontal coverage. Special techniques can be employed to narrow the pick-up angle further, ultimately resulting in the highly focused "shotgun" microphones often used to pick out questions from an audience or the quarterback's signals on televised football games.

Used for stereo recording, cardioids demand some

The three basic pickup patterns provided by the various types of microphones are shown in somewhat idealized form below. They are the bi-directional figure-eight (Fig. 3), the omnidirectional (Fig. 4), and the cardioid uni-directional (Fig. 5).

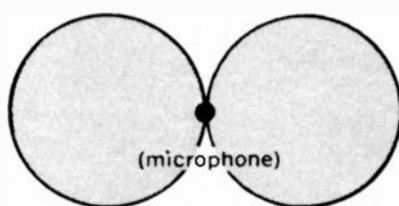


Fig. 3



Fig. 4

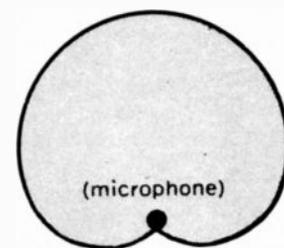


Fig. 5

care in placement, for just as they can eliminate audience noise, they will also eliminate a performer who is far enough off axis from the microphone. To cover a wide angle it is sometimes necessary to pull a pair of cardioid mikes well back from the performers, resulting in a rather "hollow" sound which lacks presence. On the other hand, overly close positioning with unidirectional microphones may result both in eliminating pick-up of the natural reverberation of the hall, and, in stereo, in exaggerated separation.

Nevertheless, for general recording of speech and music, the cardioid probably has an edge in usefulness over the omnidirectional microphone. A person naturally tends to aim a microphone (even an "omni") in the direction of the desired sound source, and it is a tremendous advantage to be able to eliminate some of the unwanted noise from the rear. Since learning to position unidirectional microphones properly requires some practice, however, the recordist must make his decision between the two types for himself, bearing in mind that for good stereo recording he will have to use slightly less physical separation between mikes (to avoid a "hole in the middle") if he selects cardioids, which results in a slightly narrower total range of coverage. The polar-pattern pick-up diagrams for various frequencies supplied by reputable manufacturers will frequently help one make the choice.

By this time the range of possibilities has been narrowed very considerably—probably to three or four microphones at the average dealer's. Obviously the best further tests would involve actually using the contemplated alternative units in normal recording circumstances. However, even in the showroom there are a couple of short but informative performance tests you can make. To make these evaluations it is important to use either your own recorder or its exact equivalent. Further, if lo-Z operation is contemplated, even though the cable run here will be very short, it is important that the transformer be installed, for some microphones which have adequate output in hi-Z operation fail to generate a strong enough signal for a particular recorder when switched to lo-Z, even with the transformer.

To check the characteristics of two microphones against each other, place them side by side on a table and connect each to a different channel of the recorder. Then, have a friend (or the dealer) stand 10 to 15 feet from the two microphones and begin to talk at a normal speaking level while you adjust the gain on the recorder until the indicators show peaks of zero VU. Then have the friend rattle a ring of keys vigorously, walking slowly in an arc around the microphones, keeping at a constant distance from them. Finally, reduce the record level and have the

friend speak normally into the microphone, head on, from a distance of 3 to 4 feet. The tape should now be rewound and played back, one channel at a time, through the very best amplifier and speaker system in the showroom. Here's what to look for:

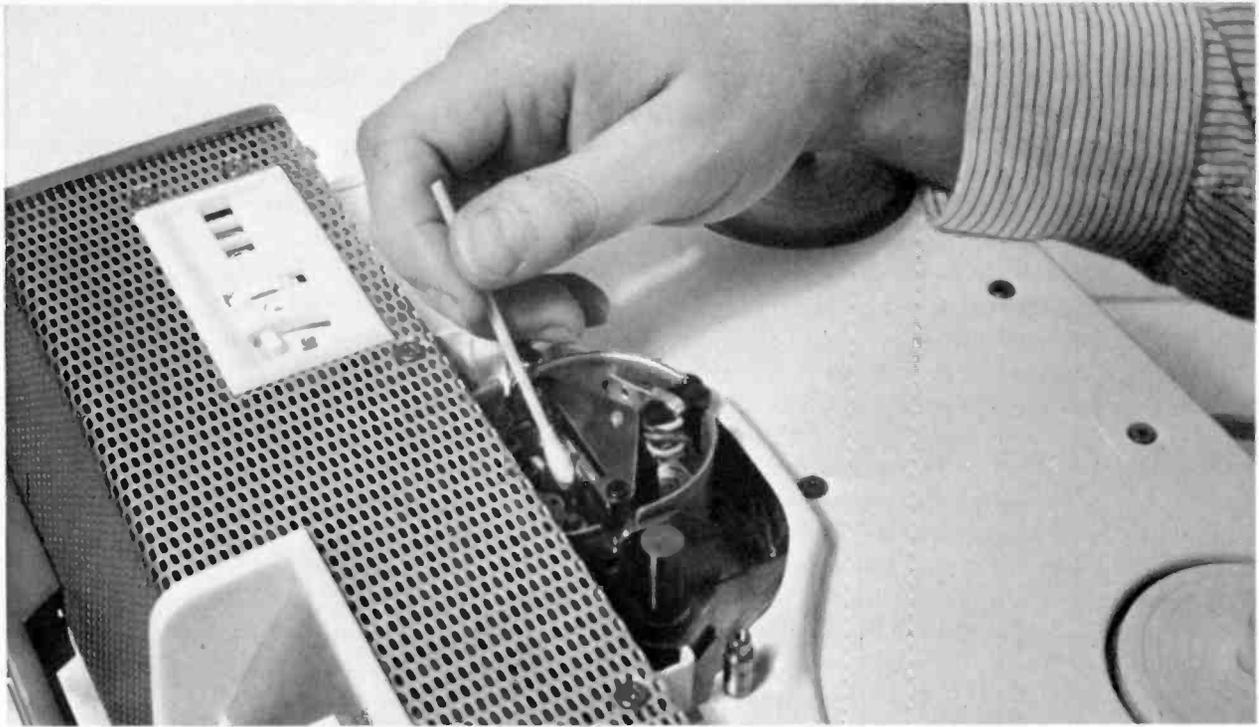
1. By turning up the *record* level high enough to get full-scale indication at a greater-than-normal speaking distance, check to see whether or not the microphone in question has a high enough signal output to ensure a "safety margin" before the recorder's own amplifier noise level becomes obtrusive. Since few home recorders possess the very high gain and low noise of professional microphone preamps, it may be necessary to eliminate an otherwise excellent microphone simply because it has inadequate output for your own particular recorder. A typical "normal" output level for a microphone is approximately -55 dB, but except for units made by the same manufacturer, you cannot always be sure that the measurement method used to arrive at that specification was the same. However, a microphone from the same line with a -49 dB rating will be 6 dB "hotter," and will permit turning down the *record* gain control by this amount while still achieving the same recorded level. This will often eliminate the noise that originates in a less-than-perfect recorder microphone preamp. On the other hand, it may sometimes be necessary to choose a less sensitive microphone (for example, -59 dB) if you intend to record live rock groups often, for in this application the output from a sensitive mike can get high enough to overload the preamplifier stages ahead of the *record*-level control.

2. Surprisingly, jingling keys produce harmonics as high as those present in live music, and so the ability to record and reproduce this sound naturally is a good index of high-frequency response. By carrying the jingling keys in an arc around the microphones to be tested, you can quickly detect a unit whose off-axis treble pick-up is deficient. There is an analogy here with the importance of good dispersion of the highs from a speaker. A microphone which becomes *overly* directional at the treble end will alter the tonal balance of an instrument located slightly off to the side in a group of performers.

3. In checking the naturalness of reproduction of a voice at normal recording level and distance, it is necessary to use some other voice than your own, for a person *never* hears himself as others hear him. Here, in comparing the recorded tracks of the two microphones being tested, you should be especially on the look-out for a somewhat "boomy" reproduction of the male voice (indicative of "peaky" bass response) and for a tendency to over-emphasive sibilants ("she sshellsss sshellsss . . . etc.").

Having selected the better of two microphones, you can then test it in the same way against a third, and so on. To insure against being misled by a fault in one of the two channels of the recorder, it is a good idea to switch the preferred microphone to the other channel, checking to see that it still sounds the same.

Microphones are the key which opens up the full range of usefulness of the tape recorder, and it's worth spending a little time and thought to come up with the best pair for your own recorder and your own needs.



KEEPING IT CLEAN

MAINTENANCE TIPS FOR YOUR TAPE RECORDER

By Judy Raskin

IF YOU'VE just bought a tape recorder, chances are that it's working perfectly. And there's no reason why it shouldn't go on reproducing quality sound either—if you operate it properly and invest a little time in cleaning it periodically.

It takes but a few minutes to perform the simple housekeeping chores that keep the machine operating as well as the manufacturer intended, so there's really no reason to allow your tape recorder to deteriorate until it sounds as if it cost \$200 less than you paid for it. And I'd recommend a careful reading of the instruction manual that came with your recorder. The manufacturer may have spent thousands of dollars preparing it so that you'd have a better idea of what your machine is all about. It's true that all tape recorders perform the same basic record and playback functions, but each model has its own design characteristics and idiosyncracies, and knowing what they are is the key to getting the most out of the machine's capabilities.

The major source of "dirt" on a tape recorder is the tape itself. Recording tape consists of oxide particles in a binder laminated onto a base material. But even the best tapes shed some of this oxide during normal play, and if you want to really enjoy your tapes and recorder, periodic cleaning of the tape heads is mandatory. At least once a month (or more often, depending upon use) clean the heads with a cotton swab that has been moistened with alcohol or some other

cleaner intended for tape heads or specifically recommended by the manufacturer. But under no circumstances should you use carbon tetrachloride, or any other general-purpose cleaner, as it may damage heads or the rubber or plastic parts adjacent to them.

Gaining access to the tape heads is easy—remove the head cover by lifting it, sliding it, or loosening a few screws, depending on the model you own. Here's where your manual can help if you're uncertain. When I bought my first machine, I kept it going incessantly. The time came when everything sounded terrible, and I went back to the store where I'd bought the machine. "Clean the heads," the salesman advised, and I rushed home to do just that. It did not occur to me then that the head cover was removable, and in cleaning the tape heads that first time I performed contortions that were worthy of an adagio dancer.

The reasons for cleaning the tape heads are clearly not aesthetic. The high-frequency response and, to a lesser extent, the signal output of the heads depend on the intimacy of contact between the oxide coating on the tape and the gap in the head. A buildup of oxide on the playback head thinner than a human hair can cause an audible loss of the highest frequencies. Buildup of oxide can also cause tape squeal and speed irregularities that result from the slippage that occurs in the system driving the tape past the head. If

your machine has pressure pads, clean them the same way and at the same time as the heads. This may help eliminate squeal. Glaze on the pads causes a loss of resiliency; if they harden and seem to have no more "give," it's time to get replacements. Check an equipment catalog or with the manufacturer of your unit for the proper pads for your machine.

Tape-head demagnetizing should be done at least as often as you clean your machine. Since tape recording is a magnetic process, any spurious or unwanted magnetism shows up as noise mixed with the output signal. A major cause of unwanted magnetic fields is the effect of the bias current that is present in the record head. This current tends to leave a residual magnetic field on the heads if steps are not taken to prevent it. (Some tape recorders have special circuitry built in to help prevent the buildup of head magnetism.) Other possible sources of magnetism may be the tape itself or electromagnetic radiation from other parts of the recorder.

A tape-head demagnetizer will get rid of such noise, but before you use it, it's a good idea to put cellophane tape over the part that's brought in contact with the tape heads to prevent scratching them. Then, turn it on or plug it in, depending on the model, and bring the demagnetizer into contact with the heads, tape guides, posts, capstan—anything that may have built up a magnetic field. Move it over each part for a couple of seconds and then, with the demagnetizer still on, move it away a few feet and turn it off. If you turn the demagnetizer off too close to the machine you may wind up with more residual magnetism than you started with. There is a wide variety of demagnetizers available for under \$5, and they all work equally well. However, if the tape slot on your machine is very narrow, you may need one with narrow pole pieces.

In respect to general servicing, don't as a rule, oil your recorder unless you've got a pretty good reason (does the idler squeak?). Use a needlepoint dispenser and the right kind of oil for the job—here again the instruction manual will be helpful—but at all costs, avoid getting oil on rubber parts or drive belts. If some does get where it shouldn't, get it off fast. Also be very sparing with the oil, because rotating parts may spray the oil onto areas where it should not go.

If you have a tube-type machine and it appears to be noisy or makes static-y sounds when recording or playing back, it may be that a tube has become noisy (microphonic). You can check by lightly tapping each tube with the end of a pencil and noting which one seems to cause most of the rumpus. (It's most likely a preamplifier tube such as the 12AX7/ECC83.) Such a fault is not likely to show up in a tube tester, especially of the drug-store variety.

When you do your tube testing, pay particular attention to the power-output (if your machine has them), bias-oscillator, and rectifier tubes (your manual will help you identify them). If you have to lift out the transport mechanism to get to the tubes, be extra careful to avoid bending the multi-bladed fan that is frequently attached to the rear shaft of the motor. If the fan blades are bent, they will cause a very distracting mechanical noise every time you turn on the recorder.

There isn't much you yourself can do to investigate trouble in a transistorized tape recorder; take it to a reliable serviceman. The manufacturer's warrantee station is usually the best bet. Read the manufacturer's warrantee first, though: repair or replacement of a defective part, providing it is made during the term of the warrantee or under conditions set down by the manufacturer, may cost little or nothing. This is true for tube-type machines too.

One more source of trouble may be your microphone. If it develops a steady or intermittent hum, or if it stops working altogether, odds are that the problem is in the cable rather than in some microphone element. Check the cable at the point where it enters the plug that fits into the tape-recorder jack. You may be able to spot a bad connection or a break just by simple visual examination. A few minutes with a soldering iron should cure the trouble.

There are other problems that may pop up, although it is unlikely they will happen very often, if at all. If you think you detect inconsistency in the speed at which the tape is being driven, you can use a tape strobe to get the answer, but you'll probably need a serviceman to make any necessary repairs.

Give your tapes their share of tender loving care too, because even the best machine can't do much for an ill-kept tape. Store tapes at least two feet away from any sources of heat, or magnetic fields such as are found near miniature high-intensity lamps or loudspeakers. You shouldn't experience any difficulty if you keep your tapes in the same place all the time, where temperature and humidity are relatively constant. I don't know what would happen if you took your tapes to the Arctic tundra and an Amazon rain forest in the same week, but the manufacturers advise against it, and they know their business. And get in the habit of storing your tapes in individual boxes, standing up, to avoid warping the reels or damaging the edges of the tape.

As you can see, keeping your tape recorder in good shape really isn't complicated or time consuming. Give it about ten minutes a month; the amount of pleasure you get from a smoothly running machine will be worth many times that.

Tape-Recorder Standards

By Burt Hines

standard, n. That which is set up and established by authority as a rule for the measure of quantity, weight, extent, value or quality.

NATURE IS, as a rule, prodigal but rather sloppy, and it sometimes seems that a good part of man's business here on earth is to impose enough standard order on her chaos that he can profit from her generosity. One of Adam's first duties in the Garden of Eden was to put names to the contents thereof, and man has continued his example ever since, naming, defining, and ordering his way through history. Thus, a pound is a pound, an inch an inch, and a gallon a gallon from Maine to California. Standardization is, if anything, even more important in our galloping technology: bolts

must fit nuts, bulbs must fit light sockets, and 60-hertz current must be just that wherever it appears. Practically every new manufactured product has had to face up to this as soon as it emerged from the laboratory, and the tape recorder was no exception. Although standards benefit the consumer, he is very seldom made aware of them; it is usually enough that things work as they should. At least a nodding acquaintance with standards, however, is useful in understanding how things work, why they sometimes do not, and in appreciating the enormous complexity of the mechanical and electrical servants we take so much for granted. With these purposes in mind, author Burt Hines examines below the standards now in force which guide the manufacture of tape recorders in this country. —Editor

THE tape-recording standard issued back in 1953 by the NAB (National Association of Broadcasters) fast became antiquated as tape-recording technology spawned new developments. In 1965, therefore, the NAB issued a revised set of standards that attempted to catch up with the industry's transitions to slower speeds, quarter-track format, stereo, thinner tapes, and the overall improved technology. Although the NAB standards are basically intended for professional machines in professional use, they are significant for the home tape enthusiast in at least four ways:

1. Home machines must conform to professional equalization standards if interchangeability of tapes among machines is to be assured. When equalization standards are followed, commercial prerecorded tapes will play back "flat" on home machines, and tape hobbyists can exchange tapes without encountering difficulties caused by frequency-response differences.

2. Specification of the widths of recorded tracks and of islands (spacing between tracks) assures interchangeability with respect to format. If the width and spacing of tracks on a prerecorded tape (or on a tape a friend has made with his machine) do not correspond to the width and spacing of the gaps of the stereo head in your machine, you'll find your machine playing half a track—or a track and a half.

3. Published high-quality performance standards tend to spur engineers to design such performance into home

machines. If a home machine claims to be "high-fidelity" or of professional quality, it can hardly do less than meet the NAB standards. Previously, home machines had an out, because the 1953 standards referred only to the faster speeds (30 and 15 ips) and not to those generally available in home machines (7½ and 3¾ ips).

4. The new standards help to assure that professional master tapes, whether ultimately converted into phono discs or into prerecorded tapes, are made on high-grade machines. Therefore, the recorded product eventually reaching the consumer has a better chance of being of high quality.

Now let us examine the specifics in the NAB standards pertaining to such matters as tape speeds, equalization, track format, and so forth.

- *Tape Speeds.* Whereas the 1953 standards applied only to speeds of 15 and 30 ips (seldom encountered in home machines), the latest standards apply to 15, 7½, and 3¾ ips, the latter two popular in home use. In fact, the prevailing home-recorder speed of 7½ ips is also designated by NAB as the "preferred" professional speed. Speeds of 3¾ and 15 ips are designated as "supplementary." The NAB also has something to say about 1⅞ ips, although this is indicated as being for use only in "special-purpose limited-performance systems."

Required speed accuracy is ±0.2 per cent throughout the reel. (An error of 0.2 per cent corresponds

to 7.2 seconds in an hour of recorded material.)

• *Playback Equalization.* For a long period before 1965 it was a frequent—but not universal—practice for home tape machines to use the 15-ips playback equalization (1953 standard) for recording at the 7½ ips speed. The 1965 standards make this official. The playback characteristic (in other words, the electrical equalization plus the specific playback-head characteristic) for 15 and 7½ ips is shown in Figure 1. Referenced to 0 dB at 400 Hz, there is about 15 dB of bass boost at 50 Hz and 17 dB of treble cut at 15,000 Hz.

A second playback-equalization characteristic is given for 3¾ and 1⅞ ips tapes. This is also shown in Figure 1. The low-frequency equalization characteristic is the same as that for the higher speeds, but there is about 5 dB less treble cut at high frequencies. This is intended to help compensate for the inherent loss of highs that troubles tape recorders at the slower speeds. (A word about “characteristic”: it must be understood that the playback characteristic in Figure 1 is not simply an equalization curve produced entirely by an electronic circuit in the tape-playback amplifier such as is used, for example, in the magnetic-phono preamplifier section of amplifiers. Rather, the tape-playback equalization is the *joint product* of the electronic circuit and the frequency-response irregularities of a specific playback head. Stated differently, the recorder's electronic circuits are designed to produce the playback curve shown in Figure 1 by taking into account the performance idiosyncrasies of the particular playback head in the machine.)

The NAB standards state that accuracy of the playback characteristic should be measured by playing an appropriate-speed NAB test tape that contains test tones covering the whole audio range. If the machine's playback characteristic is correct, response will be flat or nearly so as measured by an audio voltmeter connected to the recorder's output. If a machine is to meet the NAB frequency-response performance standards, it must remain within the permissible deviations from flat response shown in Figure 2 (see next page). At 7½ ips, response should be up no more than 1 dB between 20 and 20,000 Hz; down no more than 1 dB between 100 and 10,000 Hz; and down no more than 3 dB at 30 and 15,000 Hz. The specification is the same for the 15 ips speed, except that response may be down no more than 1 dB at 15,000 Hz. At 3¾ ips response may be up no more than 1 dB; down no more than 1½ dB between 100 and 7,500 Hz; and down no more than 3 dB at 50 Hz and 4 dB at 10,000 Hz.

• *Record-Playback Response.* There is no specification for record-playback response of a machine.

Instead, the NAB standards state: “The recording equalization of a recorder-reproducer should be adjusted for an overall response which matches as nearly as possible the response of the reproducer from the NAB Standard Test Tape.” Any errors in the playback characteristic are *not* to be compensated by corresponding errors in the recording characteristic. In other words, a machine should be designed to produce tapes that can be played back flat on any NAB-equalized machine. There should be no attempt, for example, to compensate for a particular machine's treble playback inadequacies by souping up the treble during recording.

The NAB does provide a specification for permissible deviations from correct recorded response, as shown in Figure 3. At 7½ ips, recorded response should be up no more than 1 dB between 20 and 20,000 Hz; down no more than 1 dB between 30 and 10,000 Hz; and down no more than 2 dB at 15,000 Hz. The specification is a shade tighter at 15 ips, and rather looser at 3¾ ips. To measure deviations from correct recorded response, the NAB stipulates the following procedure: (1) measure playback frequency response with an NAB test tape—this serves as a reference; (2) measure the machine's record-playback response; (3) the difference between the two sets of measurements consists of deviations from correct recorded response. (To illustrate, assume that at 5,000 Hz the response is 2 dB high when playing the test tape and record-playback response is also 2 dB high; recorded response is correct at 5,000 Hz.)

• *Tape Dimensions and Format.* Although it is generally stated that tape is one-quarter inch or 250 mils (thousandths of an inch) wide, its actual rated width, according to the NAB standards, is 246 mils. And the standards also provide that this width may vary ± 2 mils—from 244 to 248 mils. In contrast, the 1953 standards permitted a range of 244-250 mils. The narrower permissible range under the new standards is advantageous: it reduces the chance that the tape will deform or shift (cup or skew) as it passes through guides, with consequent azimuth and head-contact problems.

The 1965 standards contemplate use of tapes with thicknesses of 1½ mils (regular) and 1 mil (extra-play), but ½-mil (double-play) or thinner tapes are in general “not recommended” for professional use.

With the tape moving from left to right and the oxide facing away from the operator, the quarter-track format (stereo or mono) is as shown in Figure 4. From top to bottom the tracks are numbered from 1 through 4. For stereo, tracks 1 and 3, respectively, carry the left and right channels in one direction of tape travel; tracks 4 and 2, respectively, carry the left and right channels in the reverse direction;

tracks 1 and 3 are recorded first; then tracks 4 and 2. For mono, the recording sequence is 1-4-3-2.

For quarter track operation, as shown in Figure 4, each track has a standard width of 43 mils; each blank area (island) between tracks, 24 mils. The four tracks plus three islands must span exactly 244 mils (minimum tape width). Hence, there is a 1-mil

margin between the tape edges and the outer edges of tracks 1 and 4 when the tape width is exactly the rated value of 246 mils. Tracks may vary between 39 and 43 mils; islands may correspondingly vary between 24 and 29 1/3 mils.

For half-track operation (stereo or mono), as shown in Figure 4, the tracks are numbered 1 and 2

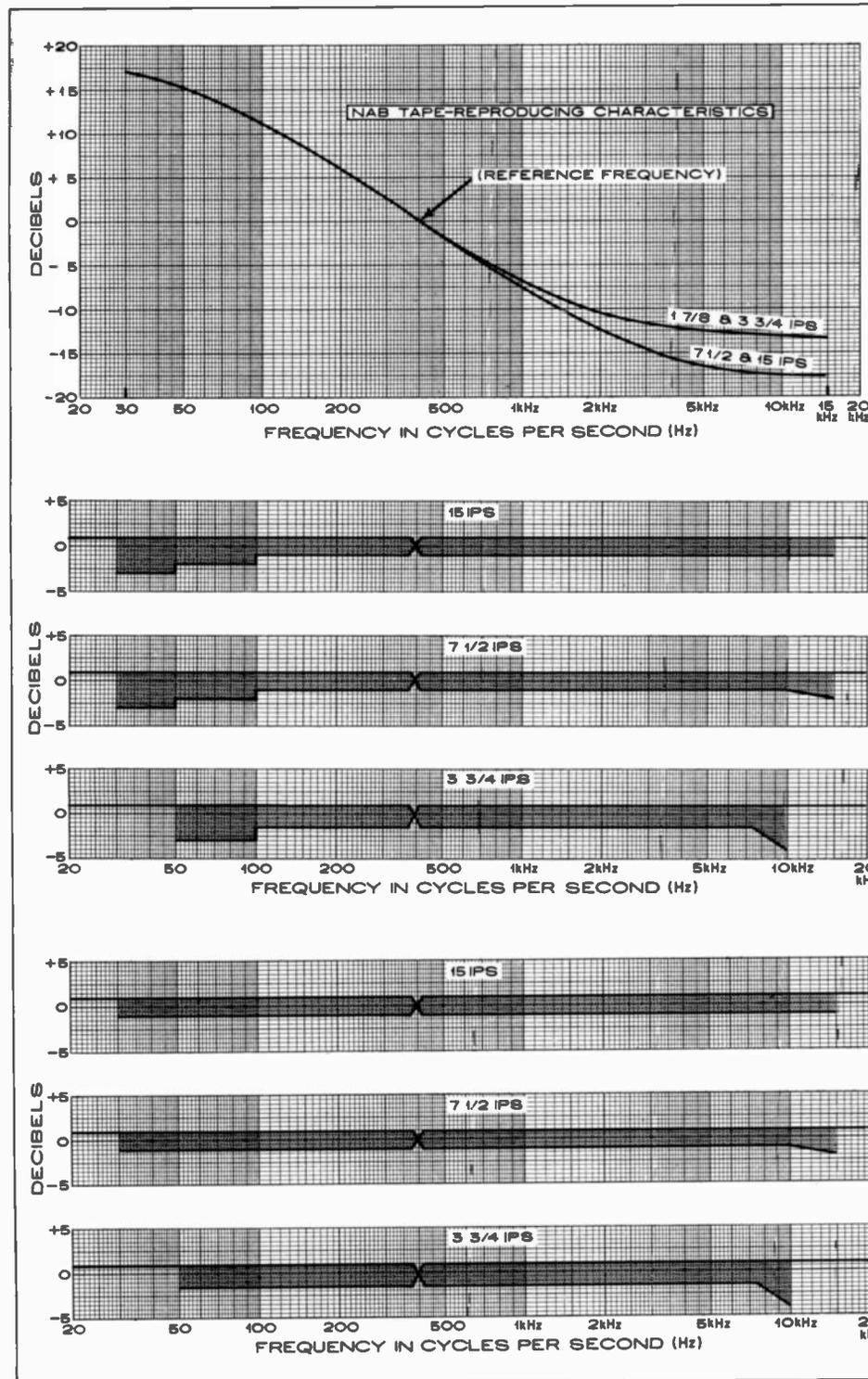


Figure 1. The NAB tape-reproducing characteristic not only results from electronic equalization, but also takes into account the characteristics of the specific playback head being used. There is reduced treble cut at the slower tape speeds to compensate for the normal high-frequency drop-off.

Figure 2. To meet NAB standards, a recorder must be within limited tolerances from flat playback. The playback response is measured with a special test tape of the appropriate speed and track width that has a series of test tones covering the frequency range of 50 to 15,000 Hz.

Figure 3. The recording characteristic must also remain within NAB response limits. A recorder's equalization should be adjusted to produce tapes that will play back flat on any NAB-equalized machine, and not to make up for the performance inadequacies of a particular unit.

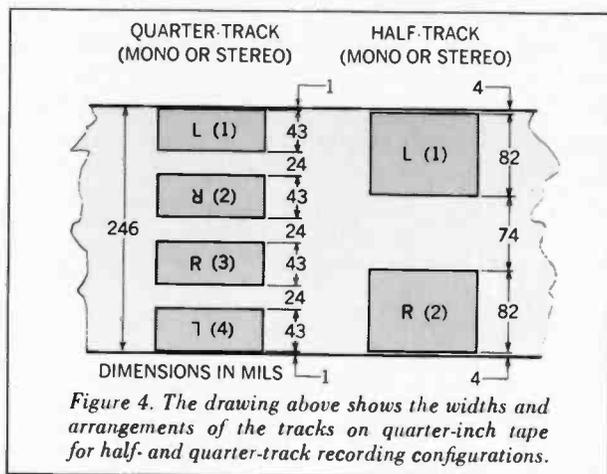


Figure 4. The drawing above shows the widths and arrangements of the tracks on quarter-inch tape for half- and quarter-track recording configurations.

from top to bottom, with 1 being the left channel in the case of stereo. Standard track width is 82 mils; island width, 74 mils. Hence, for a tape 246 mils wide, there is a margin of 4 mils between the tape edges and the outer edges of the two tracks. The tracks may vary between 80 and 84 mils, and the islands correspondingly between 68 and 80 mils. (Unfortunately, the range of variation is such that it becomes possible for track 2 of a two-track stereo tape to be so low that very little of the track is scanned by the lower gap of a quarter-track stereo head.

- **Signal-to-noise Ratio.** The $7\frac{1}{2}$ -inches-per-second NAB test tapes carry a 400-Hz tone recorded 8 dB below that level which produces 3 per cent third-harmonic distortion on a blank tape of standard characteristics. This 400-Hz tone is called the "Standard Reference Level" (SRL) and is the basis of a new technique for measuring signal-to-noise ratio (and for setting the new 0-dB reference level).

The specified procedure for measuring signal-to-noise ratio is to play the NAB test-tape reference tone and measure the machine's playback output. This is used as the 0-dB level. A virgin tape is then put through the recording process, but with *no* audio-input signal. The machine is switched to playback and the output signal (which is noise) is measured. The two output measurements are compared (that is, the 0-VU level relative to the noise level, which will be x-number of decibels below 0 dB). In contrast, the 1953 standards provided that the reference level should be a 400-Hz tone recorded (on the machine under test) at a level that results in 2 per cent harmonic distortion of the taped signal.

- **Flutter and Wow.** To meet professional requirements, the NAB standards establish that flutter should be no more than 0.15 per cent at 15 ips, 0.2 per cent at $7\frac{1}{2}$ ips, and 0.25 per cent at $3\frac{3}{4}$ ips.

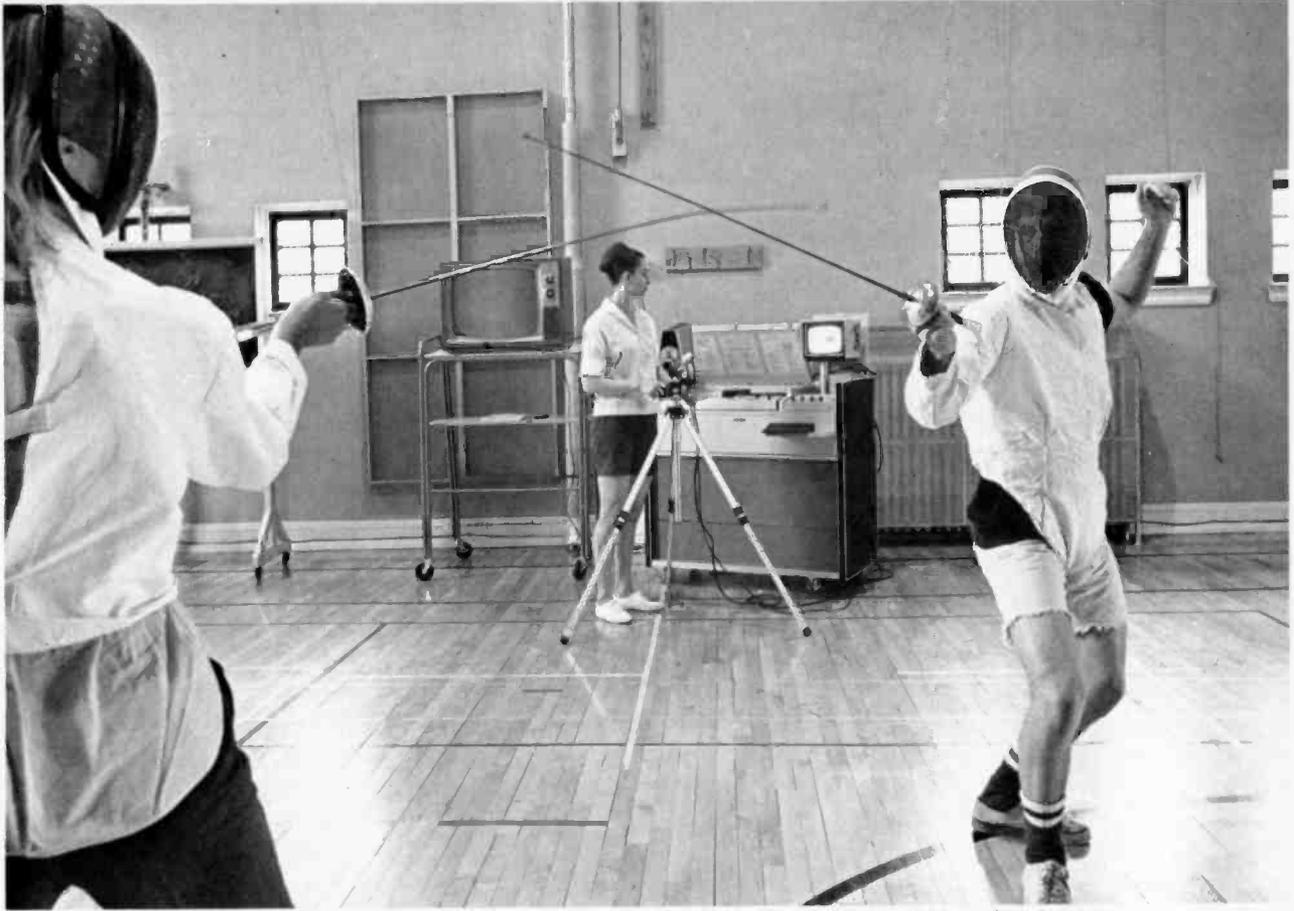
- **Crosstalk and Stereophonic-channel Separation.** Crosstalk refers to signal leakage between adjacent

tape tracks (which on four-track tapes do *not* have the same program material), whereas channel separation refers to leakage between the right and left channels of a stereo system—either in the electronics or in the tape heads. The NAB standards specify that between 200 and 10,000 Hz the crosstalk level should be at least -60 dB and that channel separation between 100 and 10,000 Hz be at least -40 dB.

- **Adjustment of VU-meter Reading.** VU meters (or meters claimed to be such) are found in most of today's home machines, perhaps less because they offer an advantage over the electronic-eye tube as a record-level indicator than because of their "professional" appearance and ready adaptability to transistor circuits. Be that as it may, the 1965 NAB standards provide that the meter shall swing to 0 VU when recording a 400-Hz tone at a level that in playback produces the same output as the NAB test tape's Standard Reference Level. Inasmuch as the SRL tone is recorded on the test tape at 8 dB *below* the level that produces 3 per cent distortion (a level considered an acceptable "ceiling" for tape recording), the indicated setting of the VU meter provides the recordist with about 8 dB of "headroom" before overload. This headroom is needed because the mechanical lag of the meter prevents it from indicating the true magnitude of brief, loud sounds. (Many engineers will argue that 8 dB is not always enough headroom with a VU meter, and rather than debate just what *is* enough headroom, they prefer an electronic eye, a fast *peak-reading* meter, or an oscilloscope as a record-level indicator.)

- **Standard NAB Test Tapes.** Each of the four test tapes (for 15, $7\frac{1}{2}$, $3\frac{3}{4}$, and $1\frac{7}{8}$ ips) has five sections: (1) an azimuth tone for head alignment (vital for maintaining treble response); (2) a 400-Hz tone at NAB Standard Reference Level for measuring signal-to-noise ratio and adjusting the VU meter; (3) another 400-Hz tone for crosstalk and separation measurements; (4) a series of signals for testing frequency response; and (5) a 1,000-Hz tone at the NAB Standard Reference Level for measuring signal-to-noise on a weighted basis.

All in all, the 1965 NAB standards reflect great progress in the state of the art and serve as a call for designers of tape machines—professional and home units alike—to reap the fruits of this progress. Furthermore, these standards promote a uniformity of practice that permits interchangeability, so that a tape recorded on one machine can be satisfactorily played on any machine. Though this bugaboo of uniformity no longer appears to plague the reel-to-reel portion of the audio-tape industry, it still remains to be laid to rest in the cartridge portion, and in the video-tape industry as well.



Students at the University of Wisconsin can review their fencing form and style immediately after a match with an assist from the Ampex VR-7100 Videotrainer system

Progress Report on HOME VIDEO TAPE RECORDERS

By Fred Petras

TWO YEARS ago, the home video tape recorder (HVTR) was still quite new and was just beginning to appear in major department stores, large audio stores, and a few specialty shops. Today, you find them not only in these same stores, but in many others, big and small, and by now most readers have been exposed to the concept of "instant home movies" on tape.

But the HVTR scene has not changed in one key respect: the oft-promised \$500, or under-\$500, video recorder is still not here—and it is not likely to be for some time to come. The problem appears to be a kind of which-comes-first, chicken or egg, proposition. If there *were* HVTR's available for \$500 or less, I'm certain there would be lots of interest, based on what we've all been hearing for the past four years. The fact that prices start at \$695 seems to indicate that the industry is bypassing the home video tape recorder market to concentrate on where the

money is—the industrial and educational fields. The manufacturers are not to be blamed for this. Profit is the oil that lubricates the ball bearings of economic and technological progress. Ultimately, I'm sure that the manufacturers can produce an HVTR that is priced at the same level as a quality audio recorder, but when that will be, I have no way of knowing.

For the moment, then, the market offers home video tape recorders starting at \$695. For those readers who have been holding off, waiting for a lower price, I suggest you wait no longer, but fatten your budget a bit and explore the magical world of video tape recording.

First off, I'd like to ease your fears that the video recorder is for sophisticated users only. Most of today's HVTR's are about as easy to operate as the average stereo tape recorder. Except for a different tape "path," the units both look and operate much like audio recorders. They have fast-forward and

ewind controls, digital counters, gain controls, level meters, and so forth, just like audio recorders. Except when used with a closed-circuit camera, they require no more effort and care to operate than an audio recorder.

There is a variety of equipment on the market, available as components or as complete systems. Some people buy a deck as a starter, then graduate to a full system. Others prefer to start out with the systems approach. Some buy monitor/receiver sets specially designed for use in systems, others prefer to have an existing TV set modified to accommodate a VTR deck.

The variety also includes a range of tape sizes—from quarter-inch to one-inch widths. Most of the quarter-inch tape units operate on the "brute-force" principle; that is, the tape is run past fixed record or playback heads at high speed—from 60 to 120 ips. Sets using half- or one-inch video tape all use the helical-scan, slant-track system in which a rapidly rotating head traces a slanting pattern of information on the tape as it passes by. Of the two approaches, the helical-scan system offers higher quality at this point in VTR development, with potential resolution of 350 lines in the one-inch format for non-broadcast machines, and more than 220 in the half-inch format. So far, horizontal resolution of the quarter-inch models is around 200 lines. Although a high figure indicates a sharper picture, resolution of 200 lines is considered quite satisfactory for non-critical viewing. (The average TV picture received in the home has a resolution ranging from 240 to 320 lines.) But horizontal resolution is only one of many elements in a TV picture and is only a relative guideline. Other important aspects are contrast, brightness, stability, and freedom from interference.

Most of the helical-scan VTR's sold for home use in the past few years have been of the half-inch variety, because the cost of the instruments and the tapes they use is lower than the one-inch format. The cost of an hour's worth of tape in the half-inch format is about \$40. An hour's worth of programing on one-inch tape costs about \$60. The lowest price for helical-scan video tape programs in the quarter-inch format is about \$15 for 37 minutes, as recorded on a recently-introduced Roberts machine. (This unit is also capable of producing a video recording using ordinary low-noise audio tape at a cost of about \$7, but the quality is substantially degraded).

The lowest-price HVTR *system* available at this writing is from Mastercraft Electronics Corp., New York City. Called "Playback," the system, which is *tentatively* priced in the \$695 to \$750 range, consists of a camera with tripod, an 11-inch video monitor, a

microphone, and a longitudinal-drive (brute-force) deck running at 90 ips and using quarter-inch tape. It can function as a closed-circuit TV system, with the camera as program source. It can also be used to record from another TV set that has undergone the required modification to connect with Playback. The system is also available with an imported TV receiver, designed to work with the system, for about \$80 additional. Playback offers approximately 15 minutes of play or record time per tape side, using 7,800 feet of tape on a 10½-inch reel. The company is planning a second model that will run at 60 ips for a full hour of program material on one reel of tape. This will be followed by a compact system using five-inch reels and offering a half hour of program per tape. Playback uses high quality half-mil audio tape. Picture resolution (horizontal) is claimed to be better than 200 lines.

The next lowest-price VTR currently on the market comes from Sony. Their Model CV2100, a helical-scan record/playback VTR deck, is priced at \$795. It replaces—with additional features—a deck originally offered at \$695, formerly the lowest price for a helical-scan instrument. The CV2100 uses half-inch video tape. A tape made on this machine is compatible with any other half-inch Sony VTR and also half-inch General Electric units (which are made by Sony). A camera for use with the unit costs \$395. An 8-inch receiver/monitor costs \$195, and an 18-inch monitor receiver costs \$250. Among its features, the deck offers video editing and sound dubbing, which means you can add either a sound track or picture independent of the other. Horizontal resolution is said to be better than 220 lines.

Running close in third place is the Model NV8000 from Panasonic, priced at \$800. This half-inch helical-scan deck also offers 220 lines of resolution and has sound dubbing among its features. A camera for the unit costs \$300. A monitor that can also be used as a program source for recording off the air is available at \$200. The NV8000 was formerly priced at \$1,050.

Trying for fourth place in two different categories at \$995 are the Roberts Model 1000 and the Ampex Model VR5000, both of which are helical-scan units. The former uses quarter-inch tape, the latter one-inch tape. The Roberts 1000 also doubles as an audio recorder, running at 7½ and 3¾ ips. As a video unit, it has a horizontal resolution of 200 lines and a signal-to-noise ratio of 40 dB. It provides 37 minutes of program time on a 7-inch, 2,130-foot reel of tape. A TV receiver/monitor is available at \$200. A Roberts camera costs \$300. The Ampex Model VR5000 offers horizontal resolution of 250 lines. A camera designed

for use with the VR5000 is priced at \$600, and a monitor/receiver costs \$285. At this writing, the set is the lowest-price one-inch HVTR on the market.

There are several other VTR systems priced under \$2,000. Among companies marketing such ensembles are Apeco Video Systems Division, Craig Panorama, Concord Electronics, General Electric, and Shibaden Corp. of America. Additionally, several companies—including those mentioned—are working on other VTR systems to be priced under \$2,000.

The cost of color VTR's is markedly higher. Currently on the consumer market are three instruments priced close to \$5,000. Bell & Howell has an entry at \$4,700 in deck form. Ampex has a deck at \$4,850. Sony sells a deck at \$3,750 which requires a color adaptor at \$1,000 and a special monitor at \$945. These units can record color programs from auxiliary TV sets. The hurdle of a low-cost color TV camera has still not been crossed. The lowest-price color TV camera for use with consumer VTR's comes from Bell & Howell and costs \$14,000.

As far as the future is concerned, the next breakthroughs are likely to occur in the area of color. For example, scheduled for introduction in 1969 or 1970 by Arvin Industries, Inc., is a color VTR using cartridges of half-inch tape. According to tentative pricing, the console unit containing recorder and receiver/monitor will sell for "under \$1,500." An hour's worth of taped color programing would be

priced at "a fraction of \$60," company officials stated. The \$60 figure was used as a reference point because that is the current overall cost of an hour's worth of home-movie color film. Another breakthrough is expected from Playtape, Inc. According to Frank Stanton, president, the company will introduce within the next year or so a "dramatic video-cartridge system."

Those who have resisted buying an HVTR because they have been hoping for a single standardized tape width had better forget about such a standard. The industry is not about to settle on one tape width. Why? For a number of reasons. In the words of Jack Trux, vice president and general manager of tape products for Bell & Howell and chairman of the Electronic Industries Association's tape-equipment subdivision: "It is not likely that the video tape recorder industry, being in Europe, the United States and Japan, as it is, will get together and arrive at any specific kind of format. First of all, I doubt that the laws of the United States would allow that." In addition, he commented that industry members with heavy financial commitments to their current formats are not likely to back off from them to endorse another firm's approach. Further, he said, "We are, unfortunately, at that point in our history where there are more people to be heard from, and we have probably not seen the final expression of the art of making pictures on tape."

SOME TERMS USED IN HOME VIDEO TAPE RECORDING

- *Brute Force*: A technique for recording picture and sound on standard quarter-inch recording tape by moving it past a stationary head at high speed.
- *CCTV Camera*: Closed-circuit television camera—a home version of the cameras used in TV studios, this accessory may be wired to your home TV set which, in turn, is wired to your video recorder. CCTV camera prices depend, in part, on the quality of their lenses. A \$350 kit, for example, offers a simple low-cost lens suitable for recording in the living room. A \$1000 camera might offer a zoom lens and a variety of other features. Lenses and other accessories generally are interchangeable with movie cameras.
- *Color Compatible*: Any video recorder now on the market will record color-TV programs in black and white. Ampex claims that all fast-speed recordings made on its 6000 series will be playable in black and white on tomorrow's color decks.
- *Helical Scan*: A technique for recording picture and sound on video tape in which a rapidly rotating head within the housing traces a slanting pattern on the tape as it passes by. The tape—usually wider than standard quarter-inch audio tape—is wrapped around a circular head housing in an omega pattern,

with the right leg lower than the left. Head-to-tape speed is much higher than is practical with brute-force recording.

- *Slant-Track Recording*: Another name for helical-scan recording.

- *Sync or Synchronization*: The technique for providing a stable TV picture. The TV image must be synchronized both horizontally and vertically to prevent the picture from tearing or rolling. A strong pulse signal is added to the tape to keep the picture framed properly. One of the difficulties in home video tape recording seems to be that of putting a strong vertical and horizontal synchronization signal onto tape. Many home video recorder pictures have a tendency to flicker to the left upon occasion—a relatively minor imperfection.

- *Writing Speed*: Tape-to-record head speed. In the case of stationary record/playback heads, the writing speed is the same as that of tape speed. In the case of helical-scan recording, the writing speed is basically determined by the rate of the revolution of the record/playback head or heads.

- *Video*: Those frequencies having to do with television-picture reception and playback.

DIRECTORY OF MOST POPULAR, LOW-PRICED



PHOTO	Model	Number of Heads	Tape Size Used (in)	Reel Size (in)	Tape Speed (in/s)	Record-Playback Time (min)	VIDEO					
							Input (V)	Level (!?)	Output (V)	Level (!?)	Response (MHz)	Horiz. Resolution (lines)
AMERICAN PHOTOCOPY EQUIPMENT CO., 2100 West Dempster Street, Evanston, Ill. 60204												
	SV-700	2	1/2	7	7.5	60	1	75	1	75	3.0	300
AMPEX CORP., 2201 Lunt Ave., Elk Grove Village, Ill. 60007												
A	VR-5100	1	1	9 3/4	9.6	60	1	75	.8-1.3	75	3.0	250
	VR-6000	1	1	9 3/4	9.6	60	1	75	1	75	2.5	250
	VR-7000	1	1	9 3/4	9.6	60	1	75	1	75	3.5	350
	VR-7100	1	1	9 3/4	9.6	60	1	75	1	75	3.5	350
	VR-7500	1	1	9 3/4	9.6	60	1	75	1	75	3.5/4.2	350
	VR-7500C	1	1	9 3/4	9.6	60	1	75	1	75	3.5/4.2	350
B	VR-7800	1	1	9 3/4	9.6	60	1	75	1	75	4.2	350
BELL & HOWELL, 7100 McCormick Rd., Chicago, Ill. 60645												
C	2920	1	1	8	6.9	60	0.5-2	75	1	75	3.5/4.2	-
CONCORD ELECTRONICS CORP., 1935 Armacost Ave., Los Angeles, Calif. 90025												
D	VTR-600	2	1/2	7	12	60	1	75	1	75	2.5	250
	VTR-620	2	1/2	7	12	60	1	75	1	75	2.5	250
E	VTR-700	2	1/2	7	12	60	1	75	1	75	2.5	250
	VTR-900	2	1/2	7	12	60	1	75	1	75	2.5	250
CRAIG CORP., 2302 E. 15th St., Los Angeles, Calif. 90021												
	6402	2	1/2	7-8 1/4	9 1/2	50	0.5	75	1.3	75	-	250
GENERAL ELECTRIC CCTV Business Section, 600 Old Liverpool Rd., Liverpool, N.Y. 13088												
G	PT-4	2	1/2	5	7 1/2	20	1	75	1.4	75	-	200+
	PT-5A	2	1/2	7	7 1/2	64	1	75	1.4	75	-	200+
	PT-5B	2	1/2	7	7 1/2	64	1	75	1.4	75	-	200+
	PT-5C	2	1/2	7	7 1/2	64	1	75	1.4	75	-	200+
	PT-5D	2	1/2	7	7 1/2	64	1	75	1.4	75	-	200+
MATSUSHITA ELECTRIC CORP. OF AMERICA, 200 Park Ave., N.Y., N.Y. 10017												
F	NV-8000	2	1/2	7	12	40	0.4	75	1	75	2	200+
	NV-8100D	2	1/2	7	12	40	0.5	75	1	75	2	220+
	NV-204C	2	1	8.5	8.57	67	0.5	75	1	75	3	250+
PHILIPS BROADCAST EQUIPMENT CORP., PO Box 426, Paramus, N.J. 07652												
H	EL3401A/54	4	1	8-9	9	60	1	75	1.4	75	2.5	250
	EL3401B/54	4	1	8-9	9	60	1	75	1.4	75	3.2	280
I	EL3403A/52	5	1	8	7+	60	1	75	2	75	3.8	320
REVERE-MINCOM DIV., 3-M CO. 3-M Center, St. Paul, Minn. 55101												
	VTR-150	1	1/2	8	7 1/2	60	1	75	1	75	2	-
	VTR-150/MC	1	1/2	8	7 1/2	60	1	75	1	75	2	-
SHIBADEN CORP. OF AMERICA, 58-25 Brooklyn-Queens Expressway, Woodside, N.Y. 11377												
	SV-727U	2	1	10	8	90	1	-	1	-	-	450
	SV-727E	2	1	10	7.9	90	1	-	1	-	-	450
	SV-800U	2	1/2	-	7.5	60+	1	75	1	-	3+	300+
SONY CORP. OF AMERICA, 47-47 Van Dam Street, Long Island City, N.Y. 11101												
K	PV-120U	2	2	7	4 1/2	90	-	75	0.5	75	3.3	-
	EV-210	2	1	8	7.8	63	0.5	75	1	75	-	320
	CV-2100	2	1/2	7	7 1/2	60	1	-	1.4	-	-	220
J	CV-2200	2	1/2	7	7 1/2	60	1	-	1.4	-	-	220
	TCV-2110	2	1/2	7	7 1/2	60	1	-	1.4	-	-	220

a. recorder; monitor as package; b. camera; c. monitor; d. tripod; e. audio mixer; f. video switcher; g. microphone panel; h. v.k.f. converter; i. remote control; j. connector panel; k. mixer/fader; l. superimposer; m. special-effects generator; n. sync generator; o. two audio

VIDEO TAPE RECORDERS



AUDIO						Response (Hz)	Dimensions (in)			Weight (lb)	Price (\$)	Special Video	Notes
Micro (dB)	Line (Ω)	Output (dB)	Response (Hz)	W	H		D						
-60	10k	-14	10k	-14	-	60-10,000	18 1/8	10 1/8	15 1/16	52.8	995	D	b,c,d,e,f,g,h
1.8mV	80k	96mV	47k	8dBm	-	90-9,000	23 1/4	18 1/4	12 1/2	62	1600	-	b,c,d,r,s
-	50k	.5V	-	6dBm	-	90-9,000	29	15	18	100	1600	-	
-	-	-	-	-	-	-	29	15	18	100	2500	-	
-	-	-	-	-	-	-	45	44 1/8	23 1/2	-	5945	-	
-	-	-	-	-	-	-	29 3/4	13 1/4	20 1/2	100	4350	-	
-	-	-	-	-	-	-	29 3/4	13 1/4	20 1/2	100	4850	A	
-	-	-	-	-	-	-	34	15	19	140	9500	A,C	16,500
.2mV	200	-	-	4dBm	600	80-10,000	19	11 1/2	13 1/2	65	4200	NTSC color	b
1mV	20k	1V	1meg	1V	600	50-12,000	17	10	16 1/2	52	1150	-	i, j
1mV	20k	1V	1meg	1V	600	50-12,000	17	10	16 1/2	52	1050	-	
1mV	20k	1V	1meg	1V	600	50-12,000	17	10	16 1/2	60	1495	-	
1mV	20k	1V	1meg	1V	600	50-12,000	17	10	16 1/2	52	995	-	
-60	10k	-10	30k	-	-	70-10,000	18 1/2	10 1/4	17 1/2	59	1200	-	k,l,m,n
.775mV	600	-	-	-	-	80-10,000	11 1/4	4 7/8	11 1/16	15	1295	-	p,batt.
.775mV	600	-	-	-2	10k	80-10,000	15 1/2	9 3/4	16 1/2	62	1348	-	b,c,g,p
.775mV	600	-	-	-2	10k	80-10,000	15 1/2	9 3/4	16 1/2	62	1374	-	b,c,g,p
.775mV	600	-	-	-2	10k	80-10,000	14 3/4	9 1/2	16 1/2	58	950	-	c
.775mV	600	-	-	-2	10k	80-10,000	14 3/4	9 1/2	16 1/2	58	975	-	c
-60	20k	0	1meg	-20	600	80-10,000	16 5/8	9 7/8	16 3/16	54 1/2	800	-	h
-20	20k	-	-	-20	600	80-10,000	17 1/4	10 5/8	17	52	1050	-	h
-65	600	-	-	0	600	80- 8,000	24 7/8	12 1/2	16 1/16	97	4250	A	i
1mV	1k	200mV	500k	1V	20k	120-12,000	24 3/4	16 1/2	15 1/4	100	1295	D	
1mV	1k	200mV	500k	1V	20k	120-10,000	24 3/4	16 1/2	15 1/4	100	1395	E	
.2mV	1k	200mV	6k	2V	600k	120-10,000	19 3/4	9 1/2	15 1/2	145	-	F,G	
.2V	10k	.2V	10k	.5V	10k	50-10,000	20	9 1/2	14	50	995	-	u
.2V	10k	.2V	10k	.5V	10k	50-10,000	20	9 1/2	14	275	2495	-	v
-	-	-	600	-	-	50-10,000	21 1/8	21 1/8	13 3/8	120	4995	-	European std
-	-	-	600	-	-	50-10,000	21 1/8	21 1/8	13 3/8	120	-	-	
-60	10k	-14	10k	-14	-	60-10,000	30	11	17 1/2	136	1295	-	
-	-	-	10k	4dBm	600	50-10,000	17 1/2	25	16 3/4	145	8950	D,E	b,c,i
-70dBm	600	-	-	4dBm	10k	50-12,000	26	11 1/4	17 3/4	88	3750	B	
-60	-	-	-	0	-	80-10,000	18 1/8	11 1/8	15 3/4	49	795	-	
-60	-	-	-	0	-	80-10,000	18 1/8	11 1/8	15 3/4	49	850	-	
-60	-	-	-	0	-	80-10,000	27 1/2	16 1/4	11	70	1050	-	
-60	-	-	-	0	-	80-10,000	27 1/2	16 1/4	11	70	1050	-	

channels; p. special lens; q. video duplicating adapter; r. test tape; s. mounted in cart; t. battery-powered; u. 1-year warranty on head; v. completely mobile; A. color; B. adaptable for color; C. electronic editing; D. stop motion; E. slow motion; F. a.g.c.; G. dubbing.

TAPE AND THE LAW

By David Licht



OUR Granddads had the Brownie camera. We have the equally ubiquitous tape recorder. In their respective ways, both record a segment of life—and preserve it better than our best recollection can. On tape, we can again hear an historic speech, the drollery of a political convention, the first burbling of our offspring, the sounds of our everyday existence. The scope goes from the most intimate to the most public; from lightness and entertainment to the serious life-and-death events of our times.

The use of the tape recorder, its pleasures, conveniences, and economy, are all taken for granted. Beneath this innocent appearance, however, lies a maze of legal ramifications, from the right of privacy to the complications of the copyright laws. Our own home is still our castle. What we do for our own private use is still pretty much our own business. Though it may be a possible technical violation of the copyright laws, an off-the-air recording for our own use is safe. Big Brother is not here yet. But take this recording and give it further circulation—whether or not for commercial payment—and the copyright violation becomes immediately real and public. And this despite whatever guise such circulation might be made under.

And the recording need not be off-the-air. When a well-known nutritionist gave a speech in Tulsa, Oklahoma, and a recording of it later came into unauthorized hands for commercial exploitation, the whole set-up came to a halt when the lady called in her lawyers. It was not necessary for a Court action to be started: lawyers in California, Oklahoma, Pennsylvania—and myself, in New York—all agreed that the lady had a pretty good claim. She got her way and the unauthorized recordings were promptly destroyed.

But things are different when we come to the public domain. A speech by the President could be recorded and circulated without permission or arrangement with the speaker. Many of us remember General MacArthur's "Old Soldiers Never Die" speech and the many different recordings of it that appeared. Perhaps it will be reissued for the new

generation in phony stereo; we'll wait for that. But it could be done without permission of the MacArthur Estate.

However, with the exercise of common sense and prudence, the amateur recordist will have little to worry about. If you record friends, parties, or entertainers; copy records; tape programs off the air or live performances; do *not* sell or distribute your recordings unless proper legal permission is gotten from all parties involved. This means the performer, his agency, his recording company, the copyright owner of the material, ASCAP perhaps, the broadcasting company, the producer, the record manufacturer, the original tape licensor (perhaps a foreign producer) and—well, maybe more.

As a hobby, tape recording is free. Make it into anything resembling business and it becomes restricted and serious. Be guided by the summary below, and you are fairly sure to avoid legal entanglements. These little *caveats* aside, have fun!

IF YOU

- A. record yourself, friends, parties, or famous personalities (in person)
- B. copy phonograph records or prerecorded tapes either directly or off the air
- C. tape programs off the air
- D. tape live performances—

DO NOT

sell or distribute your recordings *unless* you obtain permission to do so from the following, wherever applicable:

- 1. the persons involved
- 2. the performer(s) and person, company, or agency to which he may be under an exclusive service contract
- 3. the copyright owner of the subject matter of the performance, if it is a work protected by copyright
- 4. the program's broadcaster and producer
- 5. the manufacturer of the recording.

The First KLH Tape Recorder



IN a recent demonstration, the \$600 KLH home tape recorder was compared to a professional machine that sells for some \$3,500.

Both recorded from the same wide-range, noise-free source; in fact all conditions of comparison were equal, with one exception: The KLH* Model Forty operated at 3¾ ips, quarter-track, the professional machine at 15 ips, half-track.

When the recordings were played back,

listeners said the only difference they heard was \$2,900.

KLH Research and Development Corp.
30 Cross Street, Cambridge, Mass. 02139

Gentlemen: Please continue. How can a 3¾ ips tape equal a 15 ips tape in sound quality? Why only one VU meter on a stereo recorder? What are those two little switches that say "Dolby System" underneath? etc.

Name _____

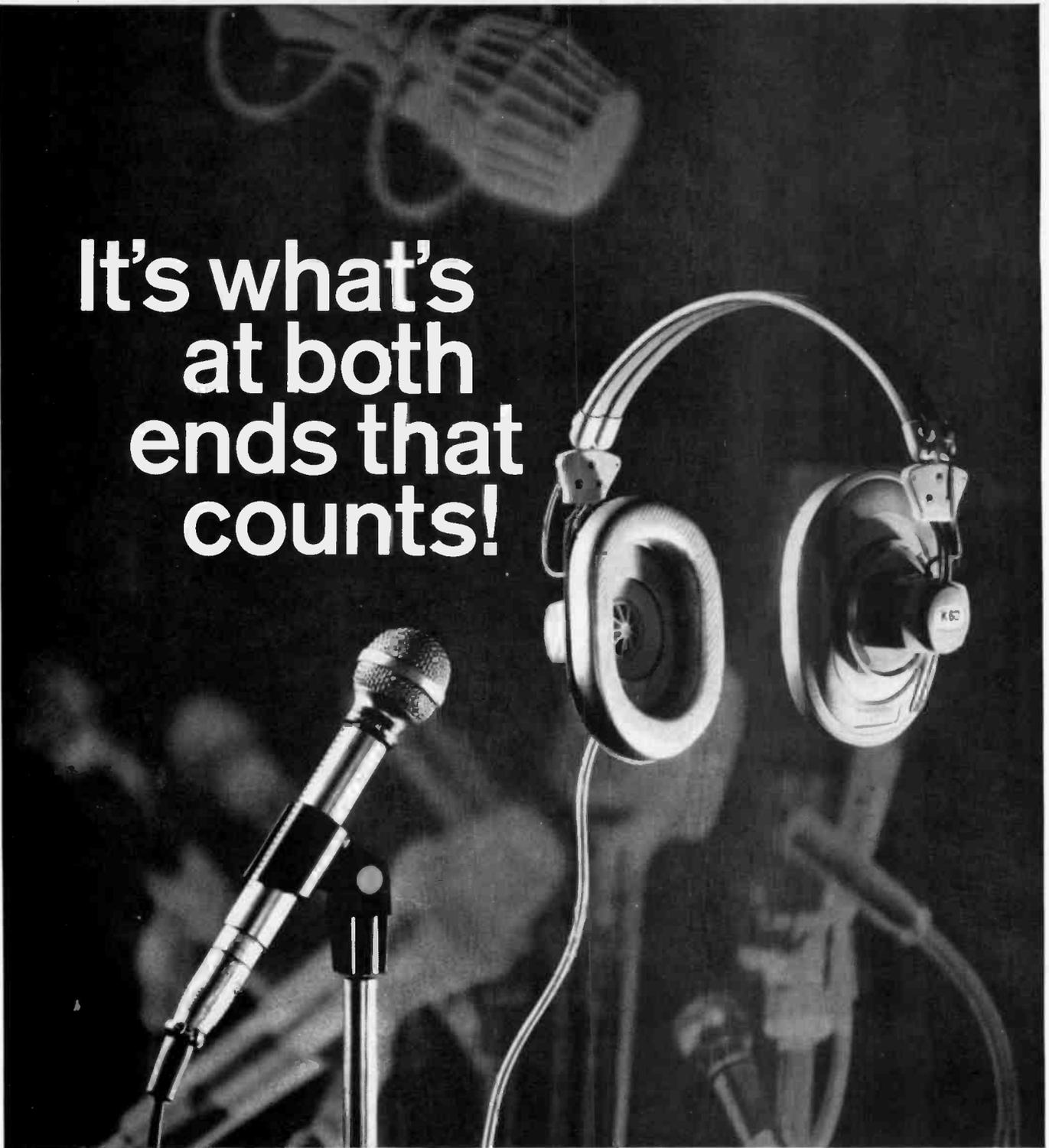
Address _____

City _____ State _____ Zip _____



*A TRADEMARK OF KLH RESEARCH AND DEVELOPMENT CORP.

It's what's at both ends that counts!



In any audio recording or reproducing system the input and output transducers represent the most critical link.

Take microphones, for example. They should perform the task of converting sound waves into electrical impulses with absolute faithfulness. **AKG** microphones are characterized by extended wide range and smooth response. They are an unsurpassed investment value.

On the output side . . . headphones should convert electrical impulses into audible sound of ultimate fidelity. Listen to natural, clean sound through **AKG**

headphones and discover the only "humanized" headphones available . . . scientifically designed to complement the characteristics of human hearing.

Ask any professional — the trademark **AKG** is synonymous with the highest standards in quality and performance.

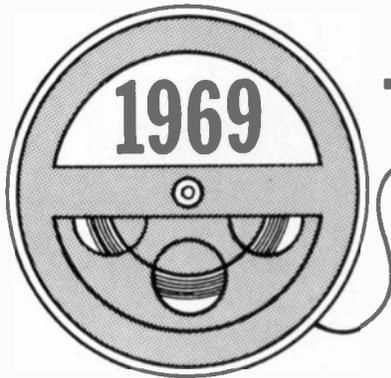
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MICROPHONES • HEADPHONES

DISTRIBUTED BY
NORTH AMERICAN PHILIPS COMPANY, INC.
100 EAST 42ND STREET, NEW YORK, NEW YORK 10017

Circle No. 1 on Reader Service Card.



TAPE RECORDER DIRECTORY

RECORDERS, PLAYERS, AND TRANSPORTS	65
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RAW TAPE	105
TAPE ACCESSORIES	108
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AIWA

TP-1013 Portable Stereo Recorder
Solid-state stereo, 2-speed (3 3/4 & 1 7/8 ips), 4-track design. Features 5" max. reel; will



operate from 4 "D" cells or 120 V a.c.; has two 4" x 2 3/4" speakers (one detachable); remote control sw.; supplied with 2 dynamic mics (one with remote control), batteries & accessory case. 3 3/4" x 11 1/8" x 15" d.\$99.95

TP-719 Portable Recorder

Solid-state mono, dual-track, 3-speed (7 1/2, 3 3/4 with switch, and 1 7/8 ips capstan



change) design; wow & flutter 0.25% @ 7 1/2 ips. Has 3" x 5" spkr. with 1.5 W output. Operates from 8 "D" batteries, 120 V a.c., or 12 V car battery. Will accept 7" reels. Supplied with attaché-size case with locking provision, car battery adapter, dynamic mic with "on-off" switch, batteries, and earphone. 16 1/2" x 13" x 3 3/8" ..\$149.95

TP-1001W Recorder

4-track solid-state, stereo, dual-speed (7 1/2 & 3 3/4 ips) design. Has record-playback & erase heads; 2 4" x 8" speakers; counter; vu meters. Response 70-15,000 Hz @ 7 1/2 ips; wow & flutter 0.15% @ 7 1/2 ips. 14 1/2" x 13 1/2" x 10" d. Supplied with two mics ..\$229.95

TP-1012 Tape Recorder

Solid-state stereo design for a.c./d.c. operation (117 V a.c., 8 "D" cells, or 12 V battery). Features 4-track, 7" reel; automatic shut-off; two vu meters; pause controls; 2

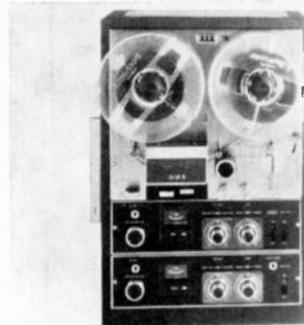
speeds (7 1/2 & 3 3/4 ips; 1 7/8 ips with capstan change); counter; 1.25 W/ch dynamic out-



put; two 6" x 4" speakers. Response 50-16,000 Hz. Supplied with 2 dynamic mics. 13 1/2" x 12 3/8" x 7 3/4" ..\$189.95

TP-1006W Tape Recorder

Solid-state; 4-track; 7" reel size; 2 speed (7 1/2 & 3 3/4 ips; 1 7/8 ips with capstan



change) design. Response 50-18,000 Hz @ 7 1/2 ips; 5 W/ch dynamic power (EIA 5% dist); wow & flutter 0.2%. Features sound-on-sound; sound-with-sound; vu meters; counter; pause control & 4" dynamic monitoring speaker. For use with external spkrs. 20 3/8" x 14" x 8". Supplied with DM-51 dynamic microphone ..\$379.95

ALLIED

1040 Stereo Tape Recorder

Records & plays 4-track stereo & mono at



7 1/2, 3 3/4 & 1 7/8 ips. Has detachable speakers, two vu meters, two mic & two aux. inputs. Response 40-16,000 Hz @ 7 1/2 ips; flutter & wow 0.15% @ 7 1/2 ips. Supplied with 7" reel and two microphones.

15C7104U ..\$179.95

TD-1030 Tape Deck/Preamp

Solid-state, 3-speed (7 1/2, 3 3/4 & 1 7/8 ips.) stereo design. Has record/play preamps for



4-track stereo and mono; digital counter; two mic inputs; two aux. inputs. Response 40-16,000 Hz ±3 dB @ 7 1/2 ips (50-12,000 Hz @ 3 3/4 ips); flutter & wow 0.15% @ 7 1/2 ips; S/N ratio 50 dB; 11D 2.5%. Supplied with wood base, 7" reels & dust cover. 15C7103U ..\$135.00
12C7162 Dynamic mic ..\$ 12.95

TD-1070 Tape Deck/Preamp

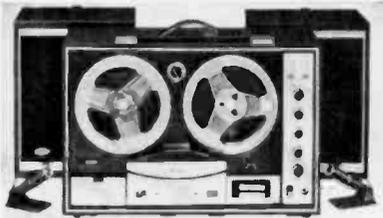
4-track, mono/stereo design featuring automatic-reverse. Will record & play in both



directions; has continuous replay. Features 3-speed (7 1/2, 3 3/4, 1 7/8 ips); sound-on-sound; pause control; solid-state stereo preamps with stereo mic & aux. inputs. Response 40-20,000 Hz at 7 1/2 ips; flutter & wow 0.15% at 7 1/2 ips. 12 3/8" x 19" x 17 1/2". Less microphones. 15C7578U ..\$299.95

TR-1080 Tape Recorder

Features same basic tape mechanism as TD-1070 except has additional stereo power amp with speakers. Portable case vinyl



covered. 12 3/4" x 19 1/2" x 12 1/4". With two mics.
15C7579U\$349.95

TR-1035 Tape Recorder

Solid-state, 4-track stereo design with built-in stereo speakers. Has 3 speeds (7 1/2, 3 3/4,



1 1/8 ips); inputs for stereo mics & aux. Response 40-14,000 Hz at 7 1/2 ips. Flutter & wow 0.12% at 7 1/2 ips. Vinyl covered case. 12 1/2" x 15 3/4" x 7 3/8". Supplied with two mics.
15C7577\$159.95

1050 Mono Tape Recorder

2-track, dual-speed (7 1/2 & 3 3/4 ips) solid-state design with 1-watt dynamic power output. Response 50-12,000 Hz. Has 4" x 6" speaker. Automatic level control. 13 3/8" x 13" x 7 1/2". With mic.
15C7575U\$99.95

1055 Battery/A.C. Recorder

2-track mono design with 5" reels, 3" x 6" speaker; 2 speeds (1 1/2 & 3 3/4 ips). Has



automatic level control. Operates from six "D" cells or a.c. line. Supplied with remote start/stop mic. 11 1/4" x 9 1/2" x 3 1/2". 8 1/2 lbs.
15C7576U\$69.95

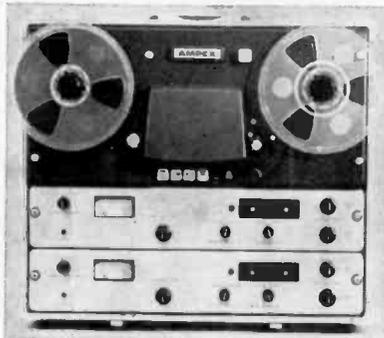
AMPEX

AG-500 Series Tape Deck/Preamp

Two-speed solid-state professional recorder with 4-position head assembly with separate erase, record & playback heads; extra position for optional 4-track stereo playback or special requirements; has vu meters; response 30-18,000 Hz ± 2 dB @ 15 ips, 30-15,000 Hz @ 7 1/2 ips, 40-8000 Hz @ 3 3/4 ips; signal-to-noise ratio 55 dB @ 15 & 7 1/2 ips (half-track or 2-track), 50 dB @ 3 3/4 ips; wow & flutter .15% @ 15 ips, .18% @ 7 1/2 ips, .25% @ 3 3/4 ips; output +4 dBm into 600-ohm balanced or unbalanced load; rack space: transport 8 3/4" x 19" x 6" d.; electronics 3 1/2" x 19" x 6" d.

Model AG-500-1 full or half-track; single channel electronics include built-in mixer to

mix line and mic or two mics; has two inputs: unbalanced bridging with provisions for plug-in line transformer or low-imp. plug-in microphone preamp; without case.
Cat. #4010048-02 full track 7 1/2 & 15 ips.\$1202.00
Cat. #4010048-06 half track 3 3/4 & 7 1/2 ips.\$1202.00
Cat. #4010048-04 half track 7 1/2 & 15 ips.\$1202.00



Model AG-500-2 two channel; stereo or mono recording; has one input per channel; inputs are unbalanced bridging with provision for plug-in line transformers or low impedance plug-in mic. preamps; features sound-on-sound, cue tracks, and other special effects.

Cat. #4010049-06 two track, 3 3/4 & 7 1/2 ips.\$1432.00

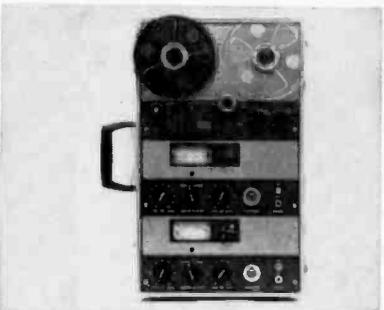
Cat. #4010049-02 two track 7 1/2 & 15 ips.\$1432.00

Remote control (in box with 30' cord)\$85.00

Cat. #4010049-08 four track 3 3/4 & 7 1/2 ips. Has three 4-track record-erase-playback heads, a 2-track playback head & a head switch. Has 1 line input for each channel. Microphone preamps or line transformers may be used with line inputs.....\$1432.00

602-2 Series Recorders/Preamps

Stereophonic tape recorder using Model 602-1 tape transport and two Model 602-1



electronic chassis for stereo record/playback; two-track erase head, record and playback heads; all performance specifications identical to Model 602-1.

Cat. #4016023-02 7 1/2 ips, portable case\$875.00

Cat. #4016023-04 3 3/4 ips, portable case\$875.00

Cat. #4016023-01 7 1/2 ips, supplied unmounted\$795.00

2100 Series Tape Recorder

Three-speed (7 1/2, 3 3/4 & 1 1/8 ips) design features automatic tape threading, automatic end-of-reel tape reverse, and manual switch for tape reverse at any time desired. Machine adds inaudible pulse onto any tape, used to actuate end-of-reel reversal. All solid-state. Has automatic shut-off and built-in preamps, power amps, and speakers. Four heads. Records 4-track stereo and mono, plays 4-track stereo and 4-track, half-track, and full-track mono. Response 30-18,000 Hz ± 2 dB @ 7 1/2 ips; S/N 52

dB @ 7 1/2 ips; power output 8 W/ch continuous r.m.s. Flutter and wow 0.08% @ 7 1/2 ips.

2150 uncased deck with stereo preamps only\$399.00



2161 complete recording outfit with two slide-on speakers\$469.00

602-1 Series Recorders/Preamp

Full-track or half-track recorder; 3 heads; erase, record, playback; frequency re-



sponse: 40 to 15,000 Hz, 40 to 10,000 Hz ± 2 dB, no more than 4 dB down at 15,000 Hz; wow and flutter under 0.17% r.m.s.; signal-to-noise ratio: full track, over 57 dB below peak recording level at 3% total harmonic distortion; half track, over 55 dB; vu meter; separate record and playback preamplifiers; reel size: 7"; timing accuracy: ± 3.6 seconds in 30 minute recording; microphone and high level inputs with full mixing provisions; vertical or horizontal operation; separate playback preamp permits instantaneous comparison between incoming program material and actual recording; headphones jack; output: +4 dBm into 600 ohm load from tapes recorded at program level.

Cat. #4016021-04 Half-track, 7 1/2 ips, portable case\$625.00

Cat. #4016021-08 Half-track, 3 3/4 ips, portable case\$625.00

Cat. #4016021-03 Half-track, 7 1/2 ips, unmounted\$575.00

Cat. #4016021-02 Full-track, 7 1/2 ips, portable case\$625.00

Cat. #4016021-01 Full-track, 7 1/2 ips, unmounted\$575.00

861 Tape Recorder

Four-track stereo, 1/2 track & mono; transistorized; dual capstan drive, no pressure pads; vu meters; 3-speed (7 1/2, 3 3/4, 1 1/8 ips). Response 50-15,000 Hz ± 4 dB @ 7 1/2 ips. Signal-to-noise -46 dB @ 7 1/2 ips. Wow & flutter .15% @ 7 1/2 ips. Complete portable design includes 6 W/ch continuous sine-wave power amplifiers; two 702 mics & two 813 slide-on speaker systems. 19" x 13 1/2" x 7 1/2"\$249.00

1161 Tape Recorder

Four-track stereo, 1/2 track & mono; automatic threading; electronic & manual reversing; transistorized; dual capstan drive, no pressure pads; vu meters; 3 speed (7 1/2, 3 3/4, 1 1/8 ips); has provision for automatic slide projector actuator. Performance at 7 1/2 ips: response 50-15,000 Hz ± 4 dB, S/N -46 dB, wow & flutter .15%.



1



6



9



2

**CONCORD
MEANS
TAPE
RECORDERS**

**Here are
10
of our
18
quality
models.**



10



3

1. F-20 A precision tape recorder with mass appeal. Under \$25. 2. MODEL F-50 Compact cassette portable with battery, AC operation. Contemporary desk-top design. Large speaker and high output for excellent room-size sound reproduction. Dynamic remote control mike, carrying case and strap. Under \$60. 3. MODEL F-95 RADIO-CORDER[®] Precision cassette portable with quality, built-in superheterodyne AM radio. Records live or directly off-the-air. Battery AC operation, remote control mike. Under \$100. 4. MODEL 300 Concord's exclusive Reverse-a-track recorder (records and plays in both directions) with same continuous recording capacity as eight inch reel recorder. Includes AC battery operation, automatic record control, precision quality transport mechanism. Under \$90. 5. MODEL 350 The world's finest battery operated portable in sound, in performance, in features. Reverse-a-track (automatically reverses). Twelve hours continuous recording time. High fidelity sound quality. Voice operation (starts automatically when there is sound). Under \$150. 6. MODEL F-103 RADIO-CORDER High quality AM FM radio combined with precision cassette cartridge tape recorder. AC/battery operation. Superb sound quality. Under \$130. 7. F-105 Compact cassette cartridge stereo tape deck. Records and plays stereo. Two VU meters. Handsome teak cabinet. Under \$140. 8. MODEL 510-D Three speed stereo tape deck with front panel sound-on-sound switching. Features "Golden Transport Mechanism." Flux-field heads. Under \$160. 9. MODEL F-98 A professional high fidelity cassette portable with outstanding performance and dozens of features. Built-in dynamic remote control mike, manual or automatic record level control, digital counter and many more. Battery/AC operation, push button controls. Under \$120. 10. MODEL F-400 cassette portable stereo. A handsome, compact unit unequalled in sound, performance and features. Built-in acoustically matched speakers, Concord's Golden pushbutton tape transport mechanism, battery/AC operation. Records and plays stereo and mono cassettes. Under \$180.



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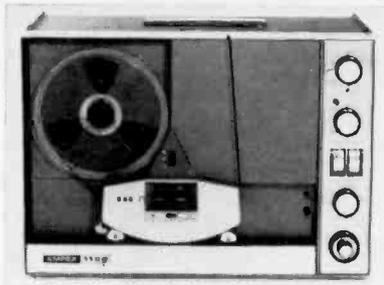


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CONCORD
THE TAPE RECORDER PEOPLE

AUDIO RECORDERS
VIDEO RECORDERS

Circle No. 11 on Reader Service Card.



Complete portable design includes 6 W/ch continuous sine-wave power amps & two slide-on speaker systems. 19" x 13½" x 7½"\$369.00

Accessories

#702 mic.: Omnidirectional dynamic type, 3¼" x ¾" dia., with stand.....\$9.95

#1101 mic. Omnidirectional dynamic type\$19.95

#2001 mic.: Omnidirectional dynamic type, 7" x 1½" dia., with stand\$29.95
Recording Accessory Kit: Complete maintenance kit. Includes head demagnetizer, head cleaner, tape splicer, leader tape, splicing tape, and cotton swabs.....\$22.50

985 Tape/Radio System

Combines stereo tape recorder with an AM-FM stereo tuner in a single, compact walnut cabinet with tambour door. Recorder specifications similar to 1100 Series tape recorder. Has automatic reverse & pause control. Will record directly from tuner. Supplied



with two mics.\$599.95
Matching speaker systems.
Model 830Pair \$99.95

761 Stereo Tape Recorder

Features 3-head design providing tape monitoring, sound-on-sound, sound-with-sound & echo effect. Response 50-15,000 Hz ±4 dB at 7½ ips; flutter & wow 0.15% at 7½ ips; 8 W/ch continuous sine wave. Supplied with two mics & pair of cube-shaped speaker systems which can be placed within carrying case. 23½" x 14" x 8½" ..\$329.00

1461 Stereo Tape Recorder

Same as Model 761 except has 4 heads. Features automatic reversing & threading



.....\$429.00
415 Cube speaker system using 6" speaker available separately. Walnut finish.pair \$39.90

ARISTO

10R-804 Stereo Tape Recorder

Solid-state, four-track, stereo design; records/plays stereo; 7" reels; a.c. operated; vu meter; individual tone & volume controls each channel; digital counter; fast-

forward sw.; two-speed selector sw. Can operate either horizontally or vertically.



Comes with two dynamic pencil mics & stands, aux. patch cords for recording direct from tuner or TV, 7" reel. 12" h. x 14" w. x 7" d.\$119.95

14R-806 Stereo Tape Recorder

14-transistor, 4-track design; plays and records stereo in vertical or horizontal posi-



tion; 7" reels; a.c. operation; push-button control; two vu meters; digital counter; volume & tone controls each channel; fast-forward sw.; automatic stop; two-speed selector sw.; removable extension speakers. Comes with two dynamic pencil mics with stands; aux. patch cords; 7" reel. 15½" h. x 20¾" w. x 8½" d.\$169.95

BELL & HOWELL

2293 Tape Deck/Preamp

Solid-state, 4-track design; response 40-17,000 Hz ±3 dB at 7½ ips; wow & flutter



0.09% at 7½ ips. Has high-level & mic inputs; 4 speeds (7½, 3¾, 1½ & 1⅞ ips); pause control; automatic head demagnetizer; source input mixing. Features automatic loading & air jet carries tape through. Fully automatic reversing\$299.95

2263 Tape Deck/Preamp

Same as Model 2293 except does not have automatic loading feature\$259.95

Model 2295 Stereo Recorder

Same as Model 2297 except 8.4 W (EIA) per channel & THD (50-15,000 Hz) under 3% at 1 W output.\$399.95

Model 2297 Stereo Recorder

Four-speed, solid-state recorder; 15 W (EIA) output per channel. Frequency response 40-18,000 Hz ±3 dB at 7½ ips (preamp output); wow & flutter less than 0.09% at 7½ ips. Amp response 50-20,000



Hz; THD under 3% at rated output. Pre-amp THD (35-20,000 Hz) under 1% re 10 vu. S/N ratio from peak recorded level better than 51 dB at 7½ ips.\$449.95

Model 2291 Stereo Deck

Four-speed, solid-state deck; S/N ratio from peak record level better than 51 dB at 7½ ips; response 40-18,000 Hz ±3 dB at 7½



ips (preamp output); wow & flutter less than 0.09% at 7½ ips; THD (preamp) under 1% from 35-20,000 Hz; source input dynamic range 50 dB at preamp output; mic input dynamic range 32 dB.\$349.95

CHANNEL MASTER

Model 6430 Stereo Tape Recorder

Solid-state, 4-track, 2-speed (7½ & 3¾ ips) stereo recorder; capstan drive; 4-pole induction motor; a.c. bias, 50 kHz. Response 50-50,000 Hz at 7½ ips, 50-9000 Hz at 3¾ ips; S/N 47 dB min. Wow & flutter less than 0.3%. Two 4" speakers in removable lids. Digital counter with reset button; automatic shutoff at end of reel; two vu meters; power "on" indicator; transistorized amp provides 3 W audio output each channel. 14½" x 13" x 10¾" in vinyl-covered wood cabinet.\$239.95

CONCERTONE

700 Portable Mono Recorder

Cordless & a.c. operated, 2-track, transistorized, 4-speed (1⅞, 1½, 3¾ & 7½ ips)



remote-control design using 7" reels. Operates from six "D" size flashlight cells & has built-in 117 V a.c. power supply. Flut-

ter & wow 0.25% r.m.s.; response 30-15,000 Hz @ 7½ ips & 30-3000 Hz @ 1½ ips; S/N ratio 45 dB; has 5½" x 3" speaker. 10⅝" x 11¾" x 5⅝". Supplied with omnidirectional mic & special dictation mic & remote start-stop switchLess than \$160.00

400Q Tape Recorder

Solid-state stereo design; 3 speeds, 4-tracks.



Features sound-with-sound\$199.95

302-D Stereo Tape Deck/Preamp

Solid-state design; 3-speed (7½, 3¾ & 1⅞ ips); 4-track; has two heads (erase &



record/play); pause/cue control; dual-type vu meter. Response 50-15,000 Hz @ 7½ ips; wow & flutter 0.15% @ 7½ ips; S/N ratio 50 dB @ 7½ ips. Features sound-with-sound & automatic shut-off. Accepts up to 7" reels. Does not have power amps. Has two line & two mic inputs & two line outputs. 14½" w. x 19" x 4½"\$169.95

790 Tape Recorder

Solid-state: a.c./battery operated; stereo; 4 speeds (15, 7½, 3¾ & 1⅞ ips). Re-



sponse 20-22,000 Hz. Has built-in Nicad battery charger. Features sound-with-sound & 7" reels\$259.95

CONCORD

510-D Tape Recorder/Preamps

Solid-state, 4-track, 3-speed (1⅞, 3¾ & 7½ ips) stereo record & playback design;



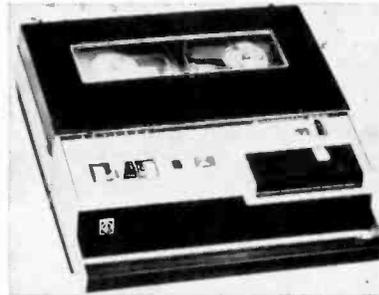
has two vu meters; 7" reels; automatic shut-off; cue control; counter. Response 30-18,000 Hz ±3 dB @ 7½ ips (30-10,000 Hz @ 3¾ ips) wow & flutter 0.17%; S/N ratio 50 dB. Mahogany cabinet. 14¾" x 12½" x 4¾"under \$160.00

776D Tape Recorder/Preamps

Solid-state, stereo, 2-speed (3¾ & 7½ ips), 4-track record & playback design. Features "Reverse-A-Track"; sound-with-sound. Response 30-20,000 Hz ±3 dB @ 7½ ips; wow & flutter 0.15%. Has stereo line outputs; 7" reels; walnut cabinet. 20" x 13½" x 7"under \$250.00

350 Automatic Portable Recorder

Features automatic tape reversal & voice-operated start/stop; 2 speeds (3¾ & 1⅞



ips); solid-state circuits; battery operation (six "D" cells); vu meter/battery level indicator; dual track; counter; cue button; external monitor; 3" x 6" speaker; mono operation. Uses up to 5" reels; response 50-10,000 Hz. Supplied with remote-control dynamic mic. 11½" x 11" x 4". 10 lbs.\$149.95

Optional equipment: AC-6 120-V adapter; FT-2 foot sw.; TP-2 telephone pickup.

Model 444 Tape Recorder

Solid-state preamps; 3-speed (7½, 3¾ & 1⅞ ips) design with built-in amplifiers



and speakers; record/playback. 2-track stereo or mono; separate erase & record/play stacked heads; response 50-15,000 Hz ±2 dB @ 7½ ips; wow & flutter 0.2% r.m.s. @ 7½ ips; S/N ratio better than 40 dB; HD less than 2% @ 3 dB below rated output; two inputs/ch (47 ohms to ext

COMPARE CRAIG

on-the-go
portable
tape
recorders



Craig "212" Portable Tape Recorder. The standard of the industry. Automatic level control and easy "T" control operation make America's top-selling portable. Model 212. Price \$39.95*



Craig "212 Cassette." The same great sound and performance of the Craig "212" in a convenient cassette version. Just pop in a cartridge and you're ready to record. Model 2603. Price \$59.95*

For go-anywhere convenience, Craig has 6 different models of cassette and reel-to-reel battery/AC-operated portable tape recorders.

*Suggested retail price

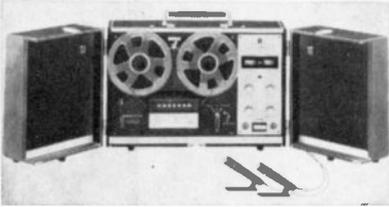
Craig

CRAIG CORPORATION
Products Division, 2302 E. 15th Street
Los Angeles, California 90021

amp & 8 ohms to ext spkr); 30A5 output tubes are used; split speakers in case cover for remote placement; 5 W/ch output; has 2 vu meters; features sound-on-sound recording; supplied with two dynamic mics & mahogany carrying case; 11½" x 13½" x 14" d.\$199.95

700 Series Recorders

Solid-state, 4-track stereo with detachable speaker enclosures. Features vu meters, counter, 2 dynamic mics, cue button, monitor, sound-with-sound. Has mic & high-Z



inputs; "Trans-A-Track" recording facility. Model 727 2-speed (7½ & 3¾ ips); one ea erase & record/playback heads; unidirectional tape transport; response 30-20,000 Hz ±3 dB; wow & flutter 0.15% @ 7½ ips; S/N ratio 50 dB; 6" speakers; 7½ W/ch output; automatic shut-off. Mahogany\$269.95
 Model 776 Same as 727 except has automatic "Reverse-A-Track" feature; with 2 ea erase and record/playback heads; automatic electronic shut-off. 13" x 20" x 6½" plus speaker 6½" x 6½" x 10". Mahogany\$299.95

Model 300 Dual-Power Recorder

Will operate from six "C" batteries or 120-V a.c. Features dual speed (1½ & 3¾



ips) 2-track, mono operation. Has record/battery level indicator; automatic record level control, "Reverse-A-Track" feature; takes up to 4" reel; response 60-10,000 Hz @ 3¾ ips. Solid-state design. Supplied with remote control dynamic mic. 3" x 10" x 9"; 6½ lbs.\$89.95
 Optional equipment. VM-10 voice-operated mic; FT-2 foot sw; TP-2 telephone pickup.

CRAIG

"Craig 910" Stereo Tape Recorder

Solid-state, 4-track, dual-speed (7½ & 3¾ ips) design. Features sound-on-sound; built-



in stereo preamps & power amps & two 4" x 5" spkrs. Has vu meters, radio & mic inputs. Response 50-15,000 Hz @ 7½ ips. 17" x 14" x 5½" d. Supplied with mics.\$179.95

2106 Portable Recorder

Mono design; battery (six "D" cells) or

optionally a.c.-operated; features 5" reel; 2 speeds (1½ & 3¾ ips); wow & flutter 0.3% @ 3¾ ips; S/N ratio 40 dB; 0.55 W output. Response 150-7500 Hz @ 3¾ ips; records on ½-track with d.c. erase; has mic & radio inputs; 3" x 6" speaker & remote-control mic. 10½" x 11½" x 4½".\$69.95

2403 Stereo Tape Recorder

3-speed design with automatic shut-off; 7" reels; dual vu meters; counter; 2½ W/ch. Walnut Cabinet\$239.95

2404 Tape Deck/Preamps

Same as Model 2403 except does not include power amps\$154.95

2402 Stereo Recorder

Features automatic reverse; three speeds (7½, 3¾ & 1½ ips); 4-tracks: sound-on-



sound; sound-with-sound. Wow & flutter 0.15% r.m.s. at 7½ ips. Output 4 W/ch dynamic power; response 30-18,000 Hz at 7½ ips. Supplied with 2 mics. 19½" w. x 15" h. x 12½". Includes separate (4") speaker systems\$349.95
 Model 2405. Deck version of 2042....\$289.95

CROWN

SX700 Series Tape Recorders

Record and play response 30-25,000 Hz ±2 dB @ 7½ ips; has three-motor modular-designed transport; differential magnetic braking; automatic stop; two-speed record/play equalization; 7½ & 3¾ ips (1½ & 15 ips available); handles up to 10½"



reels; wow & flutter 0.09% @ 7½ ips; S/N ratio 55 dB @ 7½ ips; HD 1.5%; inputs: two high imp. inputs per channel, mic or line: +6 dBm or 2.5 V output.

SX711 Full-track mono\$ 895.00
 SX712 Half-track mono\$ 895.00
 SX724 Two-track stereo\$ 995.00
 SX724-P2 Four-track stereo with two- and four-track stereo playback\$1220.00

CX700 Series Solid-State Recorders

Three heads, three motors featuring differential magnetic braking, automatic stop, three speeds. Handles up to 10½" reels; wow & flutter 0.09% @ 7½ ips. Available with either mono electronics or stereo control center. Response @ 7½ ips (4-tr) 30-30,000 Hz ±2 dB; S/N ratio 60 dB. Four-channel stereo control center. Basic unit with 4 unbalanced line inputs, 2 mixing inputs per channel; line (basic) or microphone, RIAA phono (using optional plug-in modules). Outputs 0 level, 5000 ohms unbalanced or up to +18 dBm (using optional amp module); two 5" vu meters.

CX711 Full-track mono\$ 995.00
 CX712 Half-track mono\$ 995.00
 CX722 Two-track stereo\$1295.00
 CX724 Quarter-track stereo\$1295.00

CX800 Series Solid-State Recorders

Can be remote controlled; features computer logic control photocell automatic stop; three motors; differential magnetic braking; three speeds. Handles up to 10½" reels; wow & flutter 0.06% @ 15 ips. Available with either mono electronics or stereo control center; response @ 7½ ips 30-30,000 Hz ±2 dB; S/N ratio 60 dB. Four-channel stereo control center. Basic unit with 4 unbalanced line inputs, 2 mixing inputs per channel: line (basic) or microphone, RIAA phono (using optional plug-in modules). Outputs 0 level, 5000 ohms unbalanced, or up to +18 dBm (using optional amp module); two 5" vu meters. Available with low-impedance mic. input and balanced 600-ohm output.

CX811 Full-track mono\$1495.00
 CX812 Two-track mono\$1495.00
 CX822 Two-track stereo\$1790.00
 CX824 Quarter-track stereo\$1790.00
 CX844 Four-channel in-line\$2880.00
 Complete series of players-only available.

SX800 Series Solid-State Recorders

Uses SX700 electronics and CX800 transport.

SX811 Full-track mono\$1395.00
 SX812 Half-track mono\$1395.00
 SX822 Two-track stereo\$1495.00
 SX824 Quarter-track stereo\$1495.00
 Complete series of SP700 and SP800 players are available.

CROWNCORDER

CRC-6250F Tape Recorder

Attaché-case mono type recorder/AM-FM radio combination with automatic tape repeater (will repeat any 15-second segment of tape); 2 speeds (3¾ & 1½ ips); 5"



reels; solid-state design, built-in a.c./battery operation; 1.5 W output; a.c. bias; 2-track; 100-10,000 Hz response; 3" x 5" speaker. With mic. 3¾" x 16¼" x 12¼" \$169.95

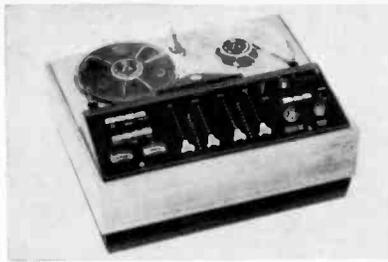
CTR-6650S Tape Recorder

Solid-state mono design with 5" reels. Has built-in a.c./battery (6 "D" cells) operation. Response 100-10,000 Hz; a.c. bias; 2-track; 1.5 W output. Has automatic tape repeater, 2 speeds (3¾ & 1½ ips); 3" x 5½" speaker. With mic. 14½" x 9¼" x 3¾"\$99.95

DYNACO

Transistorized Tape Recorder

Imported from B&O of Denmark; fully transistorized, 3-speed complete recorder with built-in power amplifiers; three inputs (200-ohm mic, RIAA equalized phono, radio tuner) mixed via professional-type slide potentiometers; provision for sound-on-sound and echo; two record-level meters; hysteresis synchronous motor; separate record and playback heads; tape-input monitoring; preamp output; all plug-in circuit boards; 40-16,000 Hz ±2 dB; r.m.s. flutter less than 0.075%; peak-to-peak flutter less



than 0.2%; S/N ratio 50 dB.\$498.00
 Portable version of the above machine includes a pair of monitor speakers built into the case covers\$525.00

GENERAL ELECTRIC

Model M8060 Stereo Recorder

Two-speed (3 3/4 & 7 1/2 ips), 4-track stereo with 6" matched dynamic speakers. Has



pause control, continuous bass/treble control; push-button function controls; storage space for mics, mic stands, and external speaker cords. Hinged speakers may be separated from cabinet. Digital counter; vu meter with stereo balancing sw.; record interlock. 18 1/2" w. x 14 1/2" h. x 9 3/4" d. Carrying handle. Walnut grain finish on polystyrene.\$164.95

GRUNDIG

TK 247 Stereo Recorder

4-track, 2-speed (7 1/2 & 3 3/4 ips) design; response 40-16,000 Hz. Has sound-on-



sound, sound-with-sound, pause bar, automatic shut-off, two 6" x 4" speakers. 17 1/2" x 13" x 7 1/2".\$249.95

TS-340U Stereo Recorder

4-track, 3-speed (7 1/2, 3 3/4 & 1 1/2 ips) recorder with solid-state amplifier (can be used separately); synchronized sound-on-sound and sound-with-sound; echo effect.



Features full push-button operation; monitoring of input signal or tape; automatic shut-off by tape end foil; 4-digit tape counter. Freq. range @ 7 1/2 ips 40-18,000 Hz; wow & flutter ±0.1% @ 7 1/2 ips. Two

7" x 5" PM speakers; output 12 W music power ea. channel. Various optional accessories available. 20 3/4" x 15 3/4" x 8 1/4". Comes with stereo mic, tripod, matching cables, 7" take-up reel, patchcords for both American & European jacks.\$349.95

TK-341 Stereo Recorder

4-track, 3-speed (7 1/2, 3 3/4 & 1 1/2 ips) recorder with synchronized sound-on-sound and sound-with-sound; monitoring of input signal or tape; level indicator; push-button operation; pause bar; automatic shut-off; digital counter with push-button reset. Freq. range 40-18,000 Hz, S/N ratio 50 dB; wow & flutter ±0.1% all at 7 1/2 ips. 12 W music power/ch. Has two 6" x 4" 5-ohm speakers. 20 3/4" x 15 3/4" x 8". Various optional accessories available.\$269.95

HARMAN-KARDON

TD-2 Tape Deck/Preamp

Features solid-state stereo design; 3-speeds (7 1/2, 3 3/4 & 1 1/2 ips); response 30-20,000



Hz at 7 1/2 ips; wow & flutter 0.1% r.m.s. at 7 1/2 ips. Sensitivity: mic 0.5 mV, aux. 0.2V. Output 1.5 V. Has 4 tracks; record/playback head & erase head. Has sound-on-sound facilities. Two sets of stereo input mic & aux. 11 3/8" x 9 3/8" h. x 6" ..\$169.50
 TD-3 Same as TD-2 except has 3 heads (separate record & playback); separate record & playback amp; tape/source monitor facilities; special 4-pole motor. Response 30-22,000 Hz at 7 1/2 ips\$219.50

HITACHI

Model TRQ-717 Stereo Recorder

Three-speed (7 1/2, 3 3/4 & 1 1/2 ips), four-track stereo recorder with built-in deflection speakers. Push-button operation; automatic level control; tape counter; tone control; speaker monitor; pause control; automatic tape shut-off; 7" reels. 15 1/2" w. x 7 1/2" h. x 13 3/4" d. Can be operated vertically or



horizontally.\$169.95

Model TRQ-707 Stereo Recorder

Three speed (7 1/2, 3 3/4 & 1 1/2 ips), four-track stereo recorder. Push-button control; automatic level control; tape counter; tone control; speaker monitor; pause control; automatic stop; 7" reel; detachable speakers. 14 3/4" w. x 8 1/4" x 14" d. Can be operated vertically or horizontally.\$229.95

Model TRQ-727 Stereo Tape Deck

Four-track, three-speed (7 1/2, 3 3/4 & 1 1/2 ips) stereo deck; push-button controls; automatic level control; 7" reels; two vu meters; tape

COMPARE CRAIG

stereo
 tape
 recorders



Craig Stereo Cassette Recorder. This complete system features easy-to-load cassette cartridge convenience in handsome walnut finish and slim-line design. Model 2703. Price \$189.95*



Craig Auto-Reverse Stereo Tape Recorder. Unequaled performance with three speeds, automatic reversing system, sound-on-sound and many more outstanding features. Model 2402. Price \$349.95*

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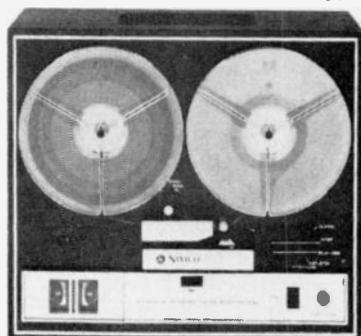


counter; two mic inputs; two line inputs; two line outputs. 15½" w. x 16" x 7¼" d.\$149.95

JVC NIVICO

1684 Stereo Tape Deck/Preamps

Solid-state, 4-track, 2-speed (7½ & 3¾ ips) design. Has built-in preamps & is supplied



with wood cabinet and dust cover. 15½" x 13¾" x 6¾" d\$149.95

1224 Stereo Tape Recorder

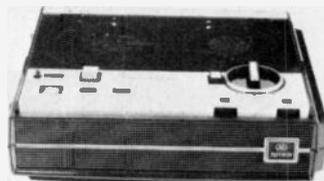
Solid-state, 4-track, 3-speed (7½, 3¾, 1½ ips). design. Has automatic reverse,



sound-on-sound, sound-with-sound; 5 W/ch dynamic power; 30-18,000 Hz response; Supplied with twin microphones & matching speaker enclosures with 6½" woofer & 3" tweeter. 12¾" h. x 38¼" w. x 7½" d\$349.95

1551 Portable Tape Recorder

Two-speed (3¾ & 1½ ips), solid-state, a.c.- or battery-operated (six "D" cells) portable. Features electronic motor governor; 1.5 W output; single rotary function control; tone



control; level meter/battery checker; various inputs. Will handle up to 5" reels. 3¾" h. x 12¾" w. x 9¾" d. 7.3 lbs.\$89.95

1541 Battery-Operated Portable

Two-speed (3¾ & 1½ ips), a.c.- or battery-operated (six "D" cells) portable; 5" reels;



3-digit tape counter; fast-forward button; monitor switch; rotary function lever; remote control from mic. Comes with full-length carrying handle and all accessories. 13¾" w. x 11½" h. x 9¼" d. 7.3 lbs.\$69.95

1351 Portable Tape Recorder

Two-speed (3¾ & 1½ ips), a.c.- or battery-operated (six "C" cells) portable; features



automatic volume control, record level meter, speaker monitor, 3-digit counter. Has push-button controls, center-mounted speaker, and remote-mic control. 2¾" h. x 11" w. x 8¾" d. 5.2 lbs.\$59.95

1171 Mono Recorder

Two-speed (3¾ & 1½ ips) mono recorder will handle up to 5" reels. Features built-in speaker monitor so unit can be used as p.a. system, instant stop, continuous a.v.c., 3-digit counter, 3" x 6" speaker, and 2 W output. Leatherette case 13¾" h. x 12¾" w.



x 6¾" d. 15 lbs.\$99.95

KLH

Four-Track Stereo Deck

Features Dolby Audio Noise Reduction System to optimize 3¾ ips speed for record/playback applications; single-band version



begins operation at about 1700 Hz; effective audible noise reduction 10 dB; system can

TAPE RECORDER ANNUAL

be switched out. 7½ ips provided for compatibility with older tape and editing live recordings. 3-motor tape transport; solenoid-operated controls; belt-driven capstan; high-speed rewind & fast-forward; 3 heads (erase, record, playback); full-source tape monitoring. Single vu meter reads louder of two channels being recorded or either channel individually. Individual level-controlled mic & aux. inputs for each channel with full mixing capability; single master control for setting record level; pause control. Features automatic rewind; automatic shut-off; amplified headphone output; duplicate inputs and outputs. Walnut base available extra.\$600.00

KNIGHT-KIT

KG-415 Tape Deck/Preamps

Solid-state stereo design with pre-assembled Viking tape transport. Has six solid-state



plug-in modules, including headphone amplifier and bias test oscillator modules. Features separate monitor switch with monitor-level controls, mixing facilities, push-to-reset digital counter, easy-edit head cover. Three 4-track hyperbolic-contoured heads permit direct tape monitoring, echo, sound-on-sound recording. Six-position "selector" control with record and playback operation shown by illuminated windows. Two vu level indicators for record and playback of each channel. Response: 50-18,000 Hz ±2 dB @ 7½ ips; 50-14,000 Hz ±2 dB at 3¼ ips. Flutter & wow .2% r.m.s. @ 7½ ips. Signal-to-noise ratio 50 dB. Has modular 1-kHz test oscillator for precise adjustment of head voltages, dual preamps drive low-impedance stereo headphones. 17 transistors & 6 diodes. 14½" x 14" x 8½".

22A3788UW Kit\$249.95
22A3003W Walnut base\$16.95

LAFAYETTE

RK-960 "Automatic Reversing" Tape Recorder

4-head, 4-track solid-state stereo design. Features one manual & three automatic tape reversing positions; 3 speeds (1½, 3¼ &



7½ ips); sound-on-sound; sound-with-sound; two 4-pole induction capstan driver motors; vu meters; stereo headphone jack; 6 inputs. Response 30-22,000 Hz ±3 dB @ 7½ ips; S/N ratio 50 dB; flutter & wow 0.25% r.m.s. @ 3¼ ips. Housed in black leatherette-covered wood case. 22" x 15½"

x 8¼" d.\$299.95

RK-920 "Automatic Reversing" Tape Deck/Preamps

Same design as RK-960 except without stereo amplifier\$199.95

RK-810A Tape Recorder

Solid-state, 4-track, 3-speed (1½, 3¼ & 7½ ips) design. Permits stereo playback when used with external amplifier. Features two heads; tape counter; vu meter; tape head output jacks; external speaker jack and stereo headphone jack. Response 40-15,000 Hz ±3 dB at 7½ ips; wow & flutter 0.25% at 7½ ips; S/N ratio 40 dB. In solid vinyl case with removable cover, accessory compartment, dynamic microphone. 11½" x 12¼" x 6¾" d.\$89.95

RK-830 Stereo Tape Deck/Preamps

Three-head, 4-track stereo deck with built-in solid-state preamps; 3-speed (1½, 3¼ & 7½ ips) design. Records sound-on-sound, sound-with-sound. Features vu meters; digital tape counter; automatic end-of-play shut-off. Has source or tape monitor. Response 40-18,000 Hz ±3 dB @ 7½ ips; wow & flutter 0.15% @ 7½ ips; S/N ratio 50 dB. Includes wood utility base. 12½" x 10½" x 6" d. in wood base.\$159.95

Deluxe walnut base\$ 9.95

RK-710 Mono Tape Recorder

Solid-state, 3-speed (1½, 3¼ & 7½ ips), dual-track mono record/playback; has 3" x 5" speaker; record/playback level meter; wow & flutter 0.2% @ 7½ ips; with dynamic microphone & carrying case 11½" x 12¼" x 6¾"\$64.95

RK-845 Stereo Tape Recorder

Solid-state 4-track stereo & mono, 3-speed (1½, 3¼ & 7½ ips) design. Features sound-on-sound, sound-with-sound, plus direct stereo disc-to-tape copy through magnetic phono inputs. Makes direct recording from FM stereo tuners. Has two 5" x 7" speakers. Response 40-18,000 Hz ±3 dB at



7½ ips; wow & flutter 0.15% at 7½ ips; output 6 W/ch dynamic power. Black leatherette wood case. With two dynamic mics. 15¼" x 14" x 7¾" d.\$229.95

RK-825 Stereo Tape Recorder

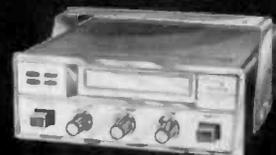
Solid-state, 4-track, 3-speed (1½, 3¼ & 7½ ips) stereo design. Features 2½ W/ch dynamic power; sound-with-sound; sound-on-sound; vu meters; and two 5" x 3" speakers. Response 40-15,000 Hz ±3 dB at 7½ ips. With solid vinyl-covered wood case, removable cover, two dynamic mics. 11½" x 12¼" x 6¾" d.\$139.95

RK-835 Stereo Tape Recorder

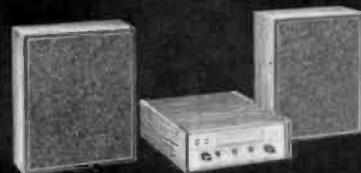
Solid-state, 4-track stereo & mono record/playback, 3-speed (1½, 3¼ & 7½ ips) design. Features sound-on-sound, sound-with-sound, vu meters, automatic end-of-tape shut-off, built-in 5" speakers. Response 40-18,000 Hz ±3 dB at 7½ ips;

COMPARE CRAIG

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players



Craig Automatic 8-track Stereo. Door-to-door stereo sound from this deluxe unit. Chrome face-plate, dust cover and track indicator lights. Model 3108. Price \$69.95*



Craig Home Stereo Cartridge System. Plays all 8-track and 4-track cartridges. A complete system including hi-compliance speakers. Double the use of your car stereo cartridges. Model 3203. Price \$144.95*

Choose from a complete selection of 8 different Craig cartridge players for the home and car including 4-track, 8-track and 4+4 models.

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wow & flutter 0.2% at 7½ ips; output 4 W/ch dynamic power. Black leatherette covered wood case. Two dynamic mics. 15¼" x 14" x 7¾" d.\$179.95

RK-870 Stereo Tape Deck/Preamps

Solid-state, 4-track record/playback preamps, 3-speed (1½, 3¾ & 7½ ips) design. Records sound-with-sound, sound-on-sound. Has vu meters; response 40-18,000 Hz ±3 dB @ 7½ ips; wow & flutter 0.2% at 7½ ips. Has walnut wood case. 12¾" x 11¾" x 6" d.\$119.95

MAGNECORD

"1020" Stereo Tape Deck

4-track design without built-in power amplifiers or speakers. Features 2-speed (7½



& 3¾ ips) operation; takes up to 8¼" reels; vu meters; counter automatic shut-off; three separate heads. Solid-state stereo preamp with 900 mV output & dual mic and line inputs with mixing facility. Response 45-18,000 Hz ±2 dB @ 7½ ips; S/N ratio 52 dB @ 7½ ips; flutter & wow 0.18% @ 7½ ips\$570.00
Walnut base\$25.00

"1022" Stereo Tape Recorder

Two-speed (3¾ & 7½ ips) stereo unit; ¼-track stereo or 4-track mono operation; full-track mono record & erase and half- or full-track mono playback. Wow & flutter 0.2% @ 7½ ips; response 45-18,000 Hz ±2 dB @ 7½ ips; S/N 53 dB for both speeds. Heads selectable ¼-track erase, ½-track record, ½-track play. Optional 2-channel stereo play head available installed in 4th head position. Inputs: mic (50,000 ohms), high impedance mixing bridge & aux. bridge. Outputs: emitter-follower & aux. emitter follower (0.5 V)\$648.00
With 4th head installed\$673.00
Case\$ 40.00

"1028" Stereo Tape Recorder

2-speed (7½ & 15 ips) tube design. Wow & flutter .15% @ 7½ ips & .1% @ 15 ips; response 35-16,000 Hz ±2 dB @ 7½ ips & 35-18,000 Hz @ 15 ips; S/N 55 dB; reels 5", 7" & 10½"; rewind time 2400' in less than 1 minute. Inputs: high & low imp. mics & high-impedance balanced & unbalanced bridge. Outputs: cathode-fol-



lower, 2.5 V & 150/600 ohms balanced. 17¾" w. x 12¾" h. x 12" d.
"1028-2X" 2-track stereo or ½-track mono; less case\$1095.00
"1028-24X" with 4th head (¼-track stereo play), less case\$1175.00
"1028-4X" ¼-track stereo or 4-track mono. less case\$1095.00
"1028-42X" with 4th head (2-track stereo play), less case\$1175.00
Case optional.....\$ 50.00

"1048" Stereo Tape Recorder

Same as Model "1028" except for tape speeds 3¾ & 7½ ips; response 40-16,000 Hz ±2 dB @ 7½ ips. 12" deep. Available versions & prices same as Model "1028" tape recorder.

MASTERWORK

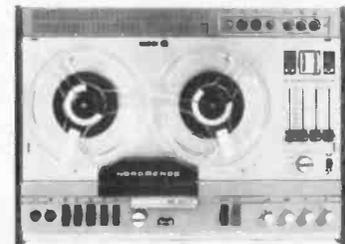
Model M-812 Stereo Recorder

Two-speed (7½ & 3¾ ips), four-track solid-state portable; frequency response 80-15,000 Hz @ 7½ ips; two 4" x 6" PM speakers (one in each detachable wood speaker enclosure); up to 12-foot separation; vertical operation. Has push-button controls for stop, rewind, 7½ ips play, 3¾ ips play & pause. Two vu meters; two "on/off/volume" controls; left & right channel record buttons; two tone controls; digital counter. Has inputs for radio monitoring and ext. speakers. Comes with 2 mics with stands, 1 empty 7" reel, 1 demo tape, alligator patch clip. Leatherette, luggage-type carrying case. 22" w. x 14" h. x 7" d.\$139.95

NORDMENDE

8001/T Mono Recorder

Solid-state, four-track, 3-speed mono recorder. Frequency response 40-18,000 Hz at 7½ ips 40-15,000 Hz at 3¾ ips, 40-10,000



Hz at 1½ ips. Has 3 heads & 3 Pabst motors. Features sound-on-sound; remote control; monitoring before and after application of signal; echo & reverb; pause. S/N 54 dB; 3 W continuous sine-wave power/ch. Has built-in mixer for recording from four separate sound sources; volume of each source controlled separately by means of 4 slide controls; fade control. Built-in speakers for monitoring. Comes with dust cover. Base extra.\$429.95

NORELCO

4408 Stereo Tape Recorder

4-track, 3-speed design; response 40-18,000

How to flip over the sound without flipping over the reel.

For years you've flipped over a little thing called a reel. You flipped because the tape would run out at inconvenient times like 30 seconds into the Minute Waltz, or three and a half movements of your favorite symphony.

Something had to be done about it.

Panasonic, the world's leading manufacturer of tape recorders, did something. That something is the Panasonic Symposium. It's a Solid-State 4-track stereo deck that's unflippable.

Unflippable because of continuous Automatic Reverse. You'll never flip over another reel again. And the turn around is so quick you'll hardly miss a beat.

And the beat is steady. That's because there's Dual Capstan drive on all three speeds. That way the Tijuana Brass won't sound like 76 Trombones and vice versa.

Of course, if you don't want it to run forever, use the automatic shutoff.

Will the Symposium match your rig at home? Yes. It has 30-20,000 CPS response, and the signal-to-noise ratio is more than 52 db's plus a recording system that has an AC bias of 90 kc. For sound-on-sound or sound-with-sound that's plenty of fidelity.

You'll be crazy about our control panel features, too. Like headphone output

and Pause Control for easy editing. Then there are two big VU meters, each sensitive enough to catch the difference between a wheeze and a whisper. Plus a 4-place digital tape counter for some of that long-distance taping you might get involved in.

Top it all off with a smoked-glass dust cover that doesn't cost extra—and everything's beautiful.

So why not go down to any dealer we permit to carry the Panasonic line. We think that once you hook up our Model RS-796, you can stop flipping over its reel and really start flipping over what you hear.



PANASONIC®

200 PARK AVENUE NEW YORK 10017.
For your nearest Panasonic dealer, call (300) 243-0355. In Conn., 853-3600. We pay for the call.

Tape Deck, Model RS-796



Hz. Has 2 vu meters & facilities for mixing, monitoring & automatic stop. Supplied with stereo mic & cabinet plus two separate speaker systems\$350.00

PANASONIC

All Panasonic designs are solid-state, 3-speeds refer to 7½, 3¼ & 1½ ips; 2-speeds 3¼ & 7½ ips. Response figures shown are at fastest tape speed; 7" reels unless otherwise specified & power figures are dynamic measurements.

RQ-501S "The Bandleader"

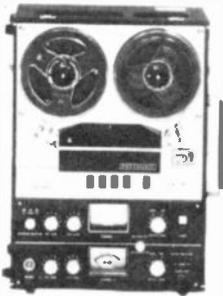
Mono solid-state portable recorder: 2-track, 2-speed (3¼ & 1½ ips) design; operates



from 117 V line or 6 "D" cells; has 4 heads; response 80-80,000 Hz; a.c. bias; 2 W; 3½" speaker; vu meter; battery indicator. Has automatic level control & will play & record in both directions. 11½" x 3½" x 10" d. Supplied with remote mic.\$99.95

RS-1000S "The Concert Master"

Solid-state 4-track, 4-head continuous automatic-reverse stereo tape deck with preamps; features vu meters; counter; tape



head or source monitoring; sound-on-sound; echo; "Pan-A-Trak" for language or music study; Two-speed design; response 25-20,000 Hz; has a.c. bias & erase. 16" x 21" x 9".\$699.95

RQ-156S "The Pilot"

Two-track mono design; two speeds; 5" reel; 100-7000 Hz response; 1 W; 3½"



speaker; vu meter; battery indicator; 11½" x 9½" x 4"; battery or a.c. operated. 7½ lbs.\$79.95

RQ-194S "The Vista" Recorder

Mono design; 5" reel; a.c./battery operation (4 "D" cells); 4 tracks, 2 heads; 1 W



dynamic power; response 100-8000 Hz; a.c. bias. Has 4¼" x 3¼" speaker; vu meter; battery indicator; sound-on-sound; sound-with-sound. With mic. 14¼" x 3½" x 11"\$125.00

RS-780S "The Impresario"

Four-track, 3-speed design; mono & stereo; response 30-18,000 Hz; S/N better than



52 dB; 8 W/ch; vu meters; tape counter; fast-forward; pause control; two 6" x 4" woofers, two 2¼" tweeters. 16¾" x 15½" x 11½".\$279.95

RS-766US "System Maker" Deck/Preamp

Stereo design; 4-track, 2-head; 3 speed. Response 30-18,000 Hz. Has pause control. Mounted in wooden case. 13¼" x 11" x 5½"\$149.95

RQ-706S "The Encore" Recorder

Mono design; 2-track, 2 head; 3 speed. Response 50-15,000 Hz; 4 W. Has two 6" x 4" speakers; vu meter; pause control. With



mic. 14" x 12" x 6¼"\$125.00

RS-761S "La Scala" Recorder

Stereo design; 4-track, 2 heads; 3 speed. Response 30-18,000 Hz; 8 W/ch. Has two



6½" woofers & two 2½" tweeters; pause control; detachable speaker systems; sound-on-sound; sound-with-sound. Supplied with

2 mics. Over-all size 7½" x 11¼" x 6½"\$249.95

RS-796US "Symposium" Deck/Preamp

Stereo design; 4-track, 4-head; 3 speed. Response 30-20,000 Hz. Has pause control;



continuous automatic reverse; records & plays in both directions; sound-on-sound; sound-with-sound. 19½" x 14" h. x 7¾"\$249.95

RS-790S "Console-Aire" Recorder

Stereo design; 4-track, 4-head, 3-speed. Response 30-20,000 Hz. 10 W /ch. Has



two 7" x 5" speakers built-in; pause control; meter. Continuous automatic or manual reverse; sound-with-sound; sound-on-sound. With 2 mics. 17" x 16½" x 9"\$329.95

RS-760S "Band Wave" Recorder

Stereo design. 2 heads, 4-track, 3-speed. Has two 6" x 4" speakers; pause control;



4 W/ch; sound-on-sound; sound-with-sound. With 2 mics. 14" x 13½" x 7".\$179.95

RCA

Model YLG-48 Stereo Recorder

Three-speed (7½, 3¼ & 1½ ips), four-track solid-state stereo unit; 7" reels. Has



pause switch, two vu meters, p.a. switch, sound-plus-sound, push-button function controls. Swing-out, lift-off speaker enclosures house four speakers; can be separated up to 16 feet. Vinyl-covered wood cabinet. Comes with 2 mics.\$229.95

REVOX

A-77 Series Stereo Recorders

Two-speed (3¼ & 7½ ips), 3-motor deck; electronically governed capstan motor; all-



silicon transistors; plug-in PC cards; frequency response 50-15,000 Hz ±1.5 dB @ 7½ ips; dist. 2% @ 7½ ips at 1 kHz. Inputs per channel: switchable hi-lo mic; radio; aux. Output power @ 8 ohms: 10 W/ch. Two built-in speakers per channel. 1304 4-track deck in metal housing for custom mounting.\$499.00
 1104 4-track deck in wood base.\$499.00
 1124 4-track recorder in wood base.\$569.00
 1124 4-track portable recorder.\$599.00
 Clear plastic dust cover.\$ 9.95
 Black nylon lock-on NAB adapters.pr. \$ 15.00
 Two-track versions of above also available. 15 ips versions available at \$100.00 additional.

RHEEM CALIFONE

3080T Mono Recorder

Dual-track, 3-speed (1½, 3¼ & 7½ ips) design; wow & flutter 0.15% @ 7½ ips;



10 W dynamic power output. Response 50-15,000 Hz. Features 8" speaker, mic & line inputs, counter, vu meter. Can be used as a p.a. system & has monitor selector switch. Supplied with high imp. mic. 13" x 13¼" x 7".....\$149.50

70-TC Mono Recorder

Solid-state, dual-track, 2-speed (3¼ & 7½ ips) design; wow & flutter 0.18%; 10 W



dynamic power output. Response 50-15,000 Hz ±2 dB. Has vu meter; 8" speaker; monitor selector sw.; counter. Can be used as a p.a. system. Supplied with high imp. mic. Over-all size 13¼" x 13¼" x 9".....\$199.50

3200-A Tape Recorder



Stereo tape recorder with three-speed option; edit lever. Tracks may be recorded independently & played back simultaneously. Mono to 4-track stereo recording with 2- & 4-track stereo playback. Has two 7" built-in speakers. Output 5 W/ch dynamic power; digital counter; frequency response 40-18,500 Hz; 16¼" x 13¼" x 7½".....\$289.50

74-TC Tape Recorder

Mono, solid-state design. Features instant pause & repeat controls; 3-speed (3¼, 7½

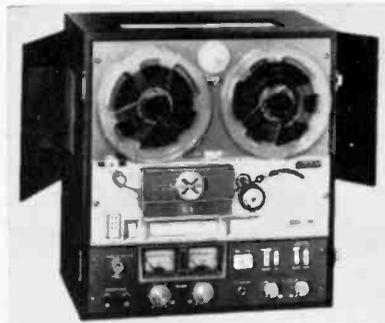


—15 ips optional); vu meter; automatic shut-off; horizontal or vertical operation; monitor & public address circuitry. Response 50-15,000 Hz ±2 dB; output 20 W; wow & flutter 0.18% r.m.s.; S/N ratio 50 dB. Has 7" reels, 8" speaker, record/play & erase heads, mike & high-level inputs. 13¼" x 13¼" x 9". Supplied with mike ...\$300.00
 Optional foot control for backspace & pause\$7.50

ROBERTS

Model 400X Stereo Recorder

Features 22,000 Hz Cross Field record head design; echo-chamber effects; replay double



reverse for automatic, continuous 4-track stereo tape replay; repeat (replays any part

Crown



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**PROFESSIONAL
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of the
Tape Industry*

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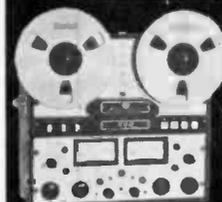
SX724 - Professional quality at a minimum price. Essential for the finest home music installations.

SX824 - For the serious audiophile, computer logic control means the ultimate home recorder.

CX724 - Superlative professional quality with outstanding flexibility for on-location live recording.

CX824 - For the audio perfectionist, precise performance with computer tape handling. The ultimate instrument for live recording.

DC300 - Laboratory standard 500-watt r.m.s. amplifier. Revolutionary patented design.



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of tape over & over); sound-on-sound; sound-with-sound; special bias for FM recording. Dual speed (7½ & 3¼ ips). Has stereo amplifier, two 6" (8 ohm) speakers; 2 vu meters; automatic stop; edit guide; 3 heads (record-play-erase) S/N -45 dB; 8 W/ch output; 2 V preamp output; wow & flutter .1%; channel separation 50 dB; 17¼" x 16" x 12¼"\$799.95
 Model 455 Same as 400X Except without automatic forward & reverse play and Cross Field head\$599.95

5000X Tape Recorder

Features 22,000 Hz transistorized professional recording studio Cross Field stereo operation; takes all size (including 10½") reels without adapters. 3 speed; electrical speed change; 4-digit counter; 2 vu meters; hysteresis-synchronous direct-drive capstan



motor; 2 large speakers; equalized preamp outputs; 4 heads; 16 W/channel output\$699.95

Model 1700 2-Track Mono Recorder
 2-speed (7½ & 3¼ ips) design with built-in p.a. system. Has input mixing facility; vu



meter; counter; response 40-12,000 Hz ±3 dB @ 7½ ips; S/N ratio 45 dB; wow & flutter 0.2% @ 7½ ips; record/play & erase heads; 3 W peak output; vacuum-tube design; 4" x 6" spkrs. 15½ x 13½" x 7½" d. Supplied with dynamic mic\$179.95

1719 Stereo Tape Recorder

Solid-state; 2-speed (7½ & 3¼ with 15 ips optional), 4-track design. Features sound-with-sound; separate volume & tone controls for each channel; speaker "on/off"; record monitoring; track select; sound adding; 2 vu meters; counter; 3 heads (record, play, erase) 5 W/ch dynamic music power (3 W/ch continuous sine wave). Response 40-15,000 Hz ±3 dB @ 7½ ips; S/N ratio 47 dB; Wow & flutter 0.25% @ 7½ ips. Has two speakers, one each side of case. Supplied with portable Pyroxylin covered case 15½" x 14¾" x 9". Comes with one mic.\$199.95

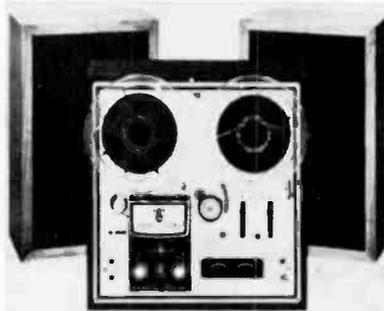
1721 Stereo Deck/Preamps

Same as Model 1719 but does not include power amps & speakers; has preamp outputs. Supplied with Pyroxylin covered base 15½" x 14¾" x 6½" but without mic.\$179.95

1725 III Stereo Tape Recorder

4-track stereo & mono record & play; 4-speed option design. Features automatic end-of-tape shut-off; counter; pause control; vu meter. Vacuum-tube design. Response 40-18,000 Hz ±3 dB @ 7½ ips; S/N ratio 45 dB; wow & flutter 0.2% @ 7½ ips. Has 2 preamps & 2 external speaker outputs & mic & phono/radio inputs. 13¼" x 7½" x 13¼"\$269.95

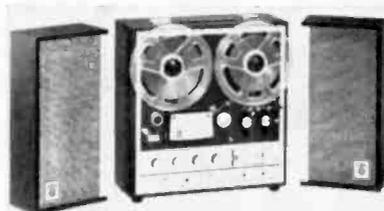
1725VIII Housed in walnut cabinet with



two external speaker systems in matching walnut\$299.95

1720 Stereo Recorder

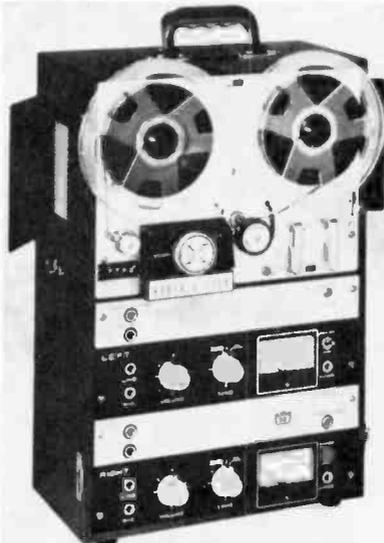
Same as Model 1719 but has two separate detachable speaker enclosures instead of



built-in. Supplied with portable Pyroxylin covered case 15½" x 14¾" x 10½". Comes with 2 mics.\$219.95

770X Cross-Field Recorder

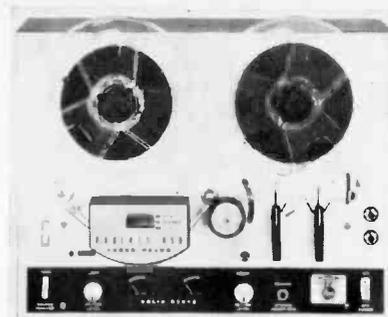
20,000 Hz Cross-Field stereo; sound-on-sound; electronically switched hysteresis-



synchronous motor; 4 speeds (1½, 3¼ & 7½ ips, 15 ips optional); two built-in extended-range/high-fidelity speakers; mute monitor and p.a. switch. Has separate tone

Model 450 Tape Deck

4-track stereo; 3 heads (record, play, erase); all-silicon transistor record & play and equalization controls for each channel.\$399.95
 amplifier; 3¼ & 7½ ips; automatic stop;



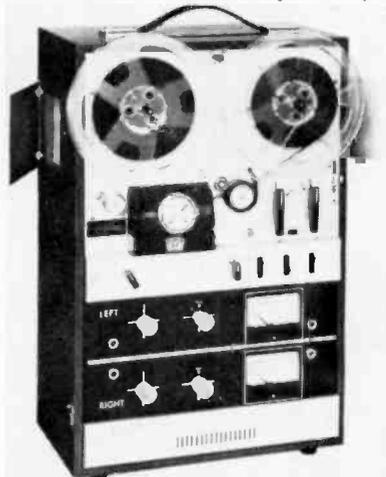
instant pause control; off-the-tape record monitoring; dust cover included; wood cab.\$199.95

1740X Tape Deck/Preamp

Walnut-enclosed component tape deck/preamp. Solid-state, four-track stereo; record & play preamplifiers; 22,000 Hz Cross-Field response; four-speed option (electrically switched) including 1½ ips. For connection to external power amp & speakers\$299.95

770XSS Cross-Field Recorder

22,000 Hz Cross-Field stereo; sound-on-sound; electrically switched hysteresis-syn-



chronous motor; 4 speeds (1½, 3¼ & 7½ ips, 15 ips optional); two built-in extended range hi-fi speakers; mute monitor and p.a. switch. Separate tone and equalization controls for each channel\$429.95

778X Cartridge & Reel Recorder

Cross-Field recording on reels even at new LP speeds; 1 micron gap record head for recording on 8-track-type cartridge; two speeds for cartridge record & play; built-in cartridge erase. Records cartridge from reels or external record player, tuner, mics, or another deck. Illuminated read-out indicators for track selection. 4-speed option for standard reel record and play\$429.95

1725-8L III Cartridge & Reel Recorder

4-track stereo reel-to-reel plus "Stereo 8" track cartridge combinations; record & play; 18,000 Hz audio; two speeds (3¼ & 7½ ips); cartridge track selector sw.; illuminated cartridge program indicator; two mics included\$359.95

Note: All Roberts stereo models, unless otherwise specified, record 4-track stereo, play back 4-track & half-track stereo; record 4-track mono; play back 4-track, half-track & full-track mono. 15 ips speed optional.

SHARP

Model RD-709 Stereo Recorder

Solid-state, four-track, four-head stereo re-



The A-6010. The top of the TEAC line, totally professional in every single specification. Unique electric phase sensing automatic reverse gives four hours of uninterrupted music pleasure without the use of sensing foil. Symmetrical control soft-touch push-button operation.

Outer-rotor motors for reel drive. Four heads in a removable unit. Four solid state amplifiers. Tape tension control switch. Mike and line mixing. Instant off-the-tape monitoring. Automatic shut off. Optional remote control and repeat play accessories.

Tough decision.



The A-4010S. Automatic reverse and symmetrical control operation. Four TEAC-built hyperbolic type heads. Four solid state amplifiers. Tape tension control switch and automatic shut off. Mike and line mixing. Instant off-the-tape monitoring. Dual speed hysteresis synchronous motor for capstan drive, 2 eddy current outer-rotor motors for reel drive. Polished walnut finish. Remote control accessory optional.



The A-1200. Unusual value — a professional deck at a budget price. All push-button system, on-sound recording and stereo echo. Instant off-the-tape monitoring. Measured wow and flutter 0.12% at 7½ ips. Remote control accessory optional.

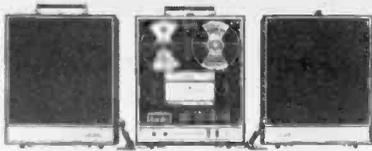


The A-2050. Only TEAC deck with bi-directional recording. You record automatically without changing reels. Center capstan drive driven by special TEAC outer-rotor motor. Easy-to-operate symmetrical lever system. Three speeds, 4 heads, 2 big VU meters. Automatic reverse and pause control, too.

Can't make up your mind? See your TEAC dealer. He'll demonstrate all four models and pass along the technical specifications we didn't list here. You'll be surprised.

TEAC®

TEAC CORPORATION OF AMERICA 1547 18th St. Santa Monica, Calif. 90404
In Canada: American General Supply of Canada, Ltd.



Model RD-708 Stereo Recorder
 Three-speed (7½, 3¼ & 1½ ips), four-track, solid-state recorder; 7" reel; two heads; 5 W/ch output. Outputs: 2000-ohm ext. amp, 8-ohm ext. speaker. Inputs: 200-ohm mic, 470k aux. Frequency response 40-16,000 Hz at 7½ ips; S/N 45 dB. Comes with detachable speakers; two dynamic mics; 7" tape; 7" take-up reel; patch-cords; speaker cords; splicing tape; reel retainer. 15½" w. x 15¼" h. x 10½" d.\$179.95

Model RD-708 Stereo Recorder

corder. Features automatic reverse; symmetrical 3-motor system; stereo headphone jack; sound-on-sound. Push-button controls; three speeds (7½, 3¼ & 1½ ips); 8 W/ch output; two-way, 4-speaker system in separate wing-type enclosures. Has vu meters; 4-digit tape counter; line input jacks for direct FM-stereo recording. Response 25-18,000 Hz at 7½ ips; wow & flutter less than 0.07% at 7½ ips; S/N better than 50 dB. Control unit 16½" w. x 18½" h. x 7¼" d. Speaker enclosure 16½" w. x 18½" h. x 5¼" d. Comes with mics & stands; 7" tape; 7" take-up reel; speaker cables; splicing tape; sensing tape; two connecting cords.\$325.00



RD-711 Portable Stereo Recorder
 Solid-state; 3-speed (7½, 3¼ & 1½ ips) stereo unit; 7" reels; 3.5 W/ch output; sound-with-sound; vu meters; tone controls; 3-digit tape counter; sound monitoring system with crossover switch for earphone listening. 19¼" w. x 15½" h. x 11¼" d. External speakers (8 ohms) available extra.\$159.95

RD-711 Portable Stereo Recorder

ter; mic & line mixing; pause control; automatic volume control; sound-on-sound; automatic shut-off; counter; response 40-18,000 Hz @ 7½ ips; S/N ratio 50 dB; flutter & wow 0.12% @ 7½ ips. Supplied with F-98 dynamic mic. 14¼" x 13½" x 7¼"\$139.50

corder. Features automatic reverse; symmetrical 3-motor system; stereo headphone jack; sound-on-sound. Push-button controls; three speeds (7½, 3¼ & 1½ ips); 8 W/ch output; two-way, 4-speaker system in separate wing-type enclosures. Has vu meters; 4-digit tape counter; line input jacks for direct FM-stereo recording. Response 25-18,000 Hz at 7½ ips; wow & flutter less than 0.07% at 7½ ips; S/N better than 50 dB. Control unit 16½" w. x 18½" h. x 7¼" d. Speaker enclosure 16½" w. x 18½" h. x 5¼" d. Comes with mics & stands; 7" tape; 7" take-up reel; speaker cables; splicing tape; sensing tape; two connecting cords.\$325.00

Sonymatic 105 Recorder

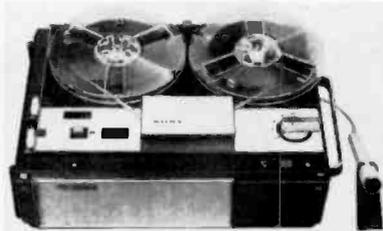
Solid-state, 4-track mono record/playback; 3-speed (7½, 3¼ & 1½ ips) design. Features 10 W dynamic power output; vu me-



Sonymatic 105 Recorder
 Solid-state, 4-track mono record/playback; 3-speed (7½, 3¼ & 1½ ips) design. Features 10 W dynamic power output; vu me-

Sonymatic 104A Recorder

Solid-state, 2-track, mono record/playback; features Sonymatic recording control; in-



stant tape threading; 7½, 3¼, 1½ ips; pause control. Response 40-18,000 Hz at 7½ ips; wow & flutter 0.12% at 7½ ips; S/N ratio 48 dB. With F-98 cardioid dynamic microphone\$112.50

155 Dubbing Tape Deck/Preamp

Complete stereo tape duplicating and playback deck with built-in solid-state playback



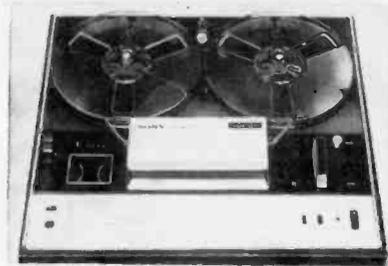
preamps. Features pause control, automatic sentinel shut-off. Response 30-18,000 Hz at 7½ ips; wow & flutter 0.09% at 7½ ips; S/N ratio 50 dB. With walnut base.\$99.50

255 Stereo Deck/Preamps

Features 3 speeds; a.c. bias; mic & line mixing; pause control. Response 30-18,000 Hz at 7½ ips; wow & flutter 0.09% at 7½ ips; S/N ratio 52 dB. Walnut base with vinyl dust cover\$179.50

355 Stereo Deck/Preamps

Solid-state, 3-head tape deck with sound-on-sound; tape-source monitoring; a.c. bias; 4-tracks; pause control; mic & phono input; response 20-22,000 Hz at 7½ ips;



wow & flutter 0.09% at 7½ ips; S/N ratio 52 dB. Walnut base and vinyl dust cover\$229.50

222A ServoControl Battery/A.C. Portable

Solid-state, 2-speed recorder with 5" reel; automatic recording control; built-in re-



charging circuit; speaker monitor in record mode; wow & flutter 0.15% at 3¼ ips; S/N ratio 48 dB. With Sony remote stop/start mic\$99.50

230 "Stereo Compact Portable"

Solid-state, 4-track, 3-speed (7½, 3¼ & 1½ ips) design with 10 W/ch dynamic

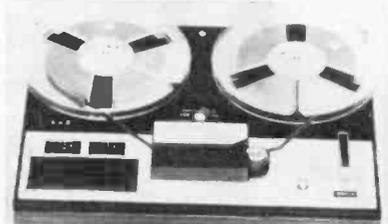


power; response 30-18,000 Hz @ 7½ ips; wow & flutter 0.09% @ 7½ ips; S/N ratio 50 dB. Features automatic shut-off; counter; two vu meters; input for magnetic phono; two detachable speaker systems. Supplied with two Sony F-45 dynamic mics\$249.50

230-CPW Same as Model 230 except cabinets. Walnut enclosures replace portable type; speakers are in bookshelf-type enclosures\$299.50

250A Tape Deck/Preamps

All-transistor stereo design; with record & playback preamps. 4-track; vu meters; auto-



matic shut-off; automatic tape lifters; single-knob operation; 7½ & 3¼ ips; flutter & wow 0.09% @ 7½ ips; response 30-18,000 Hz; S/N 50 dB. Has mic. & line inputs. 14½" x 6½" x 9" h.\$119.50

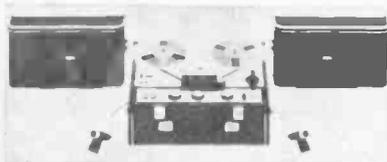
560 Stereo Tape Recorder

Solid-state, 4-track, 3-speed (7½, 3¼ &

SONY/SUPERSCOPE

200 Solid-State Recorder

Four-track stereo/mono record/playback system; features built-in stereo amplifier & speakers (15' separation); 2 vu meters;





1 1/2 ips) design with 10 W/ch dynamic power. Features Sony E-S-P. (electronic sensory perception) automatic reverse; response 30-18,000 Hz @ 7 1/2 ips; wow & flutter 0.07% @ 7 1/2 ips; S/N ratio 52 dB. Features two vu meters; counter; automatic sentinel shut-off after tape has made complete reverse cycle; input for magnetic phono. Has two detachable speaker systems. Supplied with two Sony F-98 cardioid dynamic mics\$449.50
560D Tape deck version of Model 560; does not include power amps & speakers. Has walnut cabinet\$349.50

666D Auto-Reverse Stereo Deck
Solid-state with Sony ESP automatic tape reverse; three motors; a.c. bias; automatic



shut-off; 7 1/2 & 3 3/4 ips; mic & phono input; response 20-22,000 Hz at 7 1/2 ips; wow & flutter 0.09% at 7 1/2 ips; S/N ratio 53 dB with noise reduction "off", 59 dB with it "on". With walnut base and plastic dust cover\$575.00

770 Portable Stereo Recorder
Available in two forms: 770-2 featuring 4 heads, two-track erase, record and play-



back, plus 4-track playback head or as 770-4, featuring reverse configuration. Both units have built-in rechargeable nickel-cadmium battery pack; mic & line mixing; remote control: a.c. or battery operation. Response 20-22,000 Hz at 7 1/2 ips; wow & flutter 0.09% at 7 1/2 ips; S/N ratio 56 dB\$750.00

Model 530 Stereo Recorder
Solid-state, 4-track stereo or mono record/playback; 3-speed (7 1/2, 3 3/4, 1 1/2) design. Features 20 W/ch dynamic power; sound-on-sound; automatic shut-off; vu meters; counter; pause control. Response 30-18,000 Hz @ 7 1/2 ips; S/N ratio 50 dB; flutter &

wow 0.09% @ 7 1/2 ips; has detachable speaker systems. Supplied with two F-98 dynamic mics. 15 1/4" x 19 3/4" x 10" d.\$399.50

864 Battery/A.C. Portable Recorder
Solid-state mono, 2-speed (3 3/4 & 1 1/2 ips) four-track, 5" reel design with built-in a.c. converter for 117 V operation. Features automatic record level control; aux. high-level input; counter; record monitoring through speaker; can be used for p.a. Response 50-13,000 Hz @ 3 3/4 ips; wow & flutter 0.15% @ 3 3/4 ips; S/N ratio 48 dB. Supplied with remote-control Sony F-85 cardioid dynamic mic.\$159.50

ServoControl 800 Mono Recorder
Battery or a.c. operation; 3 speed (7 1/2, 3 3/4,



1 1/2 ips); transistorized; 5" max. reel. Response 50-18,000 Hz @ 7 1/2 ips; flutter & wow 0.1% @ 7 1/2 ips; has automatic record level (a.v.c.) with defeat sw. for recording music; vu meter for level & battery voltage indication. Supplied with cardioid dynamic mic with remote start/stop sw. 12 1/4" x 10 1/2" x 4 1/4"\$199.50

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This is the SHARPE HA-10A



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The outstanding HA-10A is a prime example of Sharpe quality and value. Experts have tested it, top rated it, approved it... agreed that it meets today's critical sound performance specifications. Rate it... to your own performance standards. You will find the HA-10A outperforms the finest stereo speaker systems. Visit your authorized Sharpe Dealer, and personally test Sharpe's complete line of quality stereophones. From \$19.95 to \$100.00.

- Fq. Response: Full 15-20,000 Hz, 40-3,000 Hz ± 2 db, 3,000-8,000 Hz ± 3 db
- Max. Input Power: 2 watts ea. phone
- Max. Acoustical Output: 130 db s.p.l.
- Impedance: 8 ohms, others optional
- Attenuation of Ambient Noise: 40 db @ 1000 Hz
- Harmonic Distortion: @ 1 vt. less than 1%
- Sensitivity: 115 db re 0.0002 dyne CM² @ 0.5 vt. input

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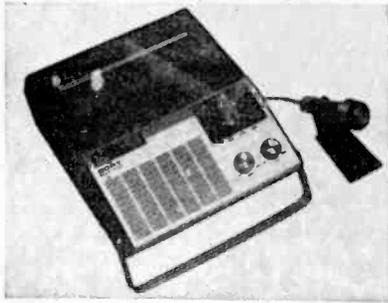


HA-660 PRO, \$60.00

HA-9, \$24.95

910 Mono Portable Recorder

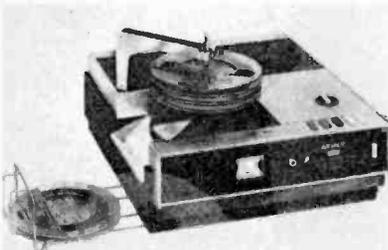
Battery or a.c. power; features solid-state circuitry; 3 1/4" reel capacity; 2-track opera-



tion; 3 3/4 & 1 1/2 ips; record indicator meter; aux. input for radio & TV recordings; S/N ratio 45 dB; wow & flutter 0.17% at 3 3/4 ips. With dynamic remote mic; vinyl carrying case. 6 lbs.\$69.50

Model 760 Reel-Changing Deck

Will handle five reels of pre-recorded tape & play them in automatic sequence. Features

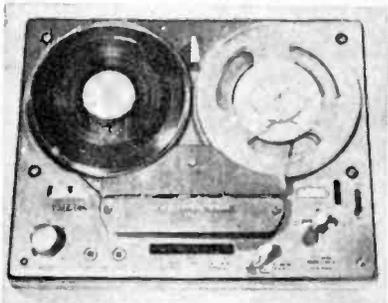


reel-changing mechanism; automatic reel threading; automatic reel reversing; ejection of completed reel after both tracks have been played. Reels can be intermixed and can vary from 3" to 7". Features solenoid push-button control for manual operation. Deck operates at 7 1/2, 3 3/4 & 1 1/2 ips.\$995.50

TANDBERG

Series 6X Tape Deck/Preamps

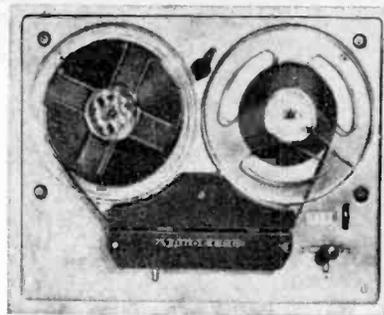
Features separate erase, record & playback heads in addition to a special bias head for



extended frequency response. Permits sound-on-sound & tape monitoring after recording. Has individual mixer record controls; separate playback controls; pause button; 4-digit counter & optional remote control. Tape speed 7 1/2, 3 3/4 & 1 1/2 ips. Has preamps only. Mono center channel output 1 V @ 200 ohms & dual stereo outputs 1.5 V @ 2000 ohms & 150 mV @ 10,000 ohms. Oscillator is transistorized, balance tubes. Dist. 0.5% at max. record level & 0.2% at max. playback level. Response at 7 1/2 ips is 30-20,000 Hz ±2 dB; wow 0.1%; S/N 62 dB. 15 1/2" x 11 1/2" x 6 1/2". Has teak wood cabinet. Model 64X Four-track\$549.00 Model 62X Two-track\$549.00

Model 65 Stereo Playback Deck

Three-speed (7 1/2, 3 3/4 & 1 1/2 ips), 4-track



stereo playback tape deck; response 30-20,000 Hz @ 7 1/2 ips, 30-15,000 Hz @ 3 3/4 ips, 50-7000 Hz @ 1 1/2 ips; 4-pole synchronous motor; lever knob for playback, fast forward, fast reverse; 4-digit revolving counter; complete mechanical drive; over-all size of the deck 16" x 12" x 6".\$209.50

Model 11 Tape Recorder

Battery-operated (10 1.5-V cells or rechargeable type can be used); battery eliminator for connection to 110/220 V, 50/60



Hz. Three speeds (7 1/2, 3 3/4 & 1 1/2 ips); electronic speed control; maximum reel diameter 7", with cover 5". Response 40-16,000 Hz @ 7 1/2 ips; S/N ratio 56 dB at maximum recording level @ 7 1/2 ips; wow & flutter better than 0.2% @ 7 1/2 ips; vu meter, solid-state. Inputs: radio & mic; outputs: line & headphone. 13" x 10" x 4". 7 lbs.\$449.50

TEAC

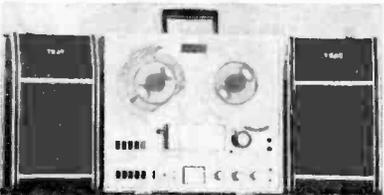
All models provide electrical speed change within motor instead of mechanical method; 4-track; 2-channel; solid-state design; 7" reels & vu meters. Unless otherwise indicated they have four heads, 2 speeds (7 1/2 & 3 3/4 ips), and 3 motors. All performance characteristics are given for 7 1/2 ips speed. All machines are stereo design and are available on special order with 1/2-track or full-track heads.

A-1500 Tape Deck

Features "Add" recording & stereo echo. Has 4 heads for automatic reverse play & monitoring actual sound on tape while recording. Response 30-20,000 Hz; wow & flutter 0.12%. Does not have power amps or speakers. Has mic & line inputs & 1 V preamp output. Has separate preamps for record and playback. 16" x 16 1/4" x 9 3/4". Portable type case\$424.50

A-1600 Tape Recorder

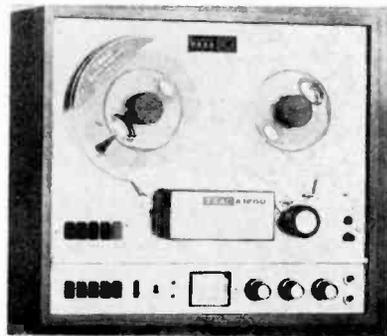
Stereo design featuring "Add" recording & stereo echo; with separate record & playback



amplifiers; line & mic inputs. Response 30-20,000 Hz @ 7 1/2 ips; wow & flutter 0.12% @ 7 1/2 ips; S/N ratio 50 dB; 8 ohms; 2 W/ch dynamic power output. Features electrified automatic reverse for uninterrupted play of up to four hours. Solid-state design. 16" x 16 1/4" x 11 3/4".\$519.50

A-1200 Tape Deck/Preamp

Has 3 heads; features stereo echo & "Add" recording. Response 30-20,000 Hz; wow & flutter 0.12%. Does not have power amp & speaker. Has mic & line input & 1 V pre-



amp outputs. 17" x 15 1/2" x 9 3/4". Walnut cabinet\$299.50

A-4010S Tape Deck/Preamp

Features contact tape automatic reverse play & monitoring actual sound on tape



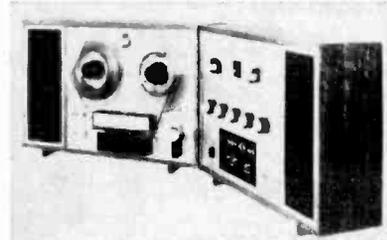
while recording. Response 30-20,000 Hz; wow & flutter 0.12%. Does not have power amps or speakers. Has preamp output 1 V and mic & line inputs. All mechanical functions are solenoid operated. 17 1/2" x 17 1/2" x 9 3/4". Walnut wood cabinet\$469.50

A-4000S Tape Transport

Same as A-4010S tape deck/preamp except does not have preamplifiers. 17 1/2" x 13" x 9 3/4". Wooden cabinet\$329.50

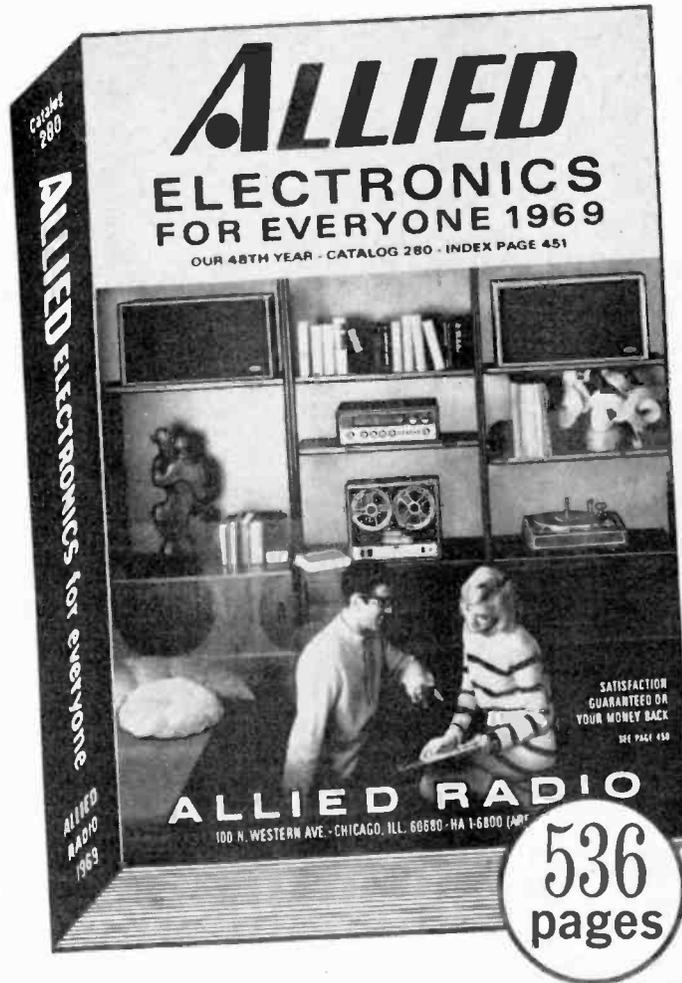
A-2020 Stereo Recorder

Four-head, four-track, two-channel stereo design. Three speeds (7 1/2, 3 3/4 & 1 1/2 ips);



wow & flutter 0.15% @ 7 1/2 ips; response ±3 dB 50-15,000 Hz @ 7 1/2 ips; S/N ratio 50 dB. Sound-on-sound; automatic reverse. 21 1/2" x 13 1/2" x 10 1/2"\$399.50

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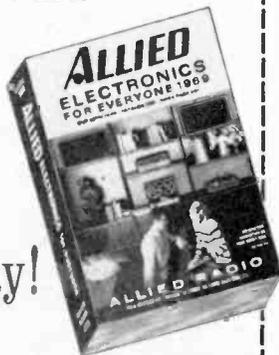
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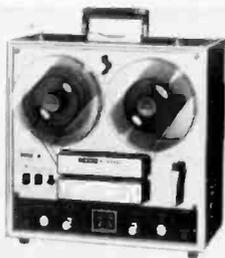
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Model A-2040 Stereo Tape Deck

Three-speed (7½, 3¾ & 1½ ips), three-head, quarter-track stereo deck; includes



power amps but not speakers; four tracks; hysteresis synchronous outer rotor. 7" max. reel size Frequency response 30-20,000 Hz ±3 dB; S/N 50 dB; wow & flutter 0.12%; crosstalk 50 dB at 1000 Hz channel to channel, 40 dB between adjacent tracks at 100 Hz. Inputs: mic: 600 ohms/line 100,000 ohms, 0.1 V min. Outputs: line 0.5 V for 50,000 ohms min., 8-ohm speakers (10 W/ch). Has foil-sensing automatic reverse & playback; pause button; 4-digit counter; vu meters.\$379.50

Model A-2050 Stereo Tape Deck

Features bidirectional record/playback; four heads; automatic reverse record/play mech-



anism; synchronized band brake; solid-state amplifier; 8-ohm headphone amp for monitoring; 4-digit index counter; automatic shut-off. Three speeds. 11¾" x 10¾" x 5½".\$349.50

Model A-7030 Stereo Tape Deck

Two- & four-track (switchable); four heads (½-track & ¼-track switchable); 15 & 7½



ips; max. reel size 10½"; response 30-20,000 Hz ±2 dB at 15 ips; S/N 55 dB; automatic drive shut-off; three-stage direct-coupled amp.\$749.50

A-4020 Tape Recorder



Features automatic reverse, bi-directional recording. Response 30-20,000 Hz; wow & flutter 0.12%; has line & mic inputs; 8 ohms; 20 W dynamic output each channel. 18¼" x 16¾" x 9"\$539.50

A6010 Tape Deck

Features phase-sensing automatic reverse for both directions. Has separate record & playback preamps. Response 30-20,000 Hz; wow & flutter 0.08%. Does not have power amps or speakers. Has 1 V preamp outputs. Has facilities to accommodate two additional heads (6 total). 20¾" x 17½" x 8¼"\$664.50

TELEFUNKEN

"Magnetophon" 300-ts Recorder

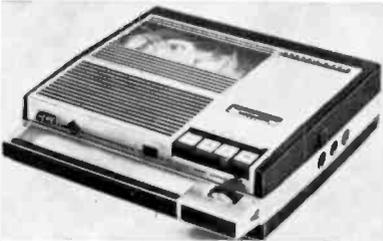
Solid-state, two-track, 3¾ ips mono design; response 40-14,000 Hz; 2¾" x 4" speaker;



1 W output. Operates direct from a 6 V d.c. battery source. Has a.c. power/recharger unit, car adapter & pause control. 10¾" x 3" x 10¾". 3 hours playing time with 5" reel.\$99.95

"Magnetophon" 302 Recorder

4-track, 2-speed (1½ & 3¾ ips), mono record & playback design; features 5" reel;



response 40-14,000 Hz @ 3¾ ips; S/N ratio -46 dB; wow & flutter ±0.3%. Has 2¾" x 4" speaker; 1 W output. Will operate on five 1½-volt flashlight cells or storage battery. Has a.c. power supply/battery charger. 10½" x 3" x 11"\$159.95

"Magnetophon" 250 Deck/Preamps

Solid-state stereo record/playback design; 2-track, 2-speed (7½ & 3¾ ips); 3 heads;



40-18,000 Hz at 7½ ips response; sound-with-sound; sound-on-sound; echo; slide control for professional mixing effects. 18¼" x 12¼" x 4¼"\$349.95

TOSHIBA

Model GT-611P Portable Recorder

Battery (six "D" cells) or a.c. operation; two speeds (3¾ & 1½ ips); solid-state;



push-button control of record, play, stop, rewind, and fast-forward; input jack for direct cable taping from radio, record player, TV, or other recorder; monitor sw. permits speaker-monitored or silent recording. Has 6" x 3" dynamic speaker; 3-digit tape counter with 0 reset; handles up to 5" reels. Comes with mic with remote-control sw.. 5" reel of tape, 5" take-up reel; shielded cables; batteries; splicing tape; a.c. adapter cord; 50-Hz capstan sleeve adapter. 3¾" h. x 11½" w. x 9¾" d.\$79.50

Model GT-701V Tape Recorder

Solid-state, two-track, two-speed (7½ & 3¾ ips) mono unit with automatic record



level; 6" x 4" dynamic speaker; 7" reel capability; output jack; tone control; 3-digit tape counter with reset; meter-type record level indicator; accidental erasure protection. Response 70-10,000 Hz; wow & flutter 0.2%; S/N 40 dB (all at 7½ ips). Fast-forward 240 sec., rewind 180 sec. (both with 7" reel). Comes with mic, 5" reel with tape, 5" take-up reel; connecting cable; dust cover. 13" h. x 13" w. x 7½" d.\$119.50

Model PT-850S Stereo Tape Deck

Solid-state, four-track deck; two speeds (7½ & 3¾ ips); pause-edit control; record amp;



playback preamp; 3-digit tape counter with 0 reset; private listening & monitoring headphone jack. Frequency response 50-15,000 Hz; S/N 45 dB; wow & flutter 0.2% (all at 7½ ips). Will handle up to 7" reels. 5¼" h. x 15¾" w. x 13¾" d.\$179.50

Model GT-840S Stereo Tape Recorder

Solid-state, four-track, two-speed (7½ & 3¾ ips) stereo unit. Features two-way





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monitoring through speaker or headphones; pause-edit control; 3-digit tape counter with push-button 0 reset; tone control; plays up to 7" reels; air-suspension speakers. Frequency response 60-10,000 Hz; wow & flutter 0.2%; S/N 45 dB (all at 7½ ips). Comes with two dynamic mics with stands; input & output cables; tape reels. 13½ h. x 15¼ w. x 10" d.\$219.50

Model GT-810S Stereo Tape Recorder

Solid-state, four-track, three-speed (7½, 3¾ & 1½ ips) stereo recorder. Features de-



tachable speakers; single-knob tape control; sound-on-sound; sound-with-sound; pause/edit control; 3-digit tape counter with push-button 0 reset; tone control; "on/off" speaker sw. each channel; p.a. hookups. Response 40-15,000 Hz; wow & flutter less than 0.15%; S/N 40 dB (all at 7½ ips). 7½" h. x 16" w. x 15¼" d.\$249.50

UHER

Model 4000L Portable Recorder

All-transistor. 2-track, 4-speed (7½, 3¾, 1½ & 1⁄16 ips) mono design; powered by five Ni-Cad cells or rechargeable battery,



6-12 V or separate 120 V a.c. power supply; electromagnetic start/stop remote control by means of microphone or remote switch; digital counter; vu meter and power supply indicator; acoustic switch available for sound control for start and stop of tape; response 40-20,000 Hz ±2.5 dB @ 7½ ips; S/N 52 dB; wow & flutter 0.1% @ 7½ ips; output speaker 1 watt; inputs: microphone 0.1 mV @ 2000 ohms; radio 1 mV @ 47,000 ohms; phono 4 mV @ 1 meg-ohm; 10 hours playing time with Ni-Cad cells; 11" x 9" x 3½"; weight without batteries 7 lbs.; complete with remote control dynamic microphone, leather case, shoulder strap, a.c. power unit, battery charger, and "Dryfit" storage battery\$440.00

Model 4400 Stereo Recorder

4-track version of Model 4000L; has additional stereo amplifiers & one speaker. Basic machine\$450.00
Mark IV package\$600.00
Model 4200 Two-track version of Model 4400. Mark IV package\$625.00

"Universal 5000" Recorder

All-transistor, 2-track, 3-speed (1½, 1 & ¾ ips), 6" reel design. Response 40-16,000 Hz @ 3¾ ips; S/N 48 dB; wow & flutter .2% @ 3¾ ips; output 2 W @ 4



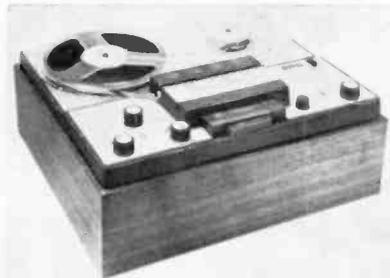
ohms. Has digital counter, automatic recording level control, completely solenoid controlled; vu meter & inputs for low-impedance mic., radio, phono. Playback outputs 2.5 V @ 4 ohms & 0.9 V @ 47,000 ohms. 6" x 10" x 13"\$300.00

6000 Mono Tape Recorder

Transistorized, 2-track, 2-speed (7½ & 3¾ ips), 7" reel design; response 40-18,000 Hz ±2.5 dB; S/N 45 dB; wow & flutter ±0.15% r.m.s.; 2 W @ 4 ohms. Has digital counter, vu meter. 3 inputs (mic, phono, radio) and 2 outputs. Speaker & earphones. 14" x 15" x 7". 117-250 V a.c., 50/60 Hz.\$160.00

7000D Tape Deck/Preamps

Transistorized, 4-track for stereo or mono record/playback, 2-speed (7½ & 3¾ ips);



7" reel design; response 40-18,000 Hz ±2.5 dB @ 7½ ips; S/N 48 dB; wow & flutter ±0.08% r.m.s.; output 0.75 V @ 15,000 ohms. Has 4-digit counter, automatic end of tape shut off, vu meter, mic & line inputs. Permits sound-on-sound. 117-250 V a.c., 50/60 Hz operation. 14" x 15" x 7"\$149.50
Model 7300 same as Model 7000 except has three heads\$199.00

1000 Portable Tape Recorder

Will operate from 117-250 V a.c., five "D" cells, or 6-12 V car battery. Solid-



state design; response 20-20,000 Hz ±2.5 dB @ 7½ ips; single 7½-ips speed; full-track; 5" reels max. Features automatic photoelectric level control; overload filter; "Pilotone" level adjust; battery condition checker; monitoring off the tape; stroboscopic speed control; built-in speaker; pause control. Designed especially for sound synchronization of motion picture films. 11" x 9" x 3½"\$695.00

Model 10,000 "Royal Deluxe"

4-speed, record/play stereo design with

10 W/ch continuous sine-wave amplifiers & two built-in speakers. Features built-in "Dia-Pilot" for sound/slide synchronization; sound-on-sound; sound-with-sound; echo single channel & stereo mixing. Amplifiers can be used independent of tape recorder. Wow & flutter 0.025% at 7½ ips. Response 20-20,000 Hz ±2 dB at 7½



ips. With walnut case & plexiglas lid. 17¼" x 13¼" x 7¼" inc. lid.\$550.00

Model 9500 "Royal Deluxe" Tape Deck

Same as Model 10,000, less output ampli-



fiers & speakers\$450.00

VIKING

Model 88 Stereo Deck/Preamps

Solid-state, 2-speed (7½ & 3¾ ips), 4-track design. Response 30-18,000 Hz ±3



dB @ 7½ ips; flutter & wow 0.2% @ 7½ ips; S/N ratio 55 dB @ 7½ ips; HD 1%. Features counter, vu meters, monitor facility, sound-on-sound, automatic shut-off. Pre-amp outputs 2 V\$339.95
1500 Cabinet, walnut\$18.95

Model 880 Same as 88 but with 5 W/ch dynamic power @ 8 ohm amp & two detachable speaker assemblies, each with 5" woofer and 2½" tweeter & crossover. 21½" w. x 14¼" x 9¼" d. Supplied with

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423 Stereo Tape Deck/Preamps

Solid-state design; 3 speeds (1½, 3¼ & 7½ ips); 4-tracks; response 50-15,000 Hz ±3 dB @ 7½ ips; input sensitivity for 0 vu: 0.55 mV for 2500-ohm impedance mic; aux. 100 mV; HD 1.5%; vu meter; wow & flutter 0.2% @ 7½ ips. Has pause control. 15¼" x 12½" x 6½" behind panel. Tape deck mechanism similar to Model 433\$249.00
423RW with remote pause & walnut base.\$319.95

Model 807 Tape Player

Plays mono or stereo ½- or ¼-track at 7½ ips or 3¼ ips. Features automatic shut-off;



response 30-18,000 Hz @ 7½ ips; flutter & wow 0.2% @ 7½ ips. Does not have preamps; heads connect direct to tape head input of external amp. 6½" x 13½" x 10" d.\$124.95

433 Stereo Tape Deck/Preamps

Three-speed (1½, 3¼ & 7½ ips), 4-track design; response 40-18,000 Hz ±3 dB @



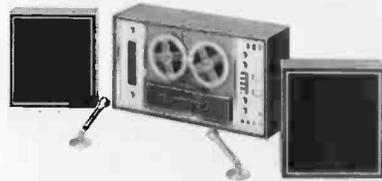
7½ ips; S/N ratio 54 dB; THD 1% at 0 level; flutter & wow 0.2% @ 7½ ips; inputs for 0 level: mic 0.5 mV; aux. 75 mV. Features solid-state design; 3 heads; mixing controls; echo sw.; sound-with and sound-on-sound; counter; pause control; automatic shut-off. Has preamps only; output 1V low impedance. 15¼" x 14½" x 6½" behind panel\$369.95
433R With remote pause\$399.95
433RW With remote pause & walnut base\$419.95

V-M

Model 754 AM-FM Tuner/Recorder

Solid-state system includes stereo recorder and provision for AM, FM, FM-stereo recep-

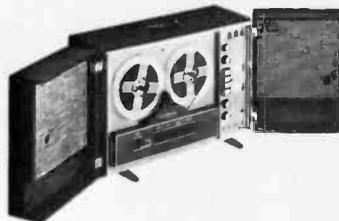
tion. Three-speed (7½, 3¼ & 1½ ips), four (¼-track) channels; response 50-15,000 Hz; power output 20 W peak music power (EIA)/ch; S/N & track separation 50 dB; wow & flutter less than 0.25% r.m.s. at 7½ ips. Features "Add-A-Track"; twin vu meters; 3-digit tape counter; headphone jack; interlock to prevent accidental erasure; push-button controls; pause button. System housed in walnut finished veneer case. Center unit 14¼" h. x 27½" w. x 9" d. Each speaker 14¼" h. x 13¼" w. x 3½" d.



Comes with two dynamic mics; shielded audio cables; speaker patchcords; 10-ft speaker cords.\$399.95
Model 754 BK Same except in vinyl-covered case.\$379.95

Model 744 Stereo Recorder

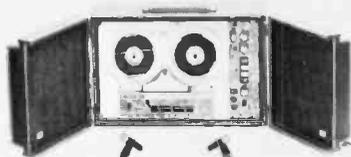
Three-speed (7½, 3¼ & 1½ ips), four (¼-track) channel, solid-state design. 7"



reels; safety interlock; twin vu meters; headphone jack; automatic shut-off; 3-digit tape counter; push-button control; pause button; "Add-A-Track." Power output 20/W peak music power (EIA)/ch; S/N & track separation 50 dB; wow & flutter less than 0.25% r.m.s. at 7½ ips. Frequency response 50-15,000 Hz. 14¼" h. x 22" w. x 11½" d. Vinyl-covered ¾" plywood enclosure. Speakers detachable & usable up to 20 feet apart.\$339.95

Model 748 Stereo Recorder

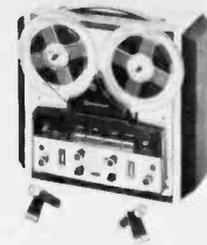
Solid-state, three-speed (7½, 3¼ & 1½ ips), four (¼-track) channel unit. Response 50-15,000 Hz; S/N 46 dB; track separation 50 db; wow less than 0.25% r.m.s. at 7½ ips. 7" reels; 3-digit counter; push-button



controls: pause button. Two 6" speakers. Heavy-duty plywood case has handle for portability. 14" h. x 21¼" w. x 11½" d.\$239.95

Model 734 Stereo Recorder

Three-speed, solid-state record/play unit. Will handle up to 7" reels; frequency response 50-15,000 Hz; wow & flutter less than 0.25% r.m.s. at 7½ ips; two built-in 6" speakers; has "Add-A-Track"; twin vu meters; headphone jack; 3-digit counter; push-button controls; pause button. Heavy duty, walnut-textured vinyl-finished cabi-



net. Carrying handle. 14" h. x 16" w. x 8" d.\$189.95

Model 733BK Tape Recorder

Compact mono unit with three speeds. 7" reels; headphone jack; safety interlock;



3-digit tape counter; special pause control; push-button operation; single-stacked record/play head. Has 5" x 7" PM speaker; 10 W peak music power (EIA) output; response 50-15,000 Hz; wow & flutter 0.25% r.m.s. at 7½ ips. 7½" h. x 13" w. x 14¼" d. Injection molded high-impact plastic housing.\$189.95

Model 782 Portable Recorder

Battery (six "D" cells or rechargeable alkaline batteries) or a.c. operated; 3¼ & 1½



ips; voice-operated start/stop; a.v.c.; 3-digit counter. Frequency response 120-7000 Hz at 3¼ ips; 6¼" oval speaker; heavy-duty high-impact plastic case.\$89.95
Model 781 Same as Model 782 except lacks



a.v.c., counter, and cannot be operated from alkaline batteries.\$69.95

WOLLENSAK

5710 2-Track Mono Recorder

Solid-state, 3-speed (7½, 3¼ & 1½ ips) design. Features 4" x 6" built-in speaker; vu meter; pause control; counter; automatic shut-off; monitor facility; automatic head demagnetization. Response 50-17,000 Hz ± 3 dB @ 7½ ips; wow & flutter 0.25% @ 7½ ips; S/N ratio 48 dB @ 7½ ips;



output 3 W dynamic power at 5% HD. Has mic & phono/radio inputs. 16" w. x 10" x 7" d. Supplied with protective cover & mic.....\$159.95

1500SS 2-Track Mono Recorder

Solid-state, 2 speed (7½ & 3¼ ips) design. Features built-in speaker; vu meter; counter; pause control; monitor facility. Accepts accessory foot control. Response 40-15,000 Hz ±3 dB @ 7½ ips; wow & flutter



0.25%; S/N ratio 48 dB; output 10 W dynamic power, 9 W continuous @ 5% HD. Has mic & phono/radio inputs. 6½" x 10¼" x 11¼".....\$184.95

WOLLENSAK MODELS 5720, 5730, 5740, 5750 & 5800 are all solid-state, 3-speed (7½, 3¼, & 1½ ips), 4-track stereo & mono play & record designs. Response 40-17,000 Hz ±3 dB @ 7½ ips; wow & flutter 0.25% @ 7½ ips; S/N ratio 48 dB @ 7½ ips. Except for Model 5720, power output is 3 W dynamic power @ 5% HD. All have 2 mic & 2 phono/radio inputs. Feature vu meters; pause control; counter; automatic shut-off; monitor facility. 5720 Preamp/deck. Does not include power



amp & speakers. Preamp outputs 1.2 V. 19¾" w. x 9¾" h. x 7½" d. Accessories not supplied\$169.95
5730 Portable with two 4" x 6" built-in speakers. Supplied with metal cover lid, one

dynamic mic. 16" x 10" h. x 7" d. \$179.95
5740 Supplied with detachable (6") speaker housings; vinyl covered case & 1 dynamic mic. Closed 21½" w. x 10½" h. x 10½"; open 42" w. x 10½" x 7½" d.\$179.95
5800 Supplied with separate walnut matching speaker systems; each system has a 6" x 9" low- and mid-range speaker & a 3" tweeter with crossover network. Recorder 21" w. x 11" x 9"; speakers 20" x 11" x 8" d. Supplied with a dynamic mic & wall mounting hardware\$259.95

5810 AM-FM Stereo Tuner

Walnut cabinet matches 5800 system. FM usable sensitivity 10 µV; response 40-12,000 Hz (stereo); separation 25 dB @ 1 kHz; hum & noise 25 dB below 1 V output\$119.95

3500 Portable Mono Tape Recorder

Operates from six "D" cells or 117-V a.c. Features 2 speeds (3¼ & 1½ ips); 5"



reels; automatic record level; solid-state design; vu level/battery condition meter. Response 100-8000 Hz ±4 dB @ 3¼ ips; wow & flutter 0.4% @ 3¼ ips; output 750 mW. Supplied with remote mic. 11½" x 10¼" x 4".....\$89.95

Model 6300 Stereo Recorder

Three-speed (7½, 3¼ & 1½ ips), four-track stereo unit; frequency response 40-15,000 Hz ±2 dB at 7½ ips; wow & flutter less than 0.15% at 7½ ips; S/N ratio 50 dB; power output 8 W/ch (EIA); dist. less



than 0.5% at 5 W. Inputs: low-imp. mic, high-level phono/tuner; outputs: 8-ohm speaker, preamp. Has tandem tone controls; vu meters; automatic reel locks; solid-state circuitry. Recorder 16½" w. x 13½" h. x 6½" d.\$229.95
Model 6200 Same as Model 6300 except with self-contained speakers.\$199.95
Model 6100 Same as Model 6300 but deck only.\$159.95

ALWAYS...

take along your copy of this Directory when shopping for hi-fi components. It is a comprehensive reference to technical details and complete prices.



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These decorative, yet sturdily constructed cases are just what you've been looking for

to keep your records and tapes from getting tossed about and damaged, disappearing when you want them most and just generally getting the "worst of it" from constant handling. They're ideal too for those valuable old "78's" that always seem to get thrown about with no place to go.

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• The 10" and 12" Record Cases (with catalog forms) are \$4.25 each; 3 for \$12; 6 for \$22.

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_____	10" Record Case at \$4.25 each; 3 for \$12, 6 for \$22.
_____	12" Record Case at \$4.25 each; 3 for \$12, 6 for \$22.

Add 75c PER ORDER for SHIPPING and HANDLING Outside U.S.A. add \$1 per case ordered.

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|--|---------------------------------|--------------------------------------|
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| <input type="checkbox"/> Pine Green | <input type="checkbox"/> Orange | <input type="checkbox"/> Yellow |
| <input type="checkbox"/> Grey | <input type="checkbox"/> Black | <input type="checkbox"/> Spice Brown |

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ADMIRAL

CTRF150 Cassette-Corder

Solid-state portable cassette recorder with built-in AM-FM radio. Can record direct



from radio (bypassing mic), play prerecorded tapes, and record. 14 transistors; record level/battery meter; 2½" speaker; monitor; push-buttons for record, forward, stop, rewind, fast-forward. Black walnut cabinet, leatherette carrying case, mic stand, batteries & a.c. charger included.\$84.95

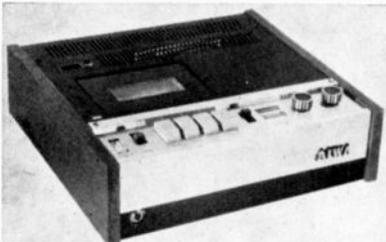
AIWA

TP-728 Cassette Recorder

Solid-state, a.c.-d.c. design. Features capstan drive; mono record & playback; output 500 mW dynamic power (EIA 5% dist.). Has 4" x 2½" spkr.; a.c. bias & erase. Supplied with mic, earphone, batteries, case & a.c. line cord. 10¼" x 6" x 3½".....\$69.95

TP-1009 Cassette Tape Deck

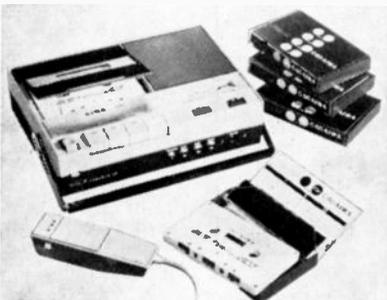
Solid-state, stereo, 117 V a.c. design; response 50-10,000 Hz; has preamps only for



record & playback; pause control; 1 V output each channel; two vu meters; a.c. bias & erase. 11" x 10" x 3¼"\$119.95

TP-707PJ Cassette Recorder

Solid-state, dual-track, mono, capstan drive design. Features a.c. bias; 1⅞ ips; ⅛" w.



tape (all cassette cartridges are ⅛" in width); 2½" speaker; 200 mW dynamic power; operates from 4 "C" cells; has record level/battery indicator meter. Supplied with remote control mic & earphone\$54.95

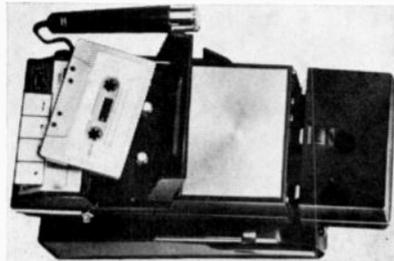
ALLIED

1150 Cassette Recorder

Solid-state, 2-track mono design; operates from six "C" cells or a.c. line. Response 200-11,000 Hz. Has auto level control, battery level meter, remote start/stop mic. 9⅝" x 6" x 2⅝"\$89.95

1100 Cassette Recorder

Similar to Model 1150 except operates from five "C" cells or a.c. adapter. Supplied with



a.c. adapter & remote start/stop mic. 12" x 6" x 4".
15S7138X\$59.95

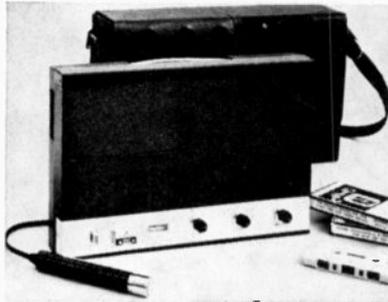
AMPEX

Micro 50 Cassette Deck/Preamp

Solid-state stereo cassette player/recorder; a.c. operated; does not have power amps and speaker. Features counter, vu meter, pause & record level controls. Has two omnidirectional mics. & walnut case. 14½" x 8¾" x 3½"\$139.00

Micro 20 Cassette Recorder

Solid-state, a.c.-d.c.-battery operated mono



recorder with remote mic. 12½" x 8" x 2¼"\$99.90

Micro 85 Cassette Recorder

Solid-state stereo cassette player/recorder; a.c. operated. Features record level, tone &

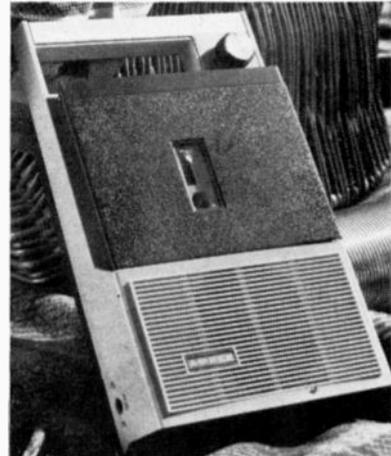


pause controls & counter. Supplied with two omnidirectional mics & two separate

speaker systems. Walnut cabinets. 14½" x 8¾" x 3½"\$189.00

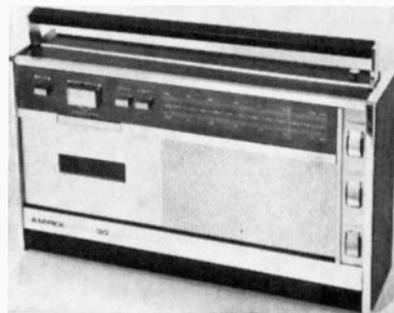
Micro 1 Cassette Player

Portable mono design; operates from 6 penlight cells & with optional adapter for a.c.



line. 6" x 2½" x 10"\$29.88

Micro 30 AM-FM-Cassette System



Mono design includes AM & FM radios and a cassette player/recorder. Is battery or a.c.-line operated, solid-state. 12" w. x 3" x 7" h. Less microphone\$129.00

Micro 10 Cassette Recorder

Portable design operating from 5 "C" cells. Features 2-track, mono, 1⅞ ips. Includes mic with remote sw. 8" x 4¼" x 2½". 4 lbs.\$69.90

Micro 5 Cassette Deck/Preamp

Solid-state, walnut-encased stereo playback design. 8¾" x 5¼" x 2⅝"\$54.90

Micro 12 Cassette Recorder

Solid-state, portable, mono with mic. Powered by 5 "C" cells or with optional adapter from a.c. line. Mic has remote sw. 4¾" x 2¼" x 7¼"\$59.90

ARVIN

97C38 Stereo Cartridge Player

Complete system consisting of 4- and 8-track cartridge player, stereo amp, and two matching speakers. Will handle 4", 6", or 8" wide

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cartridges with machine making the necessary adjustments automatically. 3 3/4 ips; capstan drive system; program selector: automatic and/or manual; automatic eject and shutoff. 14" w. x 8" h. x 13" d. Walnut woodgrain vinyl cabinet\$159.95

97C18 Stereo Cartridge Player

Solid-state, 4- or 8-track stereo/mono cartridge player designed to be used with com-



ponent hi-fi systems. Has two aux. input jacks for phono, tuner, or reel-to-reel; automatic switching; automatic channel selection; automatic cartridge eject & switch off. Handles 4", 6", and 8" cartridges; 3 3/4 ips; capstan drive. Preamp output 0.5 to 1 volt. Includes two 4 ft patchcords, two external amp. jacks. 14" w. x 8" h. x 13" d. Walnut veneer cabinet.\$119.95

30L71-1K 4-Track Recorder

4-track solid-state stereo unit with two extendible enclosures each with 5 1/4" x 3"



speaker. Records and plays 4-track stereo or 2-track mono; automatic cassette loader/unloader; push-button controls for play, fast forward, rewind, stop; record interlock button; counter with auto-reset; dual controls for individual speaker balance; a.c. erase; capstan drive for constant 1 1/4 ips speed. Has output jacks for stereo headphones, external amps, monitor; 2 mic jacks & 2 aux. input jacks. 12 3/4" w. x 4 1/4" h. x 9" d. Comes with two mics with fin stands & blank cassette. Beige.\$179.95

40L31-19 Recorder/AM-FM Radio

Battery or a.c. operation; records from mic or radio; 2-track mono; 500 mW output;

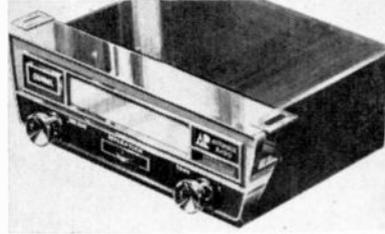


capstan drive; push-button controls for stop, fast-forward, play, rewind, record. Has remote-control mic with stand; aux. input; combination vu/battery meter; response 100-8000 Hz; 4" speaker. 13 1/8" w. x 9 1/2" h. x 3 1/2" d. Black with silver trim.\$89.95

AUTOMATIC

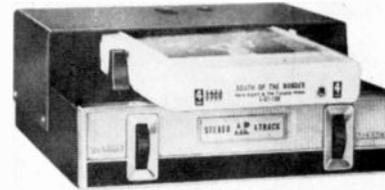
MNE-6725 Cartridge Player

Based on 8-track stereo, playback-only design; 3 3/4 ips; wow & flutter 0.3%; re-



sponse 50-15,000 Hz; output 4 W dynamic power (2 W/ch); 12 V negative ground. Features solid-state circuitry, automatic switching of channels at end of each play. Supplied with two 5" speakers. 6 1/4" x 2 1/2" x 6" d.\$79.95

SFB-6802 4-Track Stereo Player



Designed for car or boat; 12 V d.c. operation. Supplied with two 5" speakers ..\$59.95

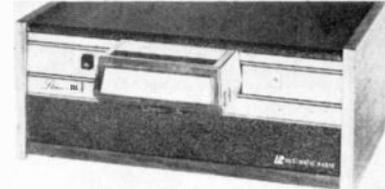
SEA-6801 8-Track Stereo Player

Designed for car or boat; 12 V d.c. operation. Solid-state; auto switching to each of



the 8 tracks. Supplied with two 5" speakers\$69.95

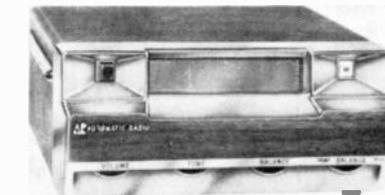
HTC-8102 Convertible Player



Same as GES-8111 except for 117-V home operation. Tape deck/preamps only ..\$79.95

GES-8111 Convertible Player

Will play stereo 8-track & 4-track with optional "gidget". Will also play AM, FM or



FM-stereo when optional cartridges are inserted in machine. For 12 V d.c. car or boat operation. Has 4-way speaker balance; solid-state circuits; 5 W/ch dynamic power; response 50-15,000 Hz. For home use optional speakers & 117 V power supply are available. Supplied with four 5" speakers\$149.95

HMX-4000 AM-FM-Tape System

Home design features built-in AM-FM stereo tuner, 10 W/ch power amp & an 8-track

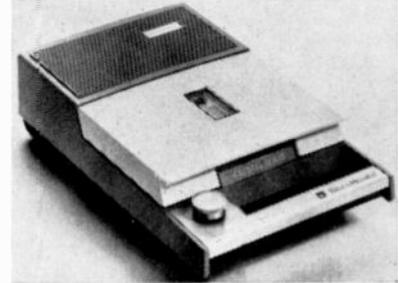


tape player (4-track also with "gidget"). Speakers not supplied. 19 1/2" x 4" x 9 3/4"\$199.95

BELL & HOWELL

292 Cassette Player

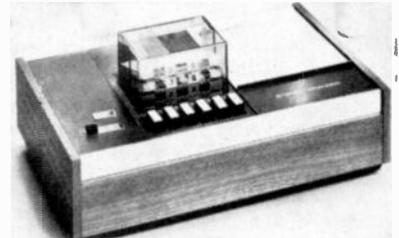
Two-track mono design; operates from six "C" cells; output 400 mW; response



150-7000 Hz; earphone output. 10" x 6" x 2 1/2"\$29.95

332 Cassette Tape Changer

Four-track stereo deck/preamps for playback only. 117 V a.c. operation; response 63-8000 Hz ±8 dB. Will store and play



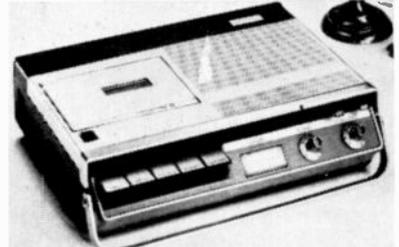
six cassette cartridges automatically. Line output 0.4 V at 20,000 ohms. 15" x 9 1/4" x 4 1/4"\$129.95

337 Cassette Tape Changer

Same basic design as Model 332 except stereo 10 W/ch r.m.s. amps have been added. Has stereo record facilities and separate speakers. 15" x 9 1/4" x 4 1/4"\$269.95

295 Cassette Recorder

Two-track mono play/record. Operates from six "C" cells & 117 V a.c. Output



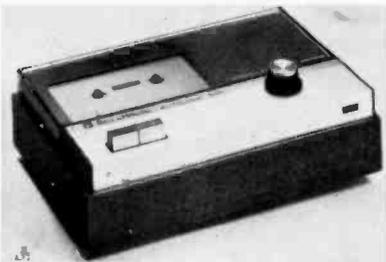
0.8 W; response 100-9000 Hz ±6 dB. Has line output for ext. speaker & mic input. 10" x 7 1/2" x 2 1/2"\$99.95

327 Cassette Recorder

Four-track stereo play/record; 10 W/ch r.m.s. output; response 63-8000 Hz ±8 dB; 117 V a.c. operation. Appearance same as Model 326. 14 1/8" x 8 1/4" x 3 1/2" ..\$229.95

322 Cassette Player

Four-track stereo deck/preamps; 117 V a.c. operation. Response 63-8000 Hz \pm 8



dB. Has 0.4 V, 20,000-ohm line output. 8 x 4 1/2" x 2 1/4"\$59.95

326 Cassette Recorder

Four-track stereo play/record deck/preamps; 117 V a.c. operation; response 63-



8000 Hz \pm 8 dB. Has line output (0.5 V at 18,000 ohms). 13 1/2" x 8 1/4" x 3 1/2"\$139.95

BLAUPUNKT

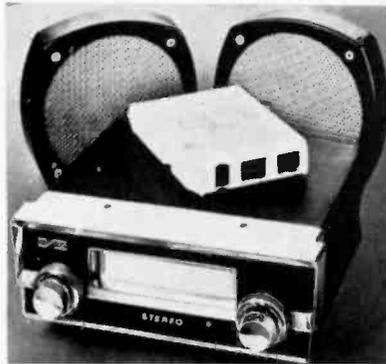
"Snob 100" Cassette Recorder

Solid-state with 0.5 W output & in car adapter 2.5 W. Has built-in speaker; state-of-battery indicator; mic with remote control. Will operate from drycells or rechargeable battery, 12 V car adapter, or 117 V power lines\$110.50

BORG-WARNER

Deluxe 8-Track Tape Player

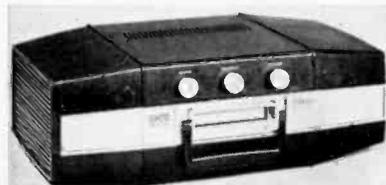
Solid-state stereo, 12 V negative-ground design; features 3 3/4 ips operation; re-



sponse 70-10,000 Hz; 0.75 W/ch dynamic power (EIA 5% dist.); 8 ohm outputs. Supplied with two 5 1/4" waterproof speakers. 3" x 8" x 7 1/2"\$109.95

"Cart/able 8" Cartridge Tape Player

Portable 8-track, 120 V a.c. design; has detachable speaker cases. Supplied with



scuff-resistant black or beige case\$99.95

"Mark II" 8-Track Tape Player

Similar to "Deluxe" design but economy version without speakers\$89.95

"Cart-A-Tune" Portable Cartridge Player

Battery-powered; 8-track cartridge player. Has jack to plug in adapter for 120 V a.c.; mono; scuff-resistant black and beige case\$39.95

CHANNEL MASTER

Model 6303 Cassette Recorder

Battery-operated (4 "C" cells), transistorized portable; capstan drive; 1 7/8 ips; re-



cords up to 2 hours; has 2 3/8" dynamic speaker; mic input jack; motor-speed regulator; phone/external speaker jack. Comes with remote control 500-ohm dynamic mic, accessory case, carrying strap, demonstration cassette.\$44.95
Model 6484 a.c. adapter/charger.\$ 6.95
Model 6591 remote control footswitch.\$ 9.95

Model 6309 A.C./Battery Recorder

Solid-state battery (5 "D" cells) or 117-volt a.c. operation; combination record level/



battery condition meter; push-button controls; 4" dynamic speaker; variable tone control; switchable automatic record level control; p.a./monitor sw.; cassette cover opener & ejector. Has built-in storage compartment for four cassettes, accessories & a.c. cord. Padded leatherette case.\$89.95

CONCERTONE

200-S Cassette Recorder

Complete solid-state system including matched pair of walnut speaker systems ..



.....\$179.95

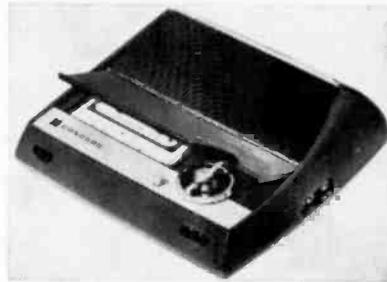
210 Cassette Recorder

Solid-state, mono design with 3.5" speaker; a.c. adapter, mic & leather-type case..\$89.95

CONCORD

F-50 Cassette Recorder

For 117 V a.c. or six "C" cell operation; mono design with auto level control; 5" speaker; response 60-10,000 Hz. 8 3/4" x 4" x 9" d. Supplied with carrying case & dy-



dynamic mic. Wt. 4 1/2 lbs.\$59.95

F-98 Cassette Recorder

For 117 V a.c. or six "C" cell operation; mono design with automatic level control;



dynamic remote-control mic; separate mic input for conference recording; 4 W output. 12" x 9" x 4 1/2" d. Wt. 8 lbs.\$119.95

F-400 Cassette Stereo Recorder

117 V a.c. & six "C" cell operation with 4 W/ch power amps. Has auto level control



50-10,000 Hz response; built-in stereo speakers. Supplied with remote-control dynamic mic. 12 3/8" x 9 3/4" x 3 3/4" ..\$179.95

CP-250 Cartridge Player/Preamps

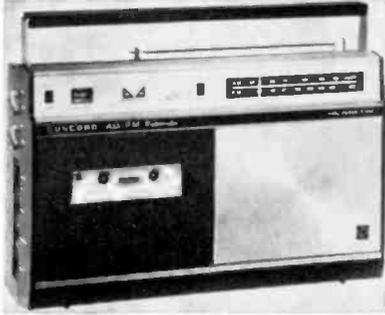
Stereo 8-track playback unit for use with ext. hi-fi power amps. Response 50-15,000



Hz; program lights indicate which track is playing; program selector button changes track. 9 3/4" x 4 1/2" x 9 1/4" d.under \$100.00

F-103 Cassette "Radiocorder"

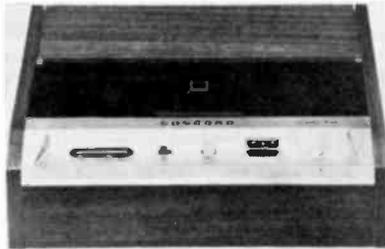
Combines an AM & FM receiver with a cassette cartridge recorder; solid-state mono



design; battery & a.c. operation, automatic shut-off in both play & fast wind/rewind modes; record level/battery condition meter; 1 7/8 ips; a.f.c.; telescoping antenna; with remote-control dynamic mic. 12" x 9 1/4" x 3 3/4"under \$130.00

F-105 Stereo Cassette Recorder/Preamps

Solid-state design with preamps. To be used with external hi-fi power amplifiers; has 4



tracks; 1 7/8 ips; separate vu meters; aux. & mic inputs. Response 40-18,000 Hz; wow & flutter 0.1%; S/N ratio 45 dB. 8 1/2" w. x 2 1/2" x 8"under \$140.00

CRAIG

2602 Cassette Recorder

Battery-operated with battery life indicator & a.c. adapter jack.\$69.95

3104 4/8-Track Tape Player

Compatible 4 & 8 track stereo playback. Features automatic selection; lighted track indicators; 117 V a.c. operation.\$99.95

2603 Cassette Recorder

117 V a.c. or five "C" cell operation. Has mic & aux inputs. Response 100-7500 Hz;



0.63 W output power; 2 3/4" speaker; remote-control dynamic mic. 5 1/4" w. x 9" x 2 3/4". Mono design\$59.95

2703 Cassette Recorder

Same basic design as 2704 except has 1.75 W/ch stereo dynamic power amps. Supplied with 2 dynamic mics & a pair of speaker systems (each with 5" x 7" speaker). Main unit 14 1/4" x 3 3/4" x 9 1/4" d. Speaker cab. 7" x 10" x 6" d. Walnut\$189.95

3110 4-Track Car Stereo Player

Plays all sizes of 4-track cartridges; output 2 W/ch; response 100-7500 Hz @ 3 3/4 ips.



7" w. x 3 1/2" x 8 1/2" d.\$49.95

2704 Cassette Deck/Preamp

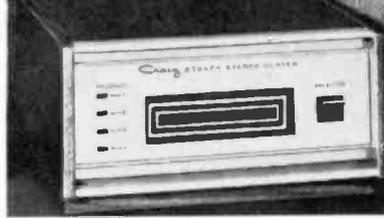
117 V a.c. design for record/playback of stereo programs. Response 50-10,000 Hz;



wow & flutter 0.35% r.m.s. Walnut cabinet. 14 1/4" x 3 3/4" x 9 1/4"\$139.95

3201 8-Track Cartridge Deck/Preamp

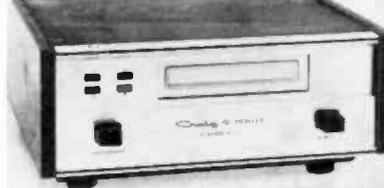
Home version stereo tape player. Response



50-10,000 Hz. 3 3/4 ips. 9" x 4 1/2" x 9 1/4". Walnut\$69.95

3202 "Four-plus-Four" Deck/Preamp

Stereo cartridge player for 8-track & 1/2-



hour, 4-track cartridges. Response 50-10,000 Hz; 3 3/4 ips. 9 1/2" x 4" x 9" d.\$99.95

3203 "Four-plus-Four" Player

Stereo 8-track & 1/2-hour, 4-track cartridge player. Output 3 W/ch dynamic power. Response 70-10,000 Hz. Supplied with two separate 6" speaker systems. 9 1/2" w. x 11 1/2" x 4 1/2". Main unit 9 1/2" x 4" x 11 1/2" d.\$144.95

All prices quoted are "list".

CROWNCORDER

CTR-9450S Cassette Recorder

Solid-state mono design with built-in a.c./battery operation; a.c. bias. 0.85 W output; 2" x 4" speaker. With mic. 9 1/2" x 6 7/8" x 2 3/8"\$69.95

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Your order receives our prompt attention.
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6-car Cartridge Carrying Case	All Steel Carrying Case Holds 14 (7) boxes in record (5) Reel (5) bronze	20
Convenient cartridge protection against heat. Ten compartments	Sturdy pressed chipboard construction.	5.49
8.95	Postpaid	

ECONOMY "House Brand" RECORDING TAPE
"MYLAR" DUPONT TRADEMARK FOR POLYESTER FILM

300' MYLAR (tensitized) 3" Reel	.89
600' 1/2 mil MYLAR, 3 3/4" Reel	.88
600' acetate (plastic), 5 in.	.70
800' 1/2 mil. MYLAR, 3 3/4" Reel	.95
600' MYLAR, 5" Reel	.75
900' Triple Play, 4" MYLAR	1.18
900' MYLAR (Polyester), 5 in.	.89
1200' 1/4 mil. tensitized MYLAR, 3 3/4" Reel	1.95
1200' acetate (plastic) 7 in.	.99
1200' MYLAR 1 1/2 mil. (strong)	.98
1200' MYLAR 1/2 mil., tensitized, 5 in.	1.59
1800' Triple Play, MYLAR, 5" Reel	1.98
1800' acetate (plastic) 7 in.	1.17
1800' MYLAR, 1 mil. thick, 7 in.	1.39
2400' MYLAR, tensitized, 7 in.	1.99
2400' MYLAR, tensitized, 7 in.	2.59
3600' MYLAR, tensitized, 7 in.	3.49

Above tape prices are plus postage. We'll return overage with postal chart.

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C-30, 30 minutes	.55	DISCOUNT
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C-90, 1 1/2 hours	1.19	4 track open reel,
C-120, 2 hours	1.39	8 track. OR cassettes;
		also blank tape and
		recorder DISCOUNT
		CATALOGS
		Postage 10c, 5c ea. add'l. cassette. 12 Postpaid

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Circle No. 32 on Reader Service Card. 95

SHC 51/500 Music System

Combines an AM-FM stereo tuner; cassette tape recorder & 15 W/ch dynamic



power amplifier. All solid-state and stereo; response 30-20,000 Hz. Recorder is a 4-track, 2-channel design. Supplied with two mics & has facilities for p.a. Walnut cases CSP-7 speakers optional. \$299.95

CTR-9650S Cassette Recorder

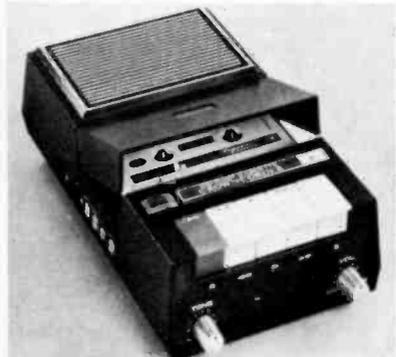
Attaché-case mono design with built-in a.c./battery operation; has automatic tape repeater. Response 100-10,000 Hz; a.c. bias; 1 W output; 4" speaker, 4" x 15 1/8" x



11 1/8" \$119.95

CTR9000 Compact Cassette Recorder

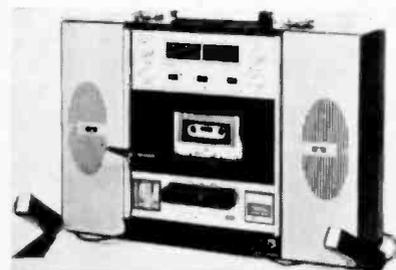
Solid-state, 1 1/2 ips design with a.c. bias; response 100-8500 Hz; 800 mW output.



Will record/play cassette-type cartridges; mono; 2 1/2" speaker; operates from 4 flash-light cells (117-V adapter available). Has recording level/battery condition meter. Supplied with remote mic. 2 3/8" x 4 3/4" x 8 3/8". \$59.95

CSC-9350 Cassette/Receiver

4-track, 1 1/8 ips. Features monitor facilities through speakers or phones; 2 detachable



speaker systems, both battery-operated (4 "D" cells) built in & 117 V a.c.; records either mono or stereo; 1.3 W/ch output; 2 record level meters. Response 100-10,000 Hz. 12 3/8" x 4" x 17 1/8". Supplied with 2 mics. \$189.95

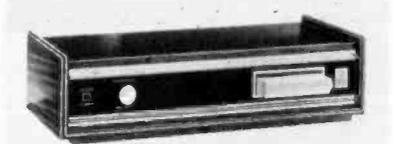
CRC-9100F Cassette/Radio

Solid-state mono recorder with AM-FM radio; battery operated (a.c. adapter optional); output 1 W; 100-10,000 Hz response; 1 1/8 ips; a.c. bias. 2 1/2" x 9 1/2" x 8". With dynamic mic. \$89.95

GENERAL ELECTRIC

Model M8600 Stereo Cartridge Player

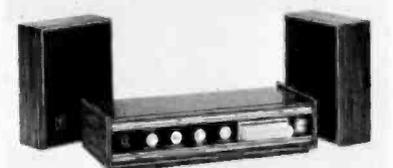
Plays standard 8-track stereo cartridges; solid-state design; automatic shut-off; push-



button channel selection. Two solid-state preamps ready for standard patch connection to radio or amp; capstan drive; 3 3/4 ips. 18" w. x 4 1/2" h. x 8 1/2" d. Walnut finish on hardwood. \$109.95

Model M8610 Cartridge Player System

Plays standard 8-track stereo cartridges through matched 9" x 6" dynamic speakers.



Rotary controls for volume, balance, and continuous bass/treble; push-button channel selection; solid-state stereo amp/preamp; capstan drive; 3 3/4 ips. 18" w. x 4 1/2" h. x 8 1/2" d. (deck). Walnut finish on hardwood. \$154.95

GRUNDIG

C-200 Cassette Recorder

Mono design; battery-powered (5 "C" cells) or optional a.c. pack. 2-track, 1 1/8 ips. Response 80-10,000 Hz; 800 mW output. Has mic with remote-control sw.; level

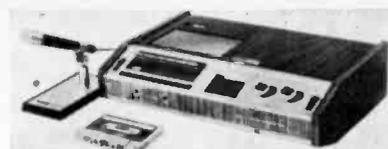


control. 4 1/2" x 2 3/4" speaker. 6" x 9 1/8" x 2 3/8" \$99.95
C-201 With built-in FM radio \$134.95

HARMAN-KARDON

CAD-4 Cassette Tape Deck/Preamp

Solid-state stereo design for record & playback; 1 1/8 ips; HD 1.5%; response 50-12,000 Hz ± 2 dB; a.c. bias; sensitivity: high level 200 mV, low level 0.2 mV; output 0.8 V r.m.s. Has two vu meters;

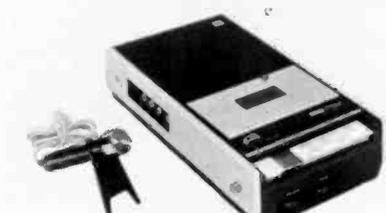


mono/stereo mic sw. & two mic inputs. Walnut \$179.50

HITACHI

Model TRQ-220 Portable Recorder

Battery- or a.c.-operated portable cassette recorder; push-button operation; cassette



pop-up system; automatic level control; adjustable tone control; automatic tape-end stop. Safety device prevents accidental erasures. 5 1/2" x 2 3/8" h. x 9 3/4" d. \$79.95

JVC NIVICO

1600 Cassette Recorder

Portable cassette recorder operating from four "C" cells. 800 mW output, response



100-10,000 Hz. Features 4" x 2 1/2" speaker; automatic recording system; push-button controls; automatic cassette eject. 2 1/2" h. x 5 1/4" w. x 9 1/4" d. Comes with mic, earphone. Plastic cabinet. 3.1 lbs. \$59.50

1700 A.C./Battery Recorder

Features auto/manual recording system; accepts all standard cassettes; provides 1 W



output with frequency response 50-12,000 Hz. Has automatic cartridge eject, tone & pause controls; speaker monitor; level meter. 3 1/2" speaker. Remote control from mic. Operates from a.c. or six "D" cells. 2 1/2" h. x 6" w. x 9 1/4" d. 4.4 lbs. \$99.95

9300 AM Radio/Cassette Player

Battery-operated player featuring automatic cartridge eject, 600 mW output. Standard



AM broadcast band. Earphone and a.c. adapter jacks are provided. Four "D" cells. 7 1/2" h. x 9" w. x 2 1/4" d. 2.5 lbs.\$34.95

9400 AM-FM/Cassette Recorder

Battery (six "D" cells) or a.c. operation; standard AM and FM broadcast bands;



1.8 W output; 80-10,000 Hz response; 5" speaker. Telescopic antenna and a.f.c. for FM reception; automatic cartridge eject; level meter; battery checker. Accepts all standard cassettes. 8" h. x 10 7/8" w. x 3 3/16" d. 7.3 lbs.\$109.95

KALOF

Model 800 Cartridge Deck

Plays all standard 8-track cartridges through existing hi-fi system; 3 3/4 ips; wow & flutter



less than 0.3%; NAB equalization; output 0 to 1 V per ch (variable); solid-state circuitry. Controls: continuous play; auto. off; auto. cue; fine tuning; fast-forward; eject; program selector. 117 V a.c. 10" w. x 5 3/4" h. x 10 1/4" d.\$139.00

Model 801 Cartridge Player

Plays all standard 8-track cartridges; 3 3/4 ips; wow & flutter less than 0.4%; NAB



equalization. Inputs: phono, tuner, aux. Speaker output imp. 8-16 ohms. All-solid-state. 30 W/ch music power; HD less than 1%; frequency response 10-20,000 Hz ±2 dB; bass & treble tone controls. 117 V, 60 Hz a.c. only. 15 1/2" w. x 10 1/2" d. x 5 1/4" h. Walnut and brushed silver finished cabinet.\$199.00

KINEMATIX

KX-900 4 & 8-Track Recorder

Includes record and playback electronics to permit use with an external amp. Will re-



cord from FM, FM-stereo, phono discs, mics, or other electronic source onto 4- or 8-track continuous-loop cartridges. Automatic shut-off with metallic foil sensing tape. Has vu meter. 110-120 V a.c. but can be converted to operate at 12 V d.c. for use in car.Less than \$170.00
Model KX-899 same except with record electronics only. 6 3/4" x 9 1/2" x 3 1/4".Less than \$160.00

KX-1770 8-Track Stereo Player

A.c. 8-track cartridge player; twin-motor system for silent channel changing; parallel



head-moving mechanism; electronic indexing to eliminate crosstalk; three-point-suspension nylon roller for easy cartridge insertion. Power output 40 W/ch; response 30-20,000 Hz; wow & flutter less than 0.3%; dist. less than 0.5% at normal listening levels; S/N greater than 45 dB; feedback 12 dB. Output impedance 4-8 ohms. Outputs: speakers, headphones. Left/right volume and tone controls; 3 3/4 ips. Walnut cabinet. 12 1/2" w. x 4 3/8" h. x 9 1/4" d.\$149.95
Matching bookcase speakers for KX-1770. 10" w. x 12" h. x 8" d.ea. \$30.00

KX-1000 8-Track Record/Playback Deck

Records & plays stereo or mono 8-track Lear or Fidelipak-type cartridges; response 50-



15,000 Hz ±3 dB (with premium tape); wow & flutter less than 0.3 W r.m.s.; S/N better than 40 dB; record & playback distortion less than 0.5%. Features two vu meters; inputs: stereo mag. phono, aux., mic; outputs: two phono plugs. Controls: two volume, two tone; record/playback, cartridge, phono, aux., function switch. 3 3/4 ips. Walnut veneer wood cabinet. 12" x 4 1/2" x 9 1/4".\$299.95

LAFAYETTE

RK-550 Cassette Deck/Preamp

Solid-state stereo design using cassette tape cartridges; 4-track record/playback with preamps. Features 2 vu meters, mic & aux. inputs, high-level amp outputs. Response

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Circle No. 16 on Reader Service Card.

At \$400 this would be
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If you had \$400 to blow on a new microphone, you'd expect the moon: a professional-quality condenser mike with "field effect transistors," the finest of printed circuitry, solid state at its solid best ... to upgrade your system to top recording studio standards of realism.

Now you can have all of that for far less in the new PML 71 Series Micro-Minature Condenser Microphones. Performance? Superb signal-to-noise ratio. High sensitivity. A linear frequency response of 40 Hz to 18 kHz ± 3 db. Selectable output impedance: 30/50, 200 or 600 Ω balanced or HI-Z unbalanced.

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Omni-Directional EK71 \$ 99.50
(Microphone supplied with stand adaptor and 12 ft. cable to power supply)

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7130S A.C. (110/125v), Stereo/Mono with two 12 ft. signal cables \$89.50

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Circle No. 41 on Reader Service Card.

40-12,000 Hz; wow & flutter 0.25%. Has simulated wood-grain metal enclosure. 15" x 5" x 9" d.\$119.95

RK-570 Integrated Stereo Music System

Control center consists of FM-stereo receiver, 4-speed stereo record changer, and



cassette stereo tape deck in a single enclosure; speaker enclosures are separate. All solid-state design with 6 W/ch dynamic power at 8 ohms. FM sensitivity 2.5 μ V for 20 dB quieting. Amplifier response 20-30,000 Hz \pm 2 dB. Push-button tape cassette deck features 0.3% wow & flutter. Each speaker has 5" woofer, 3" tweeter; response 60-18,000 Hz. Control center size 20 $\frac{3}{4}$ " x 4 $\frac{1}{2}$ " x 3 $\frac{3}{8}$ " h. (7" to spindle top). Speakers 12" x 7" x 8" d. Oiled walnut wood cabinets\$249.95

LEAR JET

Model A-239 FM Radio/Stereo Player
Plays 8-track stereo or mono tapes @ 3 $\frac{3}{4}$ ips; electronic speed control; automatic



and/or manual push-button program selector; wow & flutter less than 0.3%. Power output 4 W/ch r.m.s., 16 W peak music power. 88-108 MHz FM tuning range; approx. 1 A battery drain; a.f.c.; edge-lighted FM tuning dial; double-tuned i.f. coils; sensitivity 8 μ V. 12-volt neg. ground. 8" w x 7 $\frac{1}{2}$ " d. x 3" h.\$154.95

Model A-249 Arm-Rest Console Player
Combination arm-rest and portable 8-track cartridge player; plugs into cigarette lighter



of any 12-volt, negative ground car, truck, boat, or plane. Accessory a.c. adapter for home use; stores up to 5 cartridges under lift-up lid. Plays 8-track stereo or mono cartridges @ 3 $\frac{3}{4}$ ips; electronic speed control; automatic and/or manual push-button program selector; 4 W/ch r.m.s. power output; two 5" round speakers. 14 $\frac{1}{2}$ " x 9 $\frac{1}{2}$ " x 7 $\frac{1}{2}$ "\$144.95

Model A-219 8-Track Stereo Player

Solid-state circuit; plays stereo or mono 8-track cartridges; 3 $\frac{3}{4}$ ips; electronic speed



control; automatic and/or manual push-button program selector; wow & flutter less than 0.3%. Power output 4 W/ch r.m.s., 16 W peak music power. Operates from 12-volt negative-ground battery systems. 8" w. x 7 $\frac{1}{2}$ " d. x 3" h.\$119.95

Model A-209 8-Track Stereo Player

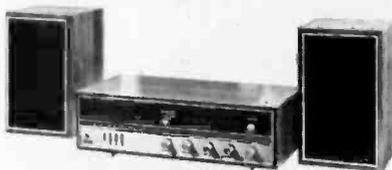
Same as Model A-219 except 2 W/ch r.m.s. power output, 4 W total. Doesn't include



fast-forward switch or synchro-track control.\$79.95

Model H-409 AM-FM Stereo/Cartridge System

Features 24-W peak music power amp, automatic 8-track stereo tape cartridge player,



AM-FM-FM-stereo tuner with a.f.c. and FM-stereo broadcast indicator, and two matching speaker enclosures (2" tweeter, 6 $\frac{1}{2}$ " air-suspension woofer in each). Plays stereo or mono cartridges at 3 $\frac{3}{4}$ ips; automatic or manual push-button program selector; wow & flutter 0.3%; frequency response 30-18,000 Hz. Output 6 W/ch music power, 24 W total peak music power. 6 $\frac{1}{4}$ " h. x 19 $\frac{3}{4}$ " w. x 10 $\frac{1}{2}$ " d. Speakers each 12 $\frac{1}{2}$ " h. x 7 $\frac{7}{8}$ " w. x 8" d.\$239.95

Model H-349 Cartridge Music System
24 W peak music power amp with 8-track stereo cartridge player. Features tape car-



tridge program selector; program indicator lights; all-solid-state circuitry; integrated speaker system. 5 $\frac{7}{8}$ " h. x 18" w. x 11" d.\$109.95

Model S-749 matching external speakers also available.

Model HSA-940 Cartridge Deck

Designed to play 8-track stereo or mono tapes through existing stereo system. Completely automatic operation; push-button



program selector; program indicator lights. Housed in walnut veneer wood cabinet. 6 $\frac{3}{8}$ " w. x 10 $\frac{1}{4}$ " d. x 3 $\frac{3}{4}$ " h.\$69.95

MASTERWORK

Model M-650 Portable Recorder

Operates on batteries or a.c. without adapter; 1 $\frac{7}{8}$ ips reel-to-reel cassettes; capstan drive;



push-button controls for stop, play, fast-forward, rewind & record; automatic level and volume controls; inputs for mic and earphone. Comes with remote-control mic, cassette, carrying case, earphone, alligator clip connection. 4 $\frac{7}{8}$ " w. x 9" h. x 3 $\frac{1}{2}$ " d. Gray and black high-impact case with black grille & chrome control panel\$59.95

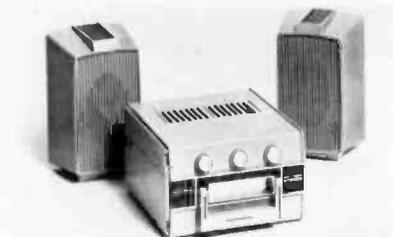
Model M-4400 Stereo Cartridge Player

Solid-state 10 W stereo amp; two side-mounted 6" speakers; operates on 8 "D"



cells, a.c. without an adapter, or from 12-volt battery through cigarette lighter. Plays four-track 3 $\frac{3}{4}$ ips cartridges. Has electronic battery indicator; changeover channel switch; volume, balance, tone and on/off sw.; jacks for external speakers. Walnut-grained vinyl covered cabinet with carrying handle/stand. 12 $\frac{1}{4}$ " w. x 9 $\frac{1}{2}$ " d. x 4 $\frac{1}{2}$ " h. Comes with batteries, auto lighter adapter cord, and a.c. cord.\$99.95

Model M-8503 Portable Stereo Player
Solid-state 20 W stereo amp; detachable speaker enclosures each with one 6" speaker;



volume, balance, and program selector controls; automatic program selector; manual switch for individual program selection; external amp output jacks; instant load and play; cartridge slot door. Housed in polystyrene case with walnut inlays & brushed chrome knobs. 5 $\frac{3}{4}$ " h. x 17" w. x 10" d.\$99.95

The average embarrassed non-technical music-loving layman's clip-and-save INSTANT GUIDE TO RECORDING TAPE



Does that shiny new tape recorder you got for a gift have you buffaloed? Do you panic at the terms like acetate tapes, Mylar tapes, tempered Mylar tapes, standard-play tapes, longer-recording tapes, double-length tapes, triple-time tapes, low-print tapes, low-noise tapes, and inches-per-second? Here's how to stop trembling and start taping. A complete course in four easy, step-by-step lessons... plus a clearly marked paragraph of advertising from the makers of Audiotape.

Lesson 1. The Basic Question— Acetate or Mylar Base?

When you record something, you are magnetizing microscopic particles of iron oxide. If you don't know what iron oxide is, don't worry. Just bear in mind that the particles have to be attached to something or they will blow away, so they are coated onto plastic tape. This base tape can be either acetate or Mylar. Choice of base does not affect fidelity of sound, so why a choice? To save you money and trouble.

Acetate gives you economy. It's not as rugged as Mylar, but professional recording studios prefer it and use it almost exclusively. You may prefer it too.

Mylar* gives you mileage. It survives for years even in deserts and jungles (if you're taping tribal chants, you'll want Mylar). Mylar tapes also can be made exceedingly thin, which means a reel can hold more feet for a longer, uninterrupted program.

Tempering overcomes Mylar's tendency to stretch under stress, and is used for the thinnest, most expensive tapes (the next lesson takes you painlessly through thick and thin). *DuPont's registered trade mark for its polyester film.

Lesson 2. Standard-Play, Longer-Recording, Double-Length, Triple-Time.

Instead of "Play," "Recording," "Length" or "Time," think of "Thickness." Picture a tape-reel 7 inches in diameter. It will hold 1200 feet of standard-recording tape (acetate or Mylar)... 1800 feet of longer-recording tape (considerably thinner acetate or Mylar)... 2400 feet of double-recording tape (still thinner Mylar). Easy, isn't it? Now move on to:

Lesson 3. Which Speed to Record At.

TAPE SPEED	RECORDING TIME PER TRACK: ONE DIRECTION (IN MINUTES)			
	1200 FT.	1800 FT.	2400 FT.	3600 FT.
1½	128	192	256	384
3¾	64	96	128	192
7½	32	48	64	96
15	16	24	32	48

Your tape recorder probably allows you to record at several different speeds (you, by the way, are a recordist; only your machine is a recorder). What's the reason for this smorgasbord of speeds? The faster the speed, the higher the fidelity; the slower the speed, the more playing time per foot and per dollar.

- 15 ips (inches-per-second). Commercial recording companies use this speed when they tape your favorite performer for later transfer to records. Forget it.
- 7½ ips is what you need for really good hi-fi music at home, and for the clearest reproduction of speech (foreign-language homework, sound-tracks for home movies, cocktail-party capers). An 1800-foot reel will play for 45 minutes—the length of a long-play record.
- 3¾ ips is fine for background music and for most speech applications—dictating to your secretary and recording baby's first words. An 1800-foot reel will play for an hour and a half.
- 1½ ips is a businesslike speed without hi-fi frills. Good for taping conferences at the office because it puts a lot of words on a single reel. An 1800-foot reel will play for three hours.
- 15/16 ips is not recommended for anything but continuous monitoring. An 1800-foot reel will play for 6 full hours. Unless you do wire-tapping, you are probably not in the market for 15/16 ips and you're ready to try this:

Tricky Test Question.

Q: How do you get longer playing time per reel of tape?

A: You can do it in either of two ways. (1) At slow speed. The tape plays longer but sound fidelity is reduced. (2) On thin tape. You get more footage per reel but it costs proportionately more. (To put it another way, the same recording job can cost you a dime or a dollar, depending on the method you select. If you're clear in that, you've earned your diploma.)

Lesson 4 Post-Graduate Course.

Experienced tape recordists, with ears and equipment that are ultra-sensitive, can sometimes hear "echoes" caused by "print-through." Think of it as a leakage of sound from layer to layer when very thin tape is wound on the reel. When you achieve that kind of expertise, you'll want special "low-print" coatings... as well as "low-noise" coatings which eliminate the barely perceptible tape-hiss that only the most expensive amplifiers can pick up anyway.

Advertising Paragraph.

Now that you feel like an expert, you'll want the brand of tape that's used by experts because it's made by experts. Its name is Audiotape. It's made by the people who supply tape for recording studios, corporate computers, Cape Kennedy countdowns and automobile stereo cartridges. It's made in the full range of acetateMylar tempered Mylar standard play longer recording double length tripletimelow print low noise. It's made better. Ask anybody who knows. They'll tell you to ask for Audiotape.



How To Make Good Tape Recordings. 150 pages packed with easy-to-understand tips. Regularly \$1.50. Yours for 25¢ or the end tab from reel of Audiotape (7-inch size). Audio Devices, Inc., Dept. 235 East 42nd Street, New York 10017.



MERCURY

Cassette Recorder Series

Features record & playback; 1 7/8 ips; solid-state design; automatic stop at end of hub; capstan drive; battery-operated (five 1 1/2 V "C" cells); 2-track; 500 mW output; response 100-7500 Hz; S/N ratio -45 dB; wow & flutter 0.5% r.m.s.; 2 1/2" speaker. Has vu meter/battery indicator.

Model 8060 Supplied with remote-control dynamic mic. 8 3/4" x 4 3/4" x 2 3/8" mono



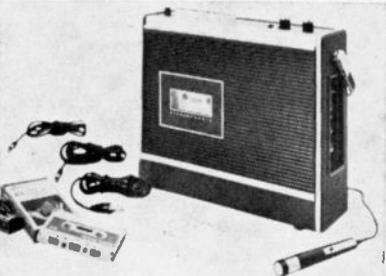
design. Optional equipment: headphones, a.c. adapter, foot pedal control & telephone pickup coil\$49.95

Model 4450 Tape deck; 4-track stereo design; response 60-10,000 Hz; wow & flutter



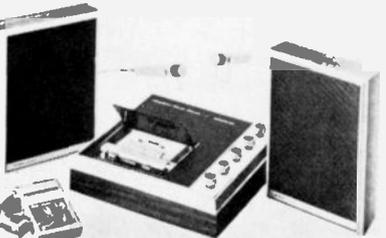
0.3%; a.c.-type bias & erase; 117 V a.c. operation; does not have power amplifiers or speakers. 10 1/2" x 10 1/2" x 3"\$114.95

Model 7200 117-V a.c. & battery operated (12 V-8 "D" cells); 4-track stereo design;



power output 2 W; response 60-8000 Hz; S/N ratio -40 dB; wow & flutter 0.4%; 6" x 4" speaker. Will play & record 2-track mono & has stereo play & record preamps with only one channel of power amplifier & speaker. Second channel designed for ext. amp. & speaker. Supplied with remote-control mic; same optional equipment as for Model 8060. 10" x 12" x 3 3/8"\$129.95

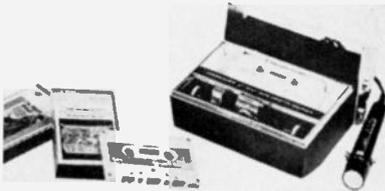
Model TR-4500 4-track stereo record/playback; 117-V a.c. operation; has two detachable speaker systems (6" speaker) with 4 W/ch dynamic power; response 60-10,000 Hz; wow & flutter 0.3%; supplied with 2 mics. 10 1/2" x 10 1/2" x 3"; speaker



cases 10" x 7" x 3 1/2"\$159.95

AP8300 Auto Cassette

For 10 to 14 volts positive- or negative-ground operation; 4 tracks; 1 7/8 ips stereo



design; 3 W/ch dynamic power; response 50-10,000 Hz; S/N ratio -45 dB; wow & flutter 0.3%; solid-state design. 7" x 6 1/2" x 2 1/2". Supplied with two 5" speakers, dynamic mic with remote switch & mounting brackets\$119.95

TR8700 Stereo Cartridge Recorder

Portable 4-track, solid state record/play design using Norelco (Philips system) reel-to-



reel cartridge; up to 90 minutes playing time; response 65-8500 Hz; 1 7/8 ips; 750 mW/ch music power; wow & flutter 0.3%; S/N 45 dB. Features automatic stop; vu meters; two 3" x 5" speakers in detachable housings. Supplied with remote ("on-off") controlled mics; operates from four "D" (6 V) batteries or built-in 120 V a.c. adapter. Supplied with walnut case and hinged lid\$159.95

TR-5000 Cassette Recorder

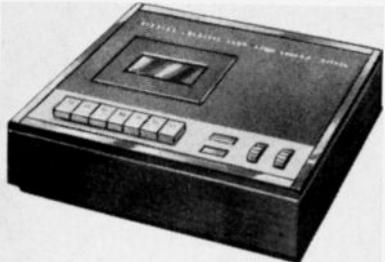
For 117 V a.c. or five "D" cell operation. Response 100-8500 Hz; mono; 500 mW



output, 2 1/4" speaker. 10" x 5 1/4" x 2 3/4". With remote-operate dynamic mic ..\$59.95

TR-4475 Cassette Deck/Preamp

For stereo play & record. Response 80-10,000 Hz. Supplied with two dynamic



mics. Has remote start/stop operation. 10 1/2" x 9" x 3 1/4"\$129.95

AP-8400 Cassette Recorder

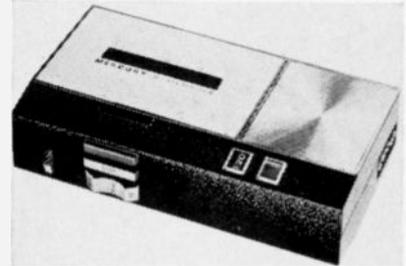
Stereo play, mono record design; 1.5 W/ch dynamic power; 80-10,000 Hz. 7 1/2" x



7 1/4" x 3". Supplied with remote-operate-type dynamic mic. Operates from 12 V d.c. supply for car or boat\$139.95

TR-1000 Cassette "Minicorder"

Battery-operated (four "AA" batteries); 2-track mono recorder. Has 2" speaker;



battery-level meter; automatic record level control; output 100 mW dynamic power. Response 250-4500 Hz. Speaker acts as microphone. 6 1/4" x 1 1/2" x 3 1/4" Supplied with earphone & telephone pickup\$89.95

All prices are suggested retail.

NORELCO

All Norelco cassette machines are designed around the Philips reel-to-reel cartridge & 1 7/8 ips.

"Carry-Corder 150" Cassette Recorder

Portable design operating direct from built-in batteries. Features 2-track 2 x 60 minutes playing time. Response 80-10,000 Hz ±3 dB; Supplied with mic & carrying case. 7 3/4" x 4 1/2" x 2 1/4"; 3 lbs.\$64.95

Car-mount. A special tray-like mounting assembly. When "Carry-Corder 150" is inserted, connections are made to car radio; can then be used as a car player\$29.95

2401 Automatic Stereo Changer Record/Playback System

Twin walnut encased speakers; built-in cassette storage compartment; dynamic stereo



microphone; record level indicator; 60-10,000 Hz; 15 1/4" x 9 1/4" x 4 1/4" ..\$249.95
2401A In deck format, without speakers\$195.95

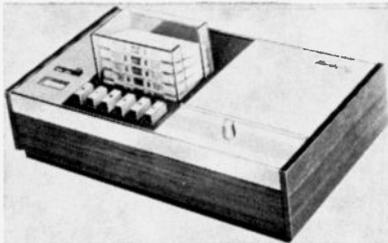
"Continental 450" Cassette Recorder

Solid-state stereo design based on the 4-track reel-to-reel cassette; response 60-10,000 Hz; wow & flutter 0.1%. Has stereo record level control; tone, loudness & balance controls; counter; vu meter & can be used as a p.a. system. Supplied with two

satellite speakers in matching teak cabinets.
120 V a.c. operation\$199.95
450A In deck format, without speakers ..
.....\$143.95

2502 Automatic Stereo Changer

Cassette-playback only; will handle 6 cassettes for up to 6 hours playing time.



Has preamps only; response 60-10,000 Hz
.....\$129.95

2500 Stereo Cassette Playback Deck

For mono & stereo playback; a.c.-operated; has preamps only; response 60-10,000 Hz.



4 1/2" x 8" x 2 1/2"\$59.95

2602 Car Cassette Player

Stereo design; playback only; has "on-off" indicator; pause control & cassette reject bar
.....\$129.95

175 Portable Cassette Recorder

Larger version of "Carry-Corder 150". Operates on six batteries. Features mono operation; record/playback level controls; vu meter. Response 80-10,000 Hz. Supplied with remote mic\$89.95

"Carry-Player 2200" Portable Player
Battery-operated (six 1 1/2 V cells); response 100-7000 Hz; 300 mV output\$29.95

ORRTRONICS

Model 682.110 Stereo Tape Player

Solid-state, 8-track playback unit; 3 3/4 ips; 3 W/ch output; automatic switching; response 50-10,000 Hz; S/N 40 dB; wow & flutter 0.25%; push-button track control selector; 11-16 V d.c. @ 1 amp. Reversible gimbal mounting bracket for under dash or floor hump mounting; 7" d. x 8 1/8" w. x 3 1/8" h. (less bracket).\$59.95

Model 682.120 Stereo Tape Player

Solid-state, 8-track player; plays 4-track cartridges with gidget. 11-16 V d.c. @ 1 A negative-ground (adaptable to pos.-ground by sw.); automatic or manual track sw.; frequency response 50-10,000 Hz; S/N 40 dB; wow & flutter 0.25%. Reversible gimbal mounting bracket for under dash or floor hump mounting; 7" d. x 8 1/8" w. x 3 1/8" h. (less bracket). Comes with two stereo speakers (Model 625.900).\$89.95

Model 690.100 Stereo Player / Speakers

Solid-state, 8-track stereo playback with optional 4-track @ 3 3/4 ips. 117 V a.c., 60 Hz; amp. output 10 W peak/ch; freq. response 50-15,000 Hz; S/N 45 dB; wow & flutter 0.25% max. Output imp. 4-8 ohms/ch; dist. less than 5% at normal listening level. Controls: volume, tone, balance, selector control, off. NAB equalization. Control center 7 1/2" d. x 13" long x 4 1/2" high. Speakers 10" w. x 12" h. x 8" d. Walnut finished wood cabinets.\$169.95

Model 690.110 Stereo Cartridge Deck
Solid-state, 8-track tape player designed to be used with existing hi-fi systems. 117 V a.c.; amp. output 1 V r.m.s. (adjustable); response 50-15,000 Hz; S/N 40 dB; wow & flutter 0.25%. Outputs: tuner, phono. 7 1/2" d. x 13" long x 4 1/2" h. Walnut finished wood cabinet.\$79.95

PANASONIC

RQ-204S "Soundvale" Cassette Recorder

Mono design; battery operated (6 "C" cells); two-track; 2 head; 1 1/2 ips. Response 80-8000 Hz; a.c. bias; 1 W. Has 3 1/2" speaker; vu meter; battery indicator; automatic level control; a.c. adapter. With mic. 9" x 2 1/4" x 10"\$49.95

RQ-210S "Tiny Tone" Cassette Recorder

Mono design; battery operated (4 "AA" cells); 2-track; 2 heads; 1 1/2 ips. Response 50-10,000 Hz; a.c. bias; 600 mW. Has 3 1/2" speaker; battery indicator; automatic level control; five IC circuits. With mic. 3 3/4" x 6 1/8" x 1 1/8"\$125.00

RQ-203S "Oakwood" Cassette Recorder

Mono design; a.c./battery operated (6 "C" cells); 2-track, 2 head, 1 1/2 ips. Response 70-10,000 Hz; a.c. bias; 1.5 W. Has 3" speaker; sound monitoring, automatic level control. With mic. 9" x 2 1/4" x 10"\$59.95



RS-800AS "Player 8" 8-Track Deck
Stereo playback-only design; 1 head; 8-tracks; 3 3/4 ips; response 50-12,000 Hz.

Has automatic operation; program indicator; preamp & walnut cabinet. 16 1/2" x 4 1/2" x 8 1/2"\$79.95



RS-810S "Music Master 8" Player

Stereo playback-only; 8-track design; 1 head; 3 3/4 ips. Response 50-12,000 Hz: 4



W/ch. Has two 6 1/2" oval speakers in separate cabinets. Has automatic operation & program indicator. 117 V a.c. operation. 16 1/2" x 4" x 9"\$149.95

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PLAYTAPE

Model 1605 AM Radio/Player

Transistorized, battery- (four "D" cells) or a.c.-d.c. operated cartridge player with full-



range AM broadcast receiver. Has 4" speaker and four controls: volume, tone, channel selector, and radio tuning. 9" h. x 6 3/4" w. x 3 3/4" d.\$42.95

"Sapphire II" Auto Tape Deck

Designed to be played through car radio speaker; universal mounting for under dash



installation. 3 1/2 W output; 12 V neg.-ground operation. For use with PlayTape cartridges.\$49.95

RCA

Model YLD-42 Stereo Tape Player

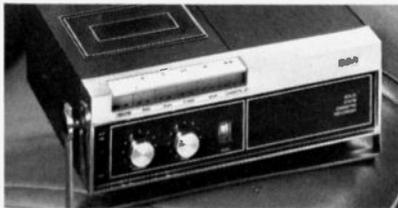
Solid-state tape player with two 5" speakers;



8 tracks; 3 3/4 ips. Housed in wood cabinet of Danish-style walnut.\$99.95

Model YLB-25 Recorder/Player

Solid-state, battery/a.c.-operated recorder/player. Push-button controls; two-tracks;



1 1/8 ips. Comes with batteries, earphone, neck cord, microphone, and blank cassette.\$75.00

SJB

Model ST-1008 FM Radio/Player

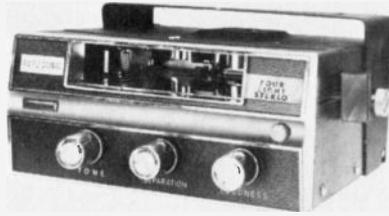
8-track, 4-channel stereo player (3 3/4 ips) with capstan drive; frequency response 70-



7000 Hz \pm 3 dB; wow & flutter less than 0.3% W r.m.s.; S/N greater than 40 dB; channel separation better than 30 dB. Output power 5 W/ch at 4 ohms. Controls: volume, balance, tone, channel selection; 12 V d.c. 8" x 5" x 8". Covers standard FM band.\$179.95

Model ST-804 4 & 8 Track Player

Compatible 4 & 8 track system; 3 3/4 ips; capstan drive; response 100-6000 Hz; 3 W/ch



at 4 ohms; 12 V d.c.; controls: volume, balance, tone, play/reset, channel selection. 7" x 3 1/2" x 7 1/2".\$99.95

Model 80-G Home Tape Player

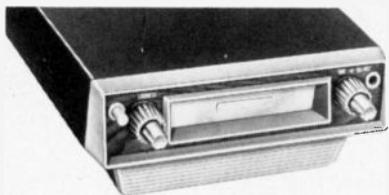
8-track, 4-channel player; 3 3/4 ips; capstan drive; 70-7000 Hz \pm 3 dB; 5 W/ch at



4 ohms; 4-8 ohms; 117 V a.c.; controls: volume, balance, tone, channel selection. 12" x 3 1/2" x 11".\$99.95

Model ST-830 8-Track Player

8-track, four-channel player; 3 3/4 ips; capstan drive; response 100-7000 Hz; 4 W/ch



output; 4-8 ohms; 10-16 V d.c. negative ground; controls: volume, separation, tone, channel selection. 6 7/8" x 3 1/4" x 8 1/4".\$89.95

Model ST-104 Tape Player

4-track, 2-channel player; 3 3/4 ips; capstan drive; 100-8000 Hz response; 3 W/ch out-



put; 4-8 ohms; 12 V d.c.; controls: volume, balance, tone, channel selection. 7" x 3" x 5".\$49.95

SONY/SUPERSCOPE

TC-50 Mono Cassette-Corder

Compact, 1 1/8 ips, 2-track design will operate from four type "AA" batteries. Features automatic record level control; built-in mic; built-in speakers; battery level

meter; response 50-8000 Hz @ 1 1/8 ips; wow & flutter 0.35%; S/N ratio 40 dB; supplied with leather case\$125.00

TC-8 8-Track Cartridge Deck/Preamp

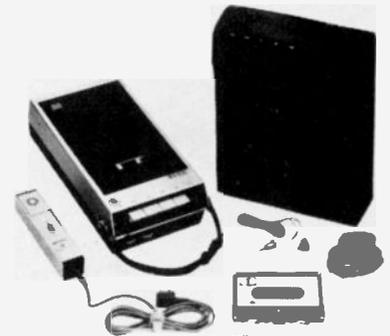
Solid-state stereo design for recording/playback @ 3 3/4 ips 8-track cartridges; re-



sponse 40-12,000 Hz; wow & flutter 0.32%; S/N ratio 45 dB; Has two low-impedance mic inputs; two high-level aux. inputs or mag. phono with RK-66 adapter (optional)\$129.50

TC-100 Mono Cassette-Corder

A.c./battery operated with built-in a.c. converter. Features 1 1/8 ips, 2-track automatic



recording control; battery level & record level meter. Operates from 4 "C" cells that can be replaced by an optionally available rechargeable nickel-cadmium battery pack (recharging circuit is built-in). Supplied with remote control mic\$99.50

124 Cassette-Corder

A.c./d.c. rechargeable; with stereo outputs; built-in speaker; response 50-10,000



Hz; wow & flutter 0.28%; S/N ratio 45 dB; with carrying case and F-99 stereo mic\$169.50
124CS With two matching speakers & vinyl shoulder strap-type carrying case for all components\$199.50

125 Cassette-Corder Deck/Preamp

Solid-state stereo design; a.c. powered; features "Tape Sentinel" end-of-cassette alarm system, a light that blinks on and off as cassette nears end of each side; noise sup-



pressor switch; response 40-10,000 Hz; wow & flutter 0.2%; S/N ratio 54 dB; walnut base\$129.50

130 Cassette-Corder

Similar to Model 125; complete stereo system in walnut, with two matching walnut speakers. Features 8 W/ch dynamic power output; noise suppressor sw; stereo monitor sw.; response 40-10,000 Hz; wow & flutter 0.2%; S/N ratio 54 dB. F-99 stereo mic\$229.50

TEAC

Model A-20 Cassette Tape Deck

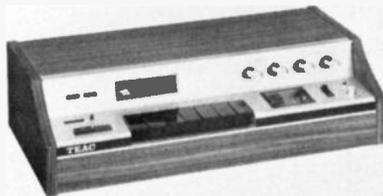
Four-track, two-channel stereo; 1 1/2 ips; response 60-10,000 Hz; wow & flutter less



than 0.2%; S/N 45 dB; Input: mic. 600 ohms. 0.3 mV/line 120,000 ohms, 0.1 V min. Output: line 50,000 ohms 0.5 V/head-
phone 8 ohms 0.1 mW. Pop-up housing for cartridge; dual vu meter; unidirectional stereo mic; all-silicon transistor amp. 9 3/4" x 10" x 4 1/4".\$139.50

Model A-20 Cassette Tape Deck

Records & plays in both directions at 1 1/2 & 3 1/2 ips; response 60-10,000 Hz; wow &



flutter less than 0.2%; S/N 45 dB. Has three heads; all-silicon transistor amp; remote control; pause button; dual vu meter; 4-digit push-to-reset index counter; record interlock; and unidirectional stereo mic. 4 1/8" x 8 1/4" x 16".\$249.00

TELEFUNKEN

"Magnetophon" 4001 Cassette Recorder

2-track, 1 1/2 ips, mono record & playback design; response 8-10,000 Hz ±3 dB; S/N ratio -45 dB; output 400 mW; operates on five "C" cells. Supplied with remote-



1969 EDITION

control mic\$69.95
A.c. power converter available.

TELEX-PHONOLA

Model 9000 Cassette Recorder

Record/playback unit; capstan drive; push-button controls; push-button cassette release; a.g.c. & volume control; 800 mW output;



3 1/4" speaker; input jacks for mic & a.c. adapter; output jacks for earphones. Battery operated, optional a.c. adapter. Comes with dynamic mic & stand; cassette; carrying case; earphone; aux. cables; "C" batteries. 5 1/4" w. x 2 1/2" h. x 9 3/4" d.\$59.95

TENNA

Model TC-48TFM FM Radio/Player

Automatic 4 & 8 track stereo player; fine-tuning control; 12-volt negative ground;



choice of two- or four-speaker kit; covers FM broadcast band; with accessory adapter receives FM-stereo. Black leatherette & chrome case. 2 1/2" h. x 7 7/8" w. x 8" d.\$179.95

Model TC-48-T Same as above except with-



out FM radio. Operates on either 12 V positive or negative ground.\$129.95

Model HTC-210-DG Cartridge Player

Plays 4 or 8 track cartridges automatically; fine tuning control adjusts playback head to



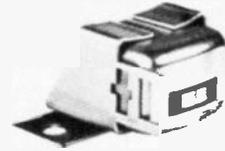
precise alignment with recorded tracks; separate speakers in matching wood cabinets. 117 V a.c. System housed in oiled walnut cabinets with gold trim.\$169.95

TOSHIBA

Model KT-20P Portable Recorder

Solid-state; battery (4 "C" cells), a.c., or 12 V d.c. (with cigarette lighter adapter cord) operation. Response 50-10,000 Hz ±3 dB; S/N 40 dB; wow & flutter 0.4%

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W r.m.s.; 1 7/8 ips. Features keyboard operation; automatic cartridge loading & unloading; record/battery condition indicator; automatic record level; 4" speaker. 2 1/8" h. x 5 1/4" w. x 10" d.\$99.50

Model KT-81 Stereo Cartridge Player
Solid-state amp 10 W/ch; input & output jacks for tuner/record player connection;



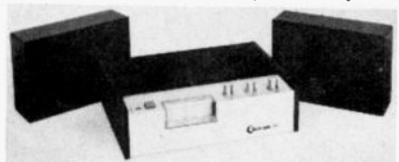
wide-range tone control; program selector, balance, volume, tone & power controls; 3 3/4 ips; hysteresis synchronous motor. Response 50-15,000 Hz; S/N better than 40 dB; channel separation 50 dB at 1000 Hz.\$119.50

Model KT-80 Similar to Model KT-81, but deck only. Output voltage 1 V max. per channel; load imp. 10,000 ohms or more/ch. Comes with 5 ft. connecting cables. 4 3/8" h. x 12 1/2" w. x 8" d.\$69.50

VIKING

811 Series 8-Track Tape Players
Automatic & push-button track selection; 40-15,000 Hz response with 0.3% r.m.s. flutter & wow. Has numerical track indication.

Model 811 Table top design in walnut cabinet with preamps only\$99.95
Model 811W Same with power amps; 5



W/ch dynamic power & two 5 1/4" speaker systems\$149.95
Model 811P Same as 811W except is a portable design\$149.95

V-M

Model 764 Stereo Recorder
Solid-state cartridge machine that will play all cassettes & record stereo or mono; 1 7/8



ips; response 60-10,000 Hz; wow & flutter 0.3% r.m.s. max.; detachable speakers; push-button operation; level meter; tape counter; fast-forward & rewind. Speakers & amplifier fit together for easy portability. Center unit 4 5/16" h. x 13 1/8" w. x 8 13/16" d.; speakers 7 1/8" h. x 9 7/8" w. x 5 3/8" d.\$199.95

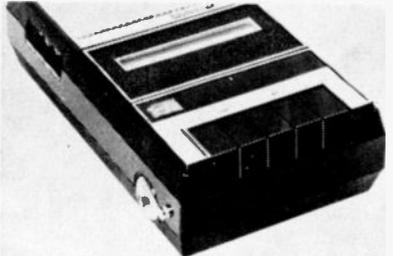
Model 762 Portable Recorder
Operates from five "C" cells; records & plays all standard cassettes; 1 7/8 ips; peak music



power 800 mW; S/N 45 dB; wow & flutter 0.3% r.m.s. High-impact plastic case. 9 3/4" long x 4 3/8" w. x 2 1/4" thick. 4 lbs.\$69.95

WOLLENSAK

4000 Cassette Recorder
Battery-operated, mono record/playback; push-button controls; vu meter. Accepts



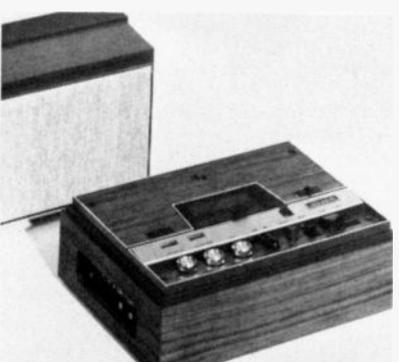
a.c. adapter-battery charger. Supplied with dynamic microphone with remote start-stop switch, mic carrying case, carrying strap, and earphone\$54.95

4200 Cassette Recorder
Battery-operated, solid-state, 1 7/8 ips mono record/playback design. Cassette is reel-



to-reel type; response 80-10,000 Hz ±3 dB; wow & flutter 0.3%; S/N ratio 45 dB; output 400 mW continuous sine wave; playing time 90 min. Features vu meter; dynamic mic with remote start/stop sw. Supplied with mic, cassette & carrying case. 4 1/2" w. x 7 7/8" x 2 1/4" d.\$74.95

Model 4800 Cassette Recorder
Records & plays both stereo & mono cassettes; 1 7/8 ips; interlock start, stop, play &



record controls; separate record level meters for each channel; digital counter; detachable compression-loaded speakers; jam-proof cassette ejector. Frequency response 70-10,000 Hz ±3 dB; wow & flutter less than 0.3% at 1 7/8 ips; S/N 45 dB. Power output 8 W/ch music power (EIA); 5 W/ch at output jack continuous. Outputs: 8-ohm speaker, preamp; inputs: mic & phono. 13 3/8" long x 9 3/8" w. x 4 3/8" high.Less than \$200.00

REGARDING PRICES:

As might be expected, prices vary across the country, and those quoted are usually those prevailing in the manufacturer's immediate vicinity. Obviously, because of sales policies, discounts, etc., prices will vary from place to place, and because of transportation costs, prices in areas remote from the point of manufacture will be higher. And, of course, manufacturers reserve the right to change prices without notice.

RAW TAPE

AMPEX

311 1.5-mil Acetate Base Tape	
3" reel, 150 feet	\$0.90
5" reel, 600 feet	\$2.25
7" reel, 1200 feet	\$3.50
321 1.0-mil Acetate Base Tape	
7" reel, 1800 feet	\$5.50
331 1.5-mil Polyester Base Tape	
5" reel, 600 feet	\$2.65
7" reel, 1200 feet	\$4.25
341 1.0-mil Polyester Base Tape	
3" reel, 275 feet	\$1.25
5" reel, 900 feet	\$3.60
7" reel, 1800 feet	\$6.20
351 0.5-mil Tensilized Polyester Tape	
3" reel, 300 feet	\$1.85
5" reel, 1200 feet	\$5.45
7" reel, 2400 feet	\$9.50
361-C60 Cassette Tape	
60 minutes, 300 feet	\$2.49
314 Low-noise 1.5-mil Acetate	
5" reel, 600 feet	\$2.80
7" reel, 1200 feet	\$4.40
344 Low-noise 1.0-mil Polyester Tape	
5" reel, 900 feet	\$4.25
7" reel, 1800 feet	\$7.35

AUDIOTAPE

AC-60 Cartridge



60-minute blank Audiotape cartridge tape for cassette machines\$3.20

Master 1.5-mil Mylar Tape

Made on 1.5 mil Mylar base; durable in wide temperature range.
Type 671M, 600 ft., 5" reel\$3.20
Type 1271M, 1200 ft., 7" reel\$5.10

Double Recording (.5-mil tempered Mylar)

Made on tempered Mylar; allows twice as much recording per reel; stronger than double length tape.
Type 331T, 300 ft., 3" reel\$1.60
Type 1231T, 1200 ft., 5" reel\$5.45
Type 2431T, 2400 ft., 7" reel\$9.50

Triple Recording (tempered Mylar)

Three times as much recording time per reel as standard plastic-base tape, plus same extra strength as other tempered Mylar tapes.
Type 633T, 600 ft., 3 1/4" reel\$2.95
Type 1833T, 1800 ft., 5" reel\$6.95
Type 3633T, 3600 ft., 7" reel\$11.95

Long Recording (1-mil plastic base)

Provides 50% more recording time per reel; 1-mil cellulose acetate base; maximum economy for applications where high strength is not required.
Type 941, 900 ft., 5" reel\$3.50
Type 1841, 1800 ft., 7" reel\$5.50

Longer Recording (1-mil Mylar)

Made on 1-mil Mylar polyester film; provides 50% more recording time per reel; exceptional strength and durability plus longer storage life.

Type 261, 225 ft., 3" mailer	\$1.00
Type 961, 900 ft., 5" reel	\$3.60
Type 1861, 1800 ft., 7" reel	\$6.20

Standard Recording (1.5-mil Mylar)

High-strength super-durable magnetic tape that meets the highest professional standards of performance; withstands extreme temperatures; virtually immune to humidity; gives maximum tape life under any conditions of use or storage.

Type 671, 600 ft., 5" reel	\$2.65
Type 1271, 1200 ft., 7" reel	\$4.25

Double Recording (.5-mil Mylar)

Made on .5-mil Mylar; twice as much recording time per reel as standard plastic-base tape; suitable for extended-play applications where tape tension is not excessive.

Type 1231, 1200 ft., 5" reel	\$3.50
Type 2431, 2400 ft., 7" reel	\$6.50

Standard Recording (plastic base)

Professional-quality recording tape; maximum fidelity, uniformity, frequency response and freedom from noise and distortion; 1.5 mil acetate.

Type 351, 300 ft., 4" reel	\$1.35
Type 651, 600 ft., 5" reel	\$2.25
Type 1251, 1200 ft., 7" reel	\$3.50

Low-Noise Tape

Provides high signal-to-noise ratio and reduced hiss level; on 1.5-mil plastic base.
Type 1257, 1200 ft., 7" reel\$4.30

BASF

LGS 52 Recording Tape

Polyvinyl chloride, "Luvitherm"® base; tensilized; 1.5-mil Standard Play.
600 ft., 5" reel\$2.48
1200 ft., 7" reel\$3.75
1200 ft., 7" reel, library box\$11.25

LGS 35 Recording Tape

Polyvinyl chloride, "Luvitherm"® base; tensilized 1-mil Long Play.
900 ft., 5" reel\$3.33
900 ft., 5" reel, library box\$9.99
1200 ft., 5 1/4" reel\$3.72
1800 ft., 7" reel\$5.42
1800 ft., 7" reel, library box\$16.26

LGS 26 Recording Tape

Polyvinyl chloride, "Luvitherm"® base; tensilized 3/4-mil Double Play.
300 ft., 3" reel\$1.47
450 ft., 3 1/2" reel\$2.44
900 ft., 4 1/4" reel\$3.98
1200 ft., 5" reel\$4.90
1200 ft., 5" reel, library box\$14.70
2400 ft., 7" reel\$7.80
2400 ft., 7" reel, library box\$23.40

PES 35 Recording Tape

Polyester base; tensilized 1-mil Long Play.
1800 ft., 7" reel\$6.62

PES 18 Recording Tape

Polyester base; tensilized, 1/2-mil Triple Play.
450 ft., 3" reel\$2.50
600 ft., 3 1/2" reel\$2.94
900 ft., 4" reel\$4.27
1200 ft., 4 1/4" reel\$6.13
1800 ft., 5" reel\$7.65
3600 ft., 7" reel\$11.76

*"Luvitherm"®, an unplasticized polyvinyl chloride film, is used as a backing material. During production it is pre-pressed, giving the tape excellent mechanical properties.

C-60 Cassette

PES-18 tensilized, low-noise tape in cassette cartridge; 300', 60 minutes\$3.08

C-90 Cassette

PES-12 polyester-base, tensilized, 1/4-mil in cassette cartridge, 450', 90 minutes\$5.08

C-120 Cassette

PES-9 polyester base, tensilized, low noise tape in cassette cartridge; 600', 120 minutes\$6.25

BURGESS

Series No. 111 1.5-mil Plastic

111-1.5 150', 3" reel.....	\$0.70
111-2.5 250', 3 1/4" reel.....	\$1.25
111-3 300', 4" reel.....	\$1.35
111-6 600', 5" reel.....	\$2.25
111-8.5 850', 5 1/4" reel.....	\$2.85
111-12 1200', 7" reel.....	\$3.50

Series No. 190 1.0-mil Extra-Play Plastic

190-2.25 225', 3" reel.....	\$0.90
190-9 900', 5" reel.....	\$3.50
190-12 1200', 5 1/4" reel.....	\$4.25
190-15 1500', 7" reel.....	\$4.50
190-18 1800', 7" reel.....	\$5.50

Series No. 102 1.5-mil Mylar

102-6 600', 5" reel.....	\$2.65
102-8.5 850', 5 1/4" reel.....	\$4.25
102-12 1200', 7" reel.....	\$4.25

Series No. 150 1.0-mil Extra-Play Mylar

150-2.25 225', 3" reel.....	\$1.00
150-3.75 375', 3 1/4" reel.....	\$1.75
150-9 900', 5" reel.....	\$3.60
150-12 1200', 5 1/4" reel.....	\$4.65
150-15 1500', 7" reel.....	\$5.15
150-18 1800', 7" reel.....	\$6.20

Series No. 200 .5-mil Double-Length Tensilized Mylar

200-3 300', 3" reel.....	\$1.60
200-6 600', 4" reel.....	\$3.05
200-12 1200', 5" reel.....	\$5.45
200-17 1700', 5 1/4" reel.....	\$7.05
200-24 2400', 7" reel.....	\$9.50

Series No. 290 .5-mil Triple-Length Tensilized Mylar

290-6 600', 3 1/4" reel.....	\$2.50
290-36 3600' 7" reel.....	\$11.95

Series No. 131 1.5-mil Plastic

131-12 1200', 7" reel.....	\$4.40
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Series No. 138 1.5-mil Mylar

138-12 1200', 7" reel	\$5.10
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Series No. 175 1.5-mil Mylar

175-6M 600', 5" reel.....	\$2.40
175-12M 1200', 7" reel.....	\$3.75

Series No. 141 1.5-mil Plastic

141-6 600', 5" reel.....	\$1.75
141-12 1200', 7" reel.....	\$2.95

Series No. 140 1.0-mil Extra-Play Plastic

140-9 900', 5" reel.....	\$2.50
140-18 1800' 7" reel.....	\$4.25

Series No. 142 1.0-mil Extra-Play Mylar

142-9 900', 5" reel.....	\$2.85
142-18 1800', 7" reel.....	\$4.95

Series No. 144 .5-mil Double-Length Mylar

144-12 1200', 5" reel.....	\$4.50
144-24 2400', 7" reel.....	\$7.95

IRISH

190 Series Recording Tape

Standard, 1½-mil, acetate base, ¼".			
195-111111	150'	3"	\$0.65
195-121111	300'	4"	\$1.55
195-131111	600'	5"	\$1.75
195-141211	850'	5¾"	\$2.50
195-151111	1200'	7"	\$2.95
Extra-length 1-mil, acetate base, ¼".			
196-111111	225'	3"	\$0.80
196-121111	450'	4"	\$2.10
196-131111	900'	5"	\$2.50
196-141211	1150'	5¾"	\$3.75
196-151111	1800'	7"	\$4.25
Extra-length, 1-mil, polyester base, ¼".			
197-111111	225'	3"	\$0.95
197-121111	450'	4"	\$2.25
197-131111	900'	5"	\$2.85
197-141211	1150'	5¾"	\$3.50
197-151111	1800'	7"	\$4.95
Double-length, ½-mil, polyester tensilized base, ¼".			
198-111111	300'	3"	\$1.40
198-121111	600'	4"	\$3.75
198-131111	1200'	5"	\$4.50
198-141211	1650'	5¾"	\$6.80
198-151111	2400'	7"	\$7.95

200 Series Professional Tape

Standard 1½-mil, acetate base, ¼".			
211-111111	150'	3"	\$0.70
211-131111	600'	5"	\$2.25
211-141211	850'	5¾"	\$2.80
211-151111	1200'	7"	\$3.50
Extra-length, 1-mil, acetate base, ¼".			
221-111111	225'	3"	\$0.90
221-131111	900'	5"	\$3.25
221-141211	1150'	5¾"	\$4.00
221-151111	1800'	7"	\$5.25
Extra-length, 1-mil, polyester base, ¼".			
241-111111	225'	3"	\$1.00
241-131111	900'	5"	\$3.40
241-141211	1150'	5¾"	\$4.50
241-151111	1800'	7"	\$5.80
Double-length, ½-mil, polyester tensilized base, ¼".			
251-111111	300'	3"	\$1.60
251-131111	1200'	5"	\$5.45
251-141211	1650'	5¾"	\$6.80
251-151111	2400'	7"	\$9.50
Standard, 1½-mil, polyester base, ¼".			
231-131111	600'	5"	\$2.65
231-151111	1200'	7"	\$4.25

261 Series Triple-Play

0.5-mil polyester base.			
261-131111	1800'	5"	\$6.95
261-151111	3600'	7"	\$11.95

270 Series Low-Print & Mastering Tape

Standard, 1½-mil, acetate base, ¼".			
271-151111	1200'	7"	\$4.40
Extra-length, 1-mil acetate base, ¼".			
272-151111	1800'	7"	\$7.25
Standard, 1½-mil, polyester base, ¼".			
273-151111	1200'	7"	\$5.50
Extra-length, 1-mil, polyester base, ¼".			
274-151111	1800'	7"	\$7.35
Double-length, ½-mil, polyester base, ¼".			
275-151111	2400'	7"	\$9.80

Cassette

261-C60 1 hour	\$3.20
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"Tape-A-Letter" Self-Mailer

4275 275' 1-mil acetate, 3"	\$1.25
4275M 275' 1-mil Mylar 3"	\$1.50

SCOTCH

Cassettes

Features "Dynarange" tapes designed specifically for low-speed, high-fidelity recording. Available in 1 hour, 1½ hours, and 2 hours recording time.

271-C-60 (mailer package)	\$3.20
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272-C-90 (mailer package)	\$4.76
273-C-120 (album package)	\$5.34

No. 102 "All-Purpose" Tape

For all general recording; suitable for long-term storage; on super-tough, weather-balanced 1½-mil polyester backing.

102-¼-600	600'	5"	\$2.65
102-¼-1200	1200'	7"	\$4.25

No. 111 "All-Purpose" Tape

For all general recording; 1½-mil plastic backing.

111-¼-150	150'	3"	\$0.70
111-¼-300	300'	4"	\$1.35
111-¼-600	600'	5"	\$2.25
111-¼-1200	1200'	7"	\$3.50

No. 120 "High-Output" Tape

Over 100% more output, greater dynamic range, and freedom from distortion on signal peaks. 1½-mil plastic backing.

120-¼-600	600'	5"	\$2.25
120-¼-1200	1200'	7"	\$3.50

No. 131 "Low-Print" Tape

Reduces print-through to a point below noise level of most professional machines; allows long-time storage. 1½-mil plastic backing.

131-¼-1200	1200'	7"	\$4.40
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No. 138 "Low-Print, Extra Strength" Tape

Same as No. 131 except on strong 1½-mil polyester backing.

138-¼-1200	1200'	7"	\$5.10
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No. 150 "Extra Length, Extra Strength" Tape

Designed to withstand temperature and humidity extremes; high potency oxide on 1-mil polyester backing.

150-¼-900	900'	5"	\$3.60
150-¼-1800	1800'	7"	\$6.20

No. 190 "Extra Length" Tape

Provides as much recording time as 1½ reels of standard tape; high potency oxide on 1-mil plastic backing.

190-¼-900	900'	5"	\$3.50
190-¼-1800	1800'	7"	\$5.50

No. 200 "Double Length, Double Strength" Tape

As much playing time as two reels of standard tape; for recording opera, concerts, or conferences; high potency oxide on tensilized polyester backing.

200-¼-1200	1200'	5"	\$5.45
200-¼-2400	2400'	7"	\$9.50

"Dynarange Tapes"

Although originally engineered for professional use, these tapes are now available for home recording. Provides high-fidelity recording even at 3¾ ips.

201 1½-mil plastic			
201-¼-600	600'	5"	\$2.80
201-¼-1200	1200'	7"	\$4.40
202 1½-mil polyester			
202-¼-600	600'	5"	\$2.85
202-¼-1200	1200'	7"	\$5.10
203 1-mil polyester			
203-¼-900	900'	5"	\$4.25
203-¼-1800	1800'	7"	\$7.35

No. 282 "Sandwich" Tape

Micro-thin protective plastic shield over oxide coating to eliminate oxide rub off and increase wear up to 30 times; weather-proof 1½-mil polyester backing.

282-¼-600	600'	5"	\$3.10
282-¼-1200	1200'	7"	\$4.95

No. 290 "Triple Length" Tape

½-mil tensilized polyester backing.

290-¼-1800	1800'	5"	\$6.95
290-¼-3600	3600'	7"	\$11.95

No. 8000 "Quick-Load" Cartridge

Completely self-contained; threads automatically; available with high potency No. 150 tape in transparent or opaque cases.

8000-¼-320C	320'	\$4.00
8000-¼-560O	560'	\$4.50
8000-¼-560C	560'	\$4.50

"Living Letters" Tape

111-¼-150-LL	150'	3"	\$0.90
200-¼-300-LL	300'	3"	\$1.85
290-¼-600-LL	600'	3"	\$2.95

SONY/SUPERSCOPE

Professional Recording Tape

Extra-heavy formula Oxi-coat homogenized oxide coating. Polyester back, "lubri-cushion" impregnated lubricant.

PR-200-24	2400'	7"	\$9.50
PR-150-18	1800'	7"	\$6.20
PR-200-12	1250'	5"	\$5.25
PR-150-9	900'	5"	\$3.60
PR-150-3	300'	3¾"	\$1.75
PR-300-6	600'	3¾"	\$1.95
PR-150-3M	300'	3"	\$1.60

Tape Cassettes

For use with Models 50, 100, 124, 124CS, 125 and 130.

C-60 60 minutes of recording	\$2.25
C-90 90 minutes of recording	\$2.95

SOUNDCRAFT

"Standard" Tape

1.5-mil acetate base; professional quality; economy priced

S-1 150 ft., 3"	\$0.70
S-6 600 ft., 5"	\$2.10
S-12 1200 ft., 7"	\$3.50

"Standard-50" Tape

Long-play version of "Standard" tape on 1-mil acetate base.

S5-9 900 ft. 5"	\$3.29
S5-18 1800 ft., 7"	\$5.17

"Lifetime" Tape

For use where utmost strength and quality are necessary; 1.5-mil Mylar base.

L-6 600 ft., 5"	\$2.65
L-12 1200 ft., 7"	\$4.25

"Plus-50" Tape

Made on 1-mil Mylar for 50% more playing time than standard 1.5-mil tapes; combines long play with great tape strength.

PL-2 225 ft., 3"	\$1.00
PL-9 900 ft., 5"	\$3.40
PL-18 1800 ft., 7"	\$5.80

"Triple-Play" Tape

.5-mil Mylar base	
TP-3 300 ft., 2¾"	\$1.45
TP-6 600 ft., 3¾"	\$2.29
TP-18 1800 ft., 5"	\$5.10
TP-36 3600 ft., 7"	\$10.00

"Triple-Play" Tensilized Tape

.5-mil tensilized Mylar base; extra long play; extra strength.

TP-6T 600 ft., 3¾"	\$2.72
TP-18T 1800 ft., 5"	\$6.80
TP-36T 3600 ft., 7"	\$11.75

"Golden Tone" Tape

High quality special tape; 25% more high-frequency output & 7 dB better signal-to-noise ratio; 7" reel.

GTA-12 1.5-mil acetate base, 1200'	\$4.70
GTM-18T 1-mil tensilized Mylar base, 1800'	\$7.50
GTM-24T .5-mil tensilized Mylar base, 2400'	\$11.40



Now for home recording—
the same kind of tape used by RCA to
capture the greatest sounds around.

RCA Red Seal tape—the tape of the professionals—comes from the same precise technology used to master record RCA albums and for pre-recorded tapes. RCA's exclusive formula gives you smooth tracking, a minimum of friction and wear and professional signal-to-noise response. Also available: Vibrant series sound tapes for flawless recording at an economical price. At RCA and independent dealers throughout the country. For all the details write RCA Magnetic Products Division, Dept. A, 15 East 26th Street, New York, New York 10010.

TAPE ACCESSORIES

AUDIOTAPE

Audio Head Alignment Tape

Prerecorded at 2 kHz, 10 kHz, 15 kHz, recorded at 15" per second; intervals between tones are 5 seconds duration; 300 ft. on 4" reel\$10.00

Audio Head Demagnetizer

Demagnetizes tape recorder heads; requires only plug-in to conventional a.c.



outlet\$10.00

AUDIOTEX

Tape Accessories

Language Lab service kit contains tape splicer; tape threading leader, hi-fi service tool kit; tape strobe; head cleaner & lubricant; cloth tape cleaner; head demagnetizer; splicing tape; tape and record labels. 30-099\$54.95

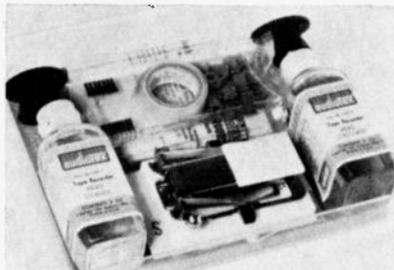
Deluxe tape splicer handles all sizes of splicing tape; tape dispenser simplifies operation; cuts & trims splicing tape with incanted cut. 30-106\$8.95

Standard tape splicer has curved cutting blades which give splice two rounded indentations; for use on all 1/4" tapes. 30-103\$5.00

Tape splicer for editing or repairing broken tape; all-aluminum construction; cutting blade included. 30-100\$2.75

Professional taperase will demagnetize tape reels of any size up to 10" diameter; erasing leaves no low-frequency spikes or thump. With 6' cord and momentary "on-off" sw. 30-114\$33.00

Tape recorder care kit includes tape splicer, splicing tape, tape head cleaner & lubricant,



tape reel holder, tape end clips, cleaning brush, cotton swabs, cleaning cloth, tape cueing & indexing labels. 30-125\$14.95

Cartridge head cleaner can be used for both home & auto tape players. Cartridge is in-



serted in unit and cleaned in 30 seconds. Kit includes cleaner cartridge, cleaning fluid, and replacement belts. 30-620 \$5.95

Tape recorder accessory kit includes tape splicer, splicing tape, tape threading leader, tape and cleaning solvent, tape end clips, phono & recorder oil; tape cueing labels, tape & record labels. 30-148\$9.95

Tape recorder strobe; designed to check speed of 7 1/2 & 3 3/4 ips tape recorders. 30-234\$5.95

Head demagnetizer designed to be used without removing head cover; complete with momentary push-button switch & 6' cord. 30-112\$12.10

Cassette "Musi-Kleen" cassette tape head cleaner. Is impregnated with exclusive non-abrasive Kleen tape fluid. Kit contains cleaner, bottle of fluid, and eye dropper. 30-618\$4.95

Auto tape player kit for 4- & 8-track players. Kit contains tape head lubricant, tape head cleaner, two 6" cleaning brushes, and 10 plastic pouches for storing tape cartridges. 30-636\$3.49

All prices are "list".

EDITALL

KP-2 Editing Kit

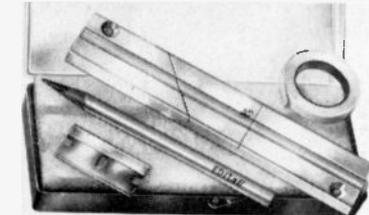
Complete kit includes splicing block, 30 splicing tapes, demagnetized razor blade,



grease pencil\$3.50

KS-2 Editing Kit

For 1/4" tape. Includes 4" x 3/4" x 1 1/4" block, marking pencil, roll of splicing tape



& cutting blade\$7.50

KS-3 Same except larger block (5 3/4" x 1" x 3/8")\$9.00

NORTRONICS

Nortronics has replacements for over 1800 domestic and foreign recorders including all of the following: Airline, Aivva, Bell & Howell, Bell Sound, Columbia, Concertone, Concord, Dukane, Ekotape, Emerson, Grundig, Heath, Knight, Luxor, Panasonic, Pentron, RCA, Recordio, Revere, Rheem-Califone, Roberts, Silvertone, Sony, Symphonic, Tandberg, Telectro, Viking, VM, Webcor, Webster Electric, Westinghouse, Wollensak, and most 8-track automobile tape players. Dealers have replacements and conversions listed by recorder model number and head number. All replacement heads and "Quik-Kits" (mounting hardware) come with complete instructions for easy installation.

Model T60E Oscillator Transformer

65-kHz bias for recording and erase current for either high or low impedance heads; one-tube oscillator circuit diagram included\$4.50

Model T60-T2 Oscillator Transformer

Similar to Model T60E but designed for transistor circuitry; 40-100 kHz; will deliver 25 to 150 volts to erase and record

heads\$4.50

Model T70-T2 Oscillator Transformer

For printed-circuit board; has plug-in, dip-solder terminals with nylon case; efficient



ferrite E-core construction; operating frequency 60-110 kHz; secondary voltage 40-120 V\$4.50
T70-T6 Osc. transformer for printed-circuit board. Same as T70-T2 except operating frequency 250-500 kHz for duplicators & secondary voltage 70 V\$9.00

Model AT-100 Alignment Tape

7 1/2 ips full-track for checking record/play heads of all types; 40-10,000 Hz; recorded for checking azimuth, equalization, and head wear\$4.95

1000 Series Record/Play Heads

Four-track stereo, laminated core, high-quality heads with all-metal hyperbolic face construction; replaces older CSQ, TLB & TLD-1 designs.

#1000—High impedance; 800 mH inductance; 100 μin. gap; for use with vacuum-tube circuits; no-mount type\$21.00

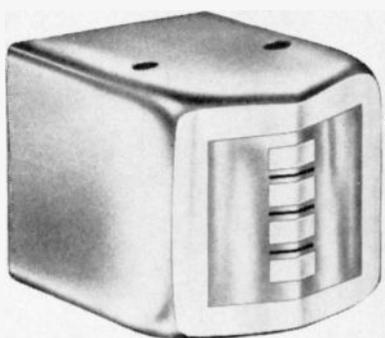
#1001—Medium impedance; 400 mH, inductance; 100 μin. gap; for use with vacuum-tube or transistor circuits; no-mount type\$21.00

#1002—Low impedance; 100 mH inductance; 100 μin. gap; for use with transistor circuits; no-mount type\$21.00

#1009 Medium impedance; 500 mH; 200 μin. gap; for vacuum-tube or transistor circuits; no-mount type only\$21.00

5600 Series Record/Play Heads

Four-channel; laminated core heads with all-metal hyperbolic face construction.



#5601 Special record-only head; low impedance 50 mH; 500 μin. gap spacer; for use with vacuum-tube or transistor circuits; no-mount type\$99.00

#5602 Low imp.; 90 mH; 100 μin. gap spacer; for use with vacuum-tube or transistor circuits; no-mount type\$99.00

#5603 Med. imp.; 370 mH; 100 μin. gap spacer; for use with vacuum-tube or transistor circuits; no-mount type\$ 99.00

1200 Series Premium Record, Record/Play Heads

Four-track stereo, laminated-core heads with all-metal, hyperbolic face construction; replaces older TLB, CSQ, and 1100 styles.

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of
sound
advice
—for the
price of 6!**



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- #1200 High impedance; 800 mH inductance; 100 μ in gap; for use with vacuum-tube circuits. No-mount type\$28.20
- #1201 Medium impedance; 400 mH inductance; 100 μ in. gap; for use with vacuum-tube or transistor circuits. No-mount type\$28.20
- #1202 Low impedance, 100 mH inductance; 100 μ in. gap; for use with transistor circuits. No-mount type\$28.20
- #1203 Low impedance record only; 50 mH inductance; 500 μ in. gap; for use with vacuum-tube or transistor circuits. No-mount type\$28.20
- #1205 Medium impedance; 200 mH inductance; 500 μ in. gap; for use with vacuum-tube circuits. No-mount type \$28.20
- #1207 Medium-low impedance; 200 mH inductance; 100 μ in. gap; for use with transistor circuits. No-mount type\$28.20

5800 Series Record/Play Heads

8 tracks on 1/4" tape; 2-channel hyperbolic metal face heads; use in automotive & background music players.

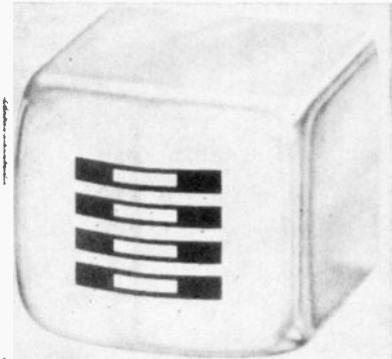
- #5800 Medium imp. record/play; 400 mH; 100 μ in gap; no-mount type\$15.00

- #5810 Low imp. record-only; 10 mH; 500 μ in gap; no-mount type\$21.00
- #5813 Low imp. record-only; 50 mH; 500 μ in gap; no-mount type\$21.00

5830 Series Record/Play Heads

Four-channel, 8-track hyperbolic metal faced heads.

- #5832 Medium low impedance record/play; 200 mH; 100 μ in gap; no-mount



- type\$81.00
- #5834 Low impedance, record only; 50 mH; 500 μ in gap; no-mount type\$81.00
- #5836 Special low impedance record only for duplicating; 2.5 mH; 500 μ in gap; no-mount type\$81.00

1400 Series Erase Heads

Four-track stereo; laminated core; double gap; premium quality with full metal face construction; replaces older SEQ and SE-50 styles.

- #1400—High impedance; 80 mH inductance 30,000 ohms impedance at 60 kHz; for use with vacuum-tube circuits; 60 kHz operating voltage: 90-150 volts; no-mount type \$12.00
- #1401—Medium impedance; 10 mH inductance; 2800 ohms impedance at 60 kHz; for use with vacuum-

- tube or transistor circuits; 60 kHz operating voltage: 28-42 volts; no-mount type ..\$12.00
- #1402—Low impedance, 0.13 mH, 40 ohms imp. at 60 kHz; for use with transistor

- circuits; 60 kHz operating voltage 3-6; no-mount type\$12.00
- #1408—Low impedance, 2.0 mH, 500 ohms at 60 kHz; for use with transistor circuits; 60 kHz operating voltage 15-25; 100 kHz operating voltage 20-30; no-mount type\$12.00

4100 Series Record/Play Heads

Full-track mono; laminated core heads with plastic, hyperbolic face construction; replaces older SF style.

- #4100—Medium impedance; 250 mH inductance; 160 μ in. gap; for use with vacuum-tube or transistor circuits; no-mount type\$34.70
- #4101—Special record only head; 55 mH inductance; 500 μ in. gap; for use with vacuum-tube or transistor circuits; no-mount type\$34.70

4400 Series Erase Heads

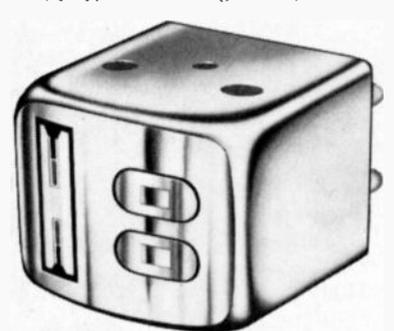
Full-track mono; laminated core; double gap; premium quality with full metal face construction; replaces older MEF and ME-250 styles.

- #4400—High impedance; 40 mH inductance; 12,000 ohms impedance at 60 kHz; for use with vacuum-tube circuits; 60 kHz operating voltage: 100-150 volts; no mount type\$14.00

- #4401—Medium impedance; 3.6 mH inductance; 1000 ohms impedance at 60 kHz; for use with vacuum-tube or transistor circuits; 60 kHz operating voltage: 32-48 volts; no-mount type\$14.00
- Same as #4000 and #4001 except rear mount\$15.50

6000 Series "Combo"

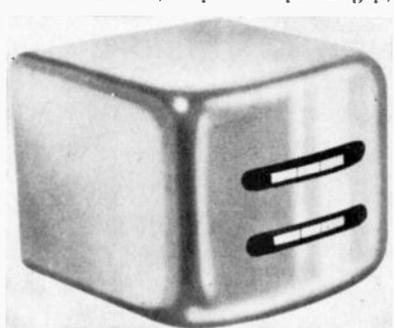
Four-track stereo/mono combination record/play/erase in a single head; laminated



- core; full metal face; deposited quartz gap; double-erase.
- #6002—4-track stereo; equiv. record/play specifications #1201; no equiv. erase specifications #1401; no-mount type\$33.00
- #6003—4-track stereo; equiv. record/play specifications #1000; equiv. erase specifications #1402; no-mount type\$33.00

6800 Series "Z-Combo"

Eight-track stereo; combination record/play/erase in a single head; polished hyperbolic head face; deposited quartz gap;

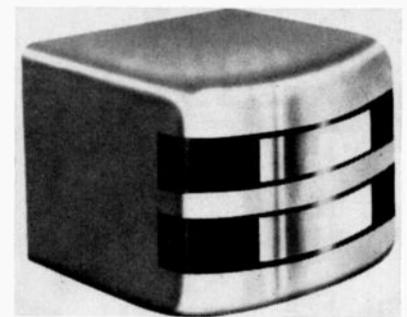


- erase gap and R/P gap 0.030" apart in same pole structure for accurate alignment and tracking. Erase bias is internally coupled to R/P section for record bias.
- #6800—8-track stereo, R/P medium imp.; R/P inductance 400 mH; R/P gap 100 μ in; playback response to 12 kHz at 3 3/4 ips; erase low imp.; erase ind. 12 mH; 60 kHz operating voltage 40; no-mount type\$23.70
- Rear mount for above (order #6850)\$28.70

8200 Series "Professional"

Two-track stereo, laminated core; hyperbolic face construction; finer laminations for increased frequency response; great depth-of-metal for longer head life.

- #8200—Play only; high imp.; 800 mH;



- 160 μ in gap; no-mount type\$32.00
- #8201—Record only; low imp.; 10 mH; 500 μ in gap; no-mount type\$32.00
- #8209—Record/Play; medium imp.; 400 mH; 100 μ in gap; no-mount type\$32.00

8600 Series "Professional"

Four-track stereo; laminated core; hyperbolic face construction; finer laminations for increased frequency response; greater depth-of-metal for longer head life.

- #8600—Play only; high imp.; 800 mH inductance; 100 μ in gap; no-mount type\$30.00
- #8604—Record only; low imp; 10 mH inductance, 500 μ in gap; no-mount type\$30.00
- #8608—Record/Play; med. imp; 400 mH inductance; 100 μ in gap; no-mount type\$30.00

8300 Series Erase Heads

Two-track stereo; laminated core; double gap; increased depth-of-metal for longer head life; hyperbolic face construction; full metal face; 56 dB erasure of saturated tape.

- #8301 High imp; 50 mH inductance; 20,000 ohms imp. at 60 kHz; 60 kHz operating voltage 100-150; 100 kHz operating voltage 160-200; no-mount type\$26.00
- #8302—Low imp; 0.2 mH inductance; 50 ohm imp. at 60 kHz; 60 kHz operating voltage 5-8; 100 kHz operating voltage 8-15; no-mount type\$26.00
- #8304—Med. imp.; 8 mH inductance; 2000 ohms imp. at 60 kHz; 60 kHz operating voltage 32-48; 100 kHz operating voltage 50-70; no-mount type\$26.00

8700 Series Erase Heads

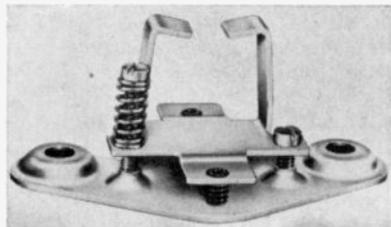
Four-track stereo; laminated core; double gap; increased depth-of-metal for longer head life; hyperbolic face construction; full metal face; 56 dB erasure of saturated tape.

- #8701—Med. imp; 10 mH inductance; 2800 ohms imp at 60 kHz; 60 kHz operating voltage 28-42; 100 kHz operating voltage 45-60; no-mount type\$26.00
- #8702—Low imp.; 0.13 mH inductance; 40 ohms imp. at 60 kHz; 60 kHz operating voltage 3-6; 100 kHz operating voltage; 5-12; no-mount type\$26.00
- #8704—High imp; 80 mH inductance; 30,000 ohms imp at 60 kHz; 60 kHz operating voltage 90-150; 100 kHz oper-

ating voltage 150-200; no-mount type\$26.00

"Quik-Kit" 74 Adjustable Head Mounting Assembly

For updating tape decks to use Nortronics no-mount heads. Includes provision for ad-



justment of tape head for wrap, height, tilt, and azimuth\$2.25

"Quik-Kit" Mounting Brackets

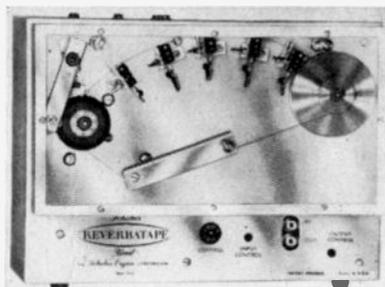
For base or side-mounting of no-mount heads. Nortronics heads are supplied in two basic mounting styles: no-mount and rear-mount. Six basic kits are available to adapt the basic no-mount style to base-mount or side-mount. Complete detailed instructions are included with each kit. "Quik-Kits" are available from your Nortronics supplier at \$1.00 each.

To order rear-mount type for Models 1000, 1200, 5600, 5700, 1400, 4400, add "50" to model number (i. e., 1000 rear mount is 1050, etc.). Add \$6.00 to cost for Models 5600 & 5700, all others add \$1.50.

SCHOBER

RV-3A "Reverbatape" Unit

Electronic reverberation system using a multi-head tape recorder; reverberation time adjustable from 0 to 6 seconds; sensitivity .3 to 3 volts r.m.s. adjustable; 500,000 ohm input impedance; emitter-follower output; gain 1; has 1 record, 3 playback, 1



erase head, and 13 transistors, with walnut case. Available in kit form from manufacturer.\$140.00

SONY/SUPERSCOPE

HE-2 Head Demagnetizer

Designed with a high flux density to provide max. reduction of residual magnetism\$12.95

FS-5 Foot Switch

Adapts Models 910, 800, 860, 100, 222A, 50 for use in transcribing dictation. Remote, foot-operated stop/start control leaves hands freeLess than \$7.95

MX-6S Stereo/Mono Mixer

Connects to all Sony solid-state recorders. Provides mixing facilities for up to three microphones and three high-level sources. Used for both stereo & mono. Required for sound-on-sound recording with Models 530, 560D, 255Less than \$29.95

SOUNDCRAFT

"Magna-See"

A non-toxic, non-inflammable chemical solution that lets you see the magnetic track recorded on tapes.

Complete kit.....\$12.00
Can of solution (1/2 pint).....\$ 4.25

Nortronics recommends that every tape recorder owner **HAVE HIS HEAD EXAMINED!**



As the world's leader in designing and producing tape heads for major recorder manufacturers, we think it's ridiculous to invest in a high quality tape recorder, spend a lot more on valuable tapes, and end up with inferior performance.

But inferior performance is what you'll get when your tape head wears out—as it will. The simple Look-Touch-Listen test tells you if it's time to replace your tape head—and restore the crisp, vivid realistic sound you're entitled to. Details in our Bulletin 7260—ask your dealer or write to us for a free copy.



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Circle No. 25 on Reader Service Card.

MICROPHONE DIRECTORY

AKG

D-707E Cardioid Microphone

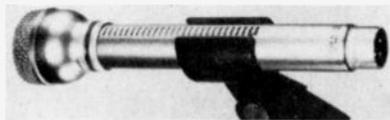
Directional, cardioid pattern dynamic; response 50-15,000 Hz ±3.5 dB; sensitivity



—52 dB; impedance 200 ohms. Includes stand adapter, case, and standard 3-pin Cannon connector with 15' cable. 1 1/16" dia. x 6"\$39.50

D-19E/200 Cardioid Microphone

Directional, cardioid pattern dynamic; continuously variable 0 to —10 dB bass roll-off



control compensates for speech or room acoustics; response 40-16,000 Hz ±3 dB; sensitivity —53 dB; impedance 200 ohms; includes stand adapter, case, and standard 3-pin Cannon connector with 15' cable. 1 1/16" dia. x 6"\$58.00

D-707TS Cardioid Microphone

Same as D-19E/200 except with "on-off"

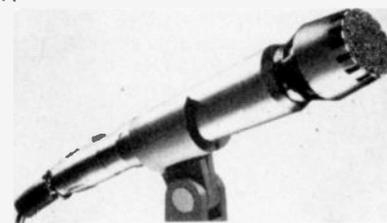
switch, transformer, and cable with phone plug for high impedance\$49.50

D-119ES Cardioid Microphone

Same as D-19E/200 except with "on-off" switch, 5-pin Cannon connector for selection of 50 ohms, 200 ohms, and high impedance; with phone plug for high impedance\$69.00

D-1000E Cardioid Microphone

Directional cardioid pattern dynamic with 3-position bass roll-off sw.; response 40-



16,000 Hz ±3.5 dB; sensitivity —52 dB; impedance 200 ohms. Includes stand adapter, case, and standard 3-pin Cannon connector with 15' cable. 1 1/16" dia. x 6"\$60.00

D-1000TS Cardioid Microphone

Same as D-1000E except with "on-off" switch, transformer, and cable with phone plug for high impedance\$75.00

D-200E Two-Way Microphone

Directional, cardioid pattern dynamic sys-



tem; uses two coaxially mounted elements with 500-Hz crossover network; system is isolated against handling and stand shock by internal, flexible suspension; response 30-15,000 Hz ±3 dB; sensitivity —55 dB; impedance 200 ohms. Includes stand adapter, case, and standard 3-pin Cannon connector with 15' cable. 1 1/16" dia. x 6"\$60.00

D-200TS Two-Way Microphone

Same as D-200E except with "on-off" switch, transformer, and cable with phone plug for high impedance\$84.00

ALTEC LANSING

650A Microphone

Cardioid dynamic moving-coil design; response 50-15,000 Hz; bass roll-off switch



rolls off response from 400 Hz down; output impedance 150/250 ohms or 20,000

ohms; output level —56 dBm/10 dynes/cm²; discrimination 20 dB average front-to-back; wind/pop filter; locking "on-off" switch; snap-off/on stand adapter; carrying case; 15' two-conductor shielded cable \$75.00
 22C Floor stand\$21.80
 26A Desk stand\$16.50

651A Microphone

Similar in design and style to Model 650A; response 60-15,000 Hz; no bass roll-off sw.; output impedance 20,000 ohms; output impedance 20,000 ohms; output level —57 dBm/10 dynes/cm²; discrimination 15 dB average front-to-back; 15' single-conductor shielded cable\$62.50

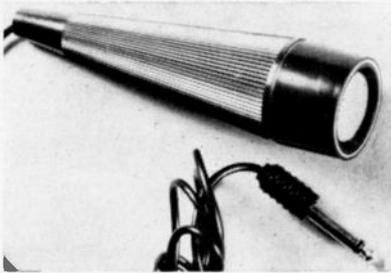
AUDIOTEX

Studio Microphone

Dynamic type; output level —62 dB with flat frequency response 50-12,000 Hz; 50,000 ohms impedance; 6' shielded cable; molded phone plug attachment. 4 3/8" long x 1 1/8" dia. Satin chrome finish.
 30-904\$17.50

Studio-Recorder Microphone

Ceramic type for general use; output level —50 dB with flat frequency response 50-10,000 Hz; 6' shielded cable; molded phone



plug; 5 1/2" long x 1 1/2" dia. 30-906. \$12.25

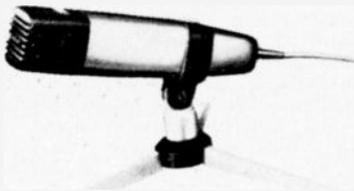
BEYER

M-55A Dynamic Mic

Omnidirectional, moving coil design with built-in transformer. Response 70-16,000 Hz; output: low imp. —56 dBm, high imp. —54 dB. Output impedance 200 and 80 kohms. Supplied with 10' cable & desk stand. 1.2" x 1.2" x 4.5"\$25.00

M-80A Dynamic Mic

Unidirectional, moving coil design with built-in transformer. Response 50—16,000



Hz; output: low imp. —53 dBm, high imp. —50 dB. Output impedance 200 & 80 kohms; cardioid polar pattern. Supplied with 10' cable & desk stand. 1.2" x 1.2" x 5.2"\$40.00
 M-808A Matched pair\$75.00

M-64 Dynamic Mic

Unidirectional, moving coil design. Response 100-10,000 Hz; output —52 dBm. Output impedance 200 ohms; cardioid polar pattern. Designed for use with SH126 gooseneck mounting. 1" x 3.1"\$50.00
 SH126 Gooseneck & 15' cable and connectors\$12.00

M-69 Dynamic Studio Mic

Moving coil, unidirectional design. Response 50—16,000 Hz. Output —50 dBm;



cardioid polar pattern; output imp. 200 ohms. Supplied with mic cable connector but without cable. 6.7" x 0.9" (head 1.7")\$80.00

For outdoor operation use windshield WS84\$22.00

M-260 Dynamic Studio Mic

Ribbon design with voice/music switch. Response 50—18,000 Hz. Output —58 dBm; hypercardioid polar pattern; output imp. 200 ohms; supplied without cable but with connector socket. 6.5" x 0.9" (head 1.7")\$75.00

M-610 Dynamic Mic

Moving coil design. Response 50—15,000 Hz. Output —52 dBm; cardioid polar pat-



tern; output imp. 200 ohms. Supplied without cable but with connector socket. 6.5" x 0.9" (head 1.7")\$60.00
 WS84 Windshield\$22.00

All Beyer microphone output levels are at 1 mW and for low imp. 0 dBm = 1 mW/10 μbar and for high imp 0 dB = 1 V/μbar.

DYNACO

Model 200 Stereo Microphone

Ribbon velocity microphone utilizing two separate housings which can be rotated up



to 90° apart for adjustable separation. Top element unplugs to provide mono mic (Model 100). Figure-8 pattern; response ±2 dB from 30 to 13,000 Hz, ± dB from 20 to 15,000 Hz. 200-ohm output. Switch provides normal music, close talk with attenuated low end, or muted positions. Sensitivity Gm = —156 dB.

Model 200\$149.95
 Model 100 Mono microphone\$ 89.95
 Model 150 Conversion element for 100 to 200\$ 69.95
 MT-2 Matching transformer (2 x 200 ohms to hi-Z)\$ 24.95

ELECTRO-VOICE

635A Omnidirectional Microphone

Has 4-stage pop & dust filter; for hand or stand. Response 80-13,000 Hz (rising); out-



put —55 dB; low-impedance. Supplied with Model 310 clamp & 18' two-conductor cable. 6" l. x 1 3/8" dia., 6 oz.List \$82.00

Model 664 Cardioid Microphone

Dynamic; unidirectional; frequency response 60 to 15,000 Hz; output —58 dB;

150 ohm and high impedance; diaphragm shielded from dust; filter to minimize wind blast; on-off switch; pressure cast case; assembly includes hinge; 15 foot cable; size 7 1/4" x 1 1/8".

Chrome finish\$89.00
 Model 664G Gold finish\$94.50

Model 636 "Slimair" Dynamic

For p.a., recording, and general use; response 60-13,000 Hz; output —58 dB;



pop-proof head; wide pickup range; on-off switch; satin chrome finish; tiltable head; Hi-Z or Lo-Z by changing one wire in connector; 15-foot cable; 10 1/4" long including stud; 1 1/8" max. dia.\$76.00
 Model 636G Gold finish\$81.50

Model 630 Dynamic Mike

Response 60-11,000 Hz; output —55 dB; has "off-on" switch; available in high-imp-



pedance or 150 ohms (matches 50-250 ohms); low impedance balanced to ground; 2" x 6 1/2"\$55.00

Model 623 Slim Microphone

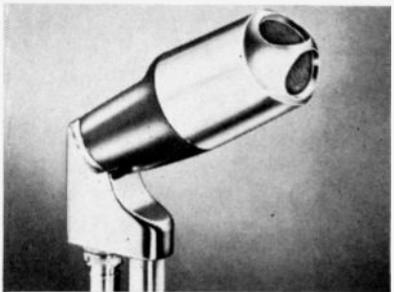
Dynamic; omnidirectional; frequency response 60 to 12,000 Hz; output —56 dB;



high and low impedance; cast case; hinge head; on-off switch; built-in MC-4 connector 3/8"-27 thread; satin chrome; 15 foot cable; size 7 1/2" x 1 1/4"; weight 15 oz.\$60.00

Model 641 Dynamic Mike

Dynamic type; high output level; wide range response; for p.a., home recording,

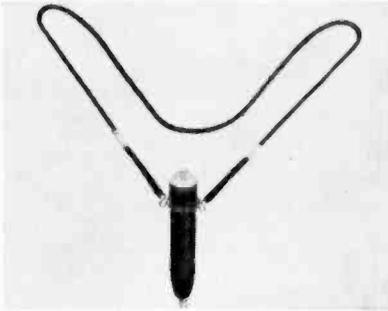


communications; integral on-off switch; response 70-10,000 Hz; output level —57 dB; omnidirectional; 15-foot cable; Hi-Z or balanced 150 ohms (matches standard low impedances)\$41.50

Model 727 Slim Ceramic

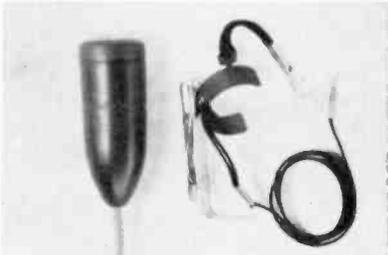
Similar in appearance to Model 729; withstands extremes of temperature and humidity; response 60-8000 Hz; output —55 dB; high-impedance only; 8 1/2-foot cable; available with or without on-off switch; 7 3/4" x 1 3/8" x 1 1/2"; supplied with desk stand and floor stand coupler\$21.00
 Model 727SR With relay control switch\$24.50

Model 647A Microphone
Omnidirectional, dynamic lavalier design. Response 70-9000 Hz; Hi & Lo imped-



ance selected at cable. Sensitivity —155 dB; output (Lo. imp.) —61 dB (0 dB = 1 mW/10 dynes/cm.²). Supplied with 18 ft., 3-conductor shielded cable, neck cord & belt clip; 3 3/4" long x 3/4" dia.\$86.50

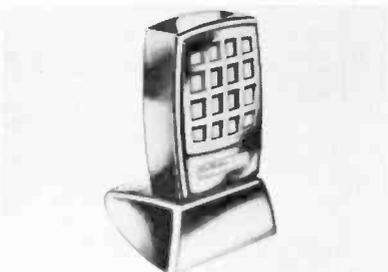
Model 624 Dynamic Lavalier
Response 100-7000 Hz; output —56 dB; features wire mesh head acoustically treated



for wind & moisture protection; available in high impedance or 150 ohms; not balanced to ground; 3 3/2" x 1 1/2"\$47.00

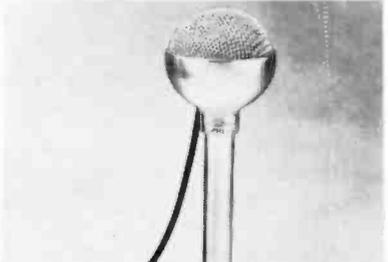
Model 729 Ceramic Microphone
Cardioid design; wide-angle front pick-up; response 60-8000 Hz; high-impedance; on-off switch; output —60 dB; 7 3/4" l. x 1 1/2" w. x 1 1/4" d.; single-conductor shielded 8 1/2 ft. cable\$25.50
Model 729SR Has relay operating switch and three-conductor (one shielded) cable\$28.00

Model 715 "Century" Ceramic
Use in any position (in hand, on table, on stand, or overhead); ceramic element;



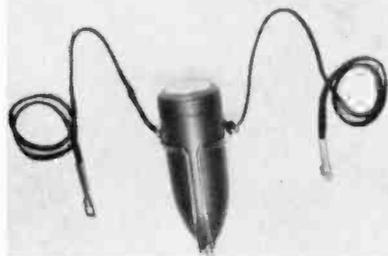
60-7000 Hz; output —55 dB; Hi-Z; 5-foot cable; nondirectional; rugged and lightweight; 3" x 2 3/16" x 1"\$15.50

920 "Spherex" Crystal Microphone
Omnidirectional pickup. Response 60-10,000 Hz; output —50 dB; wire mesh head



treated for wind & moisture protection. Has high capacity & high impedance; 2 1/4" dia., 15' cable; 8 oz.List \$29.00

924 Lavalier Crystal Microphone
Supplied with neck cord, support clip & 18' cable. Has wire mesh head for wind &



moisture protection. Response 60-8000 Hz; output —60 dB; high imp.; 1 1/2" dia. x 3 3/2". 8 oz.List \$24.50

Model 805 Contact Microphone
For guitar, banjo, other stringed instruments; Hi-Z; sealed crystal; chrome finish;



15-foot cable\$21.00

Model 335A Blast Filter
Designed for use with Models 630, 641, 638 & 634 microphones. Will not affect freq. response\$13.00

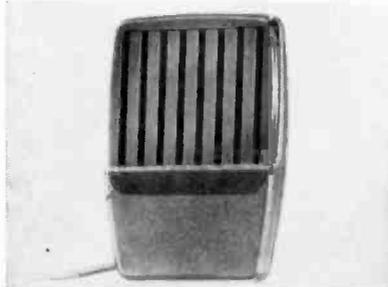
Model 355 Windscreen
Designed for use with Models 655C, 654A, 636, 623 & 926. Reduces wind blast with-



out altering freq. response. Acts also as a protective device\$11.50

Model 524A Windscreen
Designed to fit Electro-Voice Model 664 cardioid microphone. Also protects against dust, magnetic particles & mechanical shock.\$12.50

Model 721 Ceramic Mic
Inexpensive design. Response 100-5000 Hz; output —52 dB; high impedance; can be



hand held or with integral fold-out stand. 2 1/4" w. x 3 3/8" h. x 1"\$6.80

502B Matching Transformer
Designed for use in series with microphone line. Transformer windings have low distributed capacity and excellent shielding



When you write for our condensed high fidelity SPEAKER, ELECTRONICS or MICROPHONE catalogs...



you really get a brief progress report on the state of the art in sound.

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against inductive hum. Low-impedance output matches 150-25,000 ohm inputs. High-impedance output is 40,000 ohms. Response 30-20,000 Hz. 3²/₂" x 1" dia.\$16.50

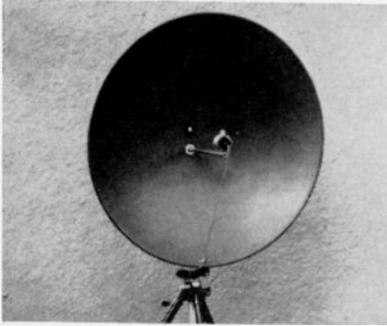
631 Omnidirectional Microphone

Design is similar in appearance to Model 635A: response 80-13,000 Hz; dynamic-type design with a sealed magnetic "on-off" switch inside case. Has removable magnetic actuator. Available in hi-Z (25,000 ohms) or low-Z (150 ohms). Has built-in 4" stage windscreen. EIA sensitivity -151 dB for hi-Z and -149 for low-Z\$63.00

FARGRAM

Parabolic Microphone

Reflector design for use with transistorized battery-operated tape recorders. Spun alumi-

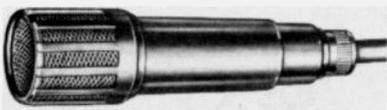


num 24" reflector with sighting gunsight on microphone. Impedance 200 ohms; reflector depth 5"; wt. 5 lbs; at 100 ft. from 500-5000 Hz sensitivity of mic. is increased 15 dB with reflector. To be used with any heavy-duty camera tripod with pan-tilt head. Supplied with mic., reflector & gunsight, microphone holder.....\$98.50

GELOSO

M11/171X Dynamic Microphone

Dual imp. (50-250/45,000 ohms) cardioid design. Has removable windscreen & 2-

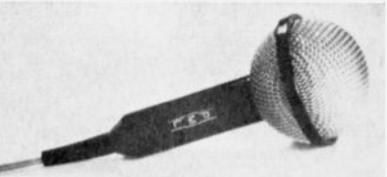


cond. shielded cable. Response 60-18,000 Hz. Sensitivity (EIA) 149 dB for 250 ohms, 151 dB for high-imp. 4¹/₂" long x 1¹/₂" dia.\$54.95

PML

D-44 Dynamic Microphone

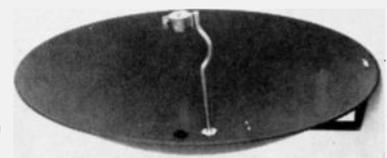
Cardioid design; 200 ohms unbalanced; response 60-16,000 Hz \pm 5 dB. EIA sensitivity



-71 dB; 5" long. Supplied with 12' cable\$34.95
D-44BS With "on/off" sw. & 30 ft cable; 200 ohms balanced & hi-Z\$39.95

Parabolic Reflector

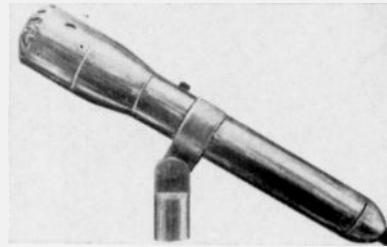
Frequencies over 10,000 Hz contained within 10° angle. Sensitivity increased 14 dB.



May be used with any mic 18 to 21 mm outside diameter\$54.50

F-67BS Dynamic Microphone

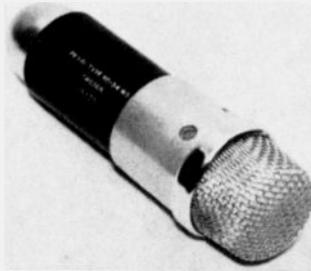
Cardioid pattern; response 40-16,000 Hz; imp. 200 ohms balanced & high imp. un-



balanced. Sensitivity -54 dB for 200 ohms at 10 dynes/cm². Supplied with 20' four-conductor shielded cable. 7³/₄" long x 1¹/₈" dia.\$59.50
Wind pop screen\$19.95

RD-34WS Dynamic Microphone

Cardioid design; 200 ohms balanced; response 30-20,000 Hz \pm 3 dB. EIA sensitivity

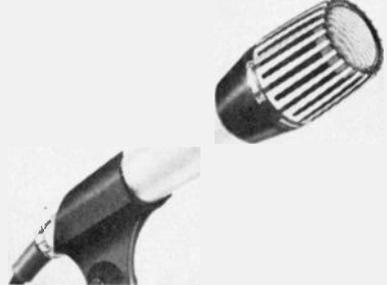


-74 dB. 4¹/₈" x 1¹/₄" dia. Supplied with 18' cable\$75.00

SHURE

Model 548 "Unidyne IV" Microphone

Rugged design with cardioid pickup pat-



tern. Has same feedback & boom suppression as "Unidyne III". Response 40-15,000 Hz. Dual-imp. output: low imp. -57 dB, high imp. -55 dB (0 dB = 1 V/ μ bar). For stand or hand use. 15 ft. cable ..\$99.95

Model 545 "Unidyne III" Microphone

Dynamic type; cardioid; frequency response 50-15,000 Hz; output -57 dB low



level. -58 dB high level; dual impedance; 15' three-conductor shielded cable; 5³/₄" x 1¹/₄"\$85.00
Model 545S "Unidyne III"; as shown above, but mounted on permanent swivel base with on/off switch.....\$89.95
Model 545L same as 545 except 150 ohms imp. & supplied with lavalier assembly &

belt clip. Has 20' 2-conductor shielded cable\$70.00

Model 55SW "Unidyne" Microphone

Dynamic type; unidirectional; frequency response 50 to 15,000 Hz; output: -55 dB at 35-50 ohms, -56.5 at 150-250 ohms; -57.5 at 35,000 ohms; 3-position impedance switch; Alnico V magnet; die-cast zinc case, satin chrome finish; Amphenol MC3M connector equivalent; self-adjust swivel; $\frac{1}{8}$ " -27 thread; on/off switch; 15 foot 2-conductor shielded cable; size 7⁷/₈" x 2¹/₄" x 3¹/₈"; wt. 1¹/₈ lbs., shpg. 3¹/₈ lbs.\$85.00
Model 55S without switch.....\$83.00

580S "Unidyne A" Dynamic Microphone

Unidirectional design; ideal for controlling feedback in p.a. & home recording applications. Has cardioid pickup pattern; shock-mounted element; "on-off" switch; response 50-12,000 Hz; output -58 dB; choice of hi- or low-impedance models; 6⁵/₈" x 1¹/₄" diameter; supplied with 15' cable with strain relief.

580SA High impedance.....\$59.00
580SB 150-250 ohms.....\$52.00
580SA-MP Matched pair for stereo recording; high-impedance; complete with plugs attached\$118.00

Model 565 Dynamic Cardioid Mic

Moving coil dual-impedance (150 & 40,000 ohms) design. Response 50-15,000



Hz; built-in wire mesh screen & internal filter protects against wind & "pop". Power level -57 dB (0 dB = 1 mV with 10 μ bars) EIA rating\$95.00
Model 566 with vibration-isolation shock mount\$140.00
Model 565S "on-off" switch on swivel connector assembly\$100.00

Model 585SA Dynamic Cardioid Mic

Similar to 565 except 150 to 250 ohms and 50-13,000 Hz. Supplied with "on-off" sw. & 15' 2-cond. shielded cable\$65.00
Model 585SB High impedance\$58.00
Model 585SAV with adjustable volume control\$72.50



585SBV with adj. volume control: low imp., -56.5 dB output\$72.50

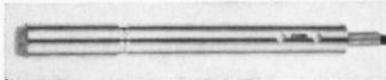
Model 515 "Unidyne B" Microphone

Low-cost version of other "Unidyne" models. Response 80-13,000 Hz. 15 ft cable with "on-off" sw.

515SA High imp (-58 dB output) \$40.00
 515SB Low imp (25-200 ohms, -59 dB)
\$35.00

578 Omnidyne Ultra-Slim Probe

Designed as a dynamic omnidirectional type p.a. microphone; response 50-15,000 Hz;



output; -59 dB high impedance, -60 dB low impedance; built-in wire mesh "pop" filter reduces breath noises; dual impedance (200 ohms & high); 3/8" dia., 7 1/16" overall length; complete with "on-off" switch and special slip-in swivel stand adapter; available in matched pairs for stereo recording (matching to ± 1 dB in level and within ± 1 1/2 dB in frequency response)\$82.50

578S Dynamic Microphone

Omnidirectional; fixed stand design with "on-off" sw. Response 50-15,000 Hz; 50-250 ohms imp.; open-circuit voltage .10 mV; EIA sensitivity -155 dB; supplied with 15' two-cond. cable; .78" diameter.\$90.00

Model 550S "Probe-Dyne" Microphone

Rugged, omnidirectional, dynamic design. Response 50-15,000 Hz; dual impedance, choice of 50-250 ohms & high; output 57.5 dB for low imp. & 58.5 dB for high imp.; complete with on/off sw., swivel & 15' cable.

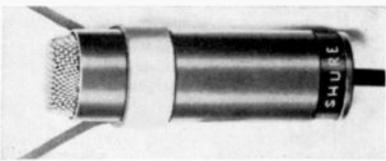
Chrome finish.....\$69.00
 Gold finish.....\$79.00

540S "Sonodyne II" Microphone

Dynamic type; unidirectional; response 50-13,000 Hz (provisions for altering response to increase voice intelligibility); output: -57 dB at 50-250 ohms, -54.5 dB at high impedance; adjusts for high or low impedance; modern die-cast zinc and Armo-Dur case; satin chrome and black finish; self-adjusting "lifetime" swivel; 15-foot, 2-conductor shielded cable; 6 3/32" x 1 21/32" x 2 1/16"\$49.95

Model 570 Lavalier Microphone

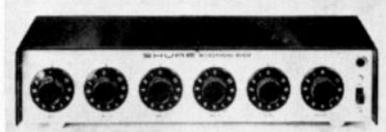
Miniature size professional-quality dynamic microphone designed for lavalier use; features special "shaped" response; output -59



dB; reduces pickup of clothing and cable noise; lightweight, flexible, 30' microphone cable attached; response 50-12,000 Hz with rising response to 6000 Hz; impedance 150 ohms to match low-impedance inputs; omnidirectional, 3/4" dia. x 2 3/8" over-all length; net weight 2 oz.....\$95.00

M68 Microphone Mixer

Solid-state design; will mix 4 mic channels plus aux. Has individual gain controls &



master. High & low imp. input selection. 2 1/2" x 11 1/16" x 5 1/16"\$125.00
 M68FC Same as M68 except input connectors are Cannon XLR-3-13 instead of XLR-3-14 type\$135.00

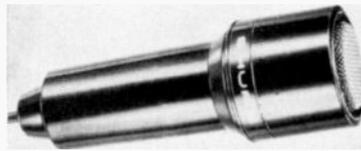
571 Dynamic Microphone

An adaptation of Model 570 for stand or

hand-held use. Can be used as lavalier type with accessory A57L assembly. Omnidirectional; response 50-10,000 Hz; 50 to 250 ohm impedance; open-circuit voltage .085 mV; EIA sensitivity -153 dB; supplied with 30' two-conductor cable; 2 5/16" dia.\$95.00

560 Dynamic Microphone

Lavalier, dual-impedance design; response 40-10,000 Hz with rising characteristic to



4500 Hz; high & low (150 to 250 ohms) impedance; open-circuit voltage level 1.48 mV (high imp.) & .149 mV (low imp.); with 18' two-conductor cable; 1.356" dia.\$42.50

Model 315 Gradient Microphone

Ribbon type; bi-directional; frequency response 50 to 12,000 Hz; output -63 dB at 30-50 ohms; -58 dB at 150-250 ohms. -62 dB at high impedance; 3-position impedance switch; Alnico V magnet; die-cast zinc case; satin chrome finish; self-adjust swivel; 3/8"-27 thread; Amphenol MC3M connector equivalent; 20 foot 2-conductor shielded cable; size 6" x 1 1/2" x 1 1/8"; wt. 1 lb., shpg., 3 1/4 lbs.\$89.50
 Model 315S with switch.....\$91.50

575S "Versadyne" Microphone

Dynamic type; omni-directional; response 40-15,000 Hz; output: high impedance



-56 dB, low impedance -57.5 dB; choice of high or low impedance versions; black Armo-Dur body with satin anodized cap and stainless steel grille; furnished with special stand adapter; on-off switch; attached 7-foot single-conductor shielded cable; 4 1/4" x 1 1/4".

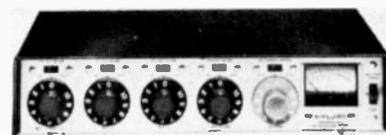
Model 575S (high impedance).....\$24.00
 Model 575SB (low impedance).....\$21.00
 Model 275S "Versaplex" (ceramic version)\$15.00

430 "Commando" Microphone

Controlled magnetic type; omni-directional; frequency response 60 to 10,000 Hz; output: Lo-Z and Hi-Z, -52 dB; changeable pin jacks give choice of 2 impedances; 150-250 ohms or high impedance; polystyrene and die-cast zinc case; satin-chrome and gray finish; A25 type swivel adapter; 3/8"-27 thread; Amphenol MC2M connector; 15 foot 2-conductor shielded cable; press-to-talk switch, locking plate furnished; size 6 3/4" long; top diameter 1 1/4"; handle 3/4"\$38.50

M67 Mic Mixer

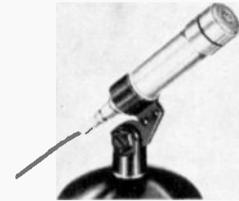
Has 4 low-imp. balanced mic inputs & one line input. Has built-in tone oscillator as a



calibration signal to balance signal levels. Response 20-20,000 Hz ± 2 dB. Automatic switchover to battery if a.c. fails. Gain 90 dB max. (150-ohm mic into 600-ohm line). 11 1/8" x 7 1/2" x 2 1/2"\$245.00
 Battery pack\$ 21.00

Model 245 "Uniplex" Microphone

Ceramic type; uni-directional; response 50-7000 Hz; output -59 dB; high imped-

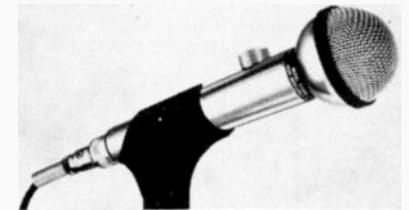


ance; die-cast zinc case; includes swivel adapter; 15-foot single-conductor shielded cable; 4 3/4" x 1 1/4"; wt. 3/4 lb.\$35.00
 Model 245S (with "on-off" switch).....\$37.00

533 "Spher-O-Dyne" Microphone

Omnidirectional design; has built-in wind, breath, and pop filters for close-talking applications. Response 40-11,000 Hz. Has "on-off" sw.

533SA High impedance, -55 dB output\$50.00
 533SB Low impedance, -55.5 dB output\$47.50



533SAV High impedance with adj. volume control\$57.50

M62 Audio Level Controller

Basically an automatic volume control; prevents "close-up" blasting. Output can be adjusted to predetermined level. Response



20-20,000 Hz ± 2 dB. Compression action 40 dB input change, 6 dB output change. For single mic. Has "on-off" sw. for bypass. Can be battery operated or from M68 mixers. 11 3/8" x 5 1/4" x 2 1/2"\$90.00

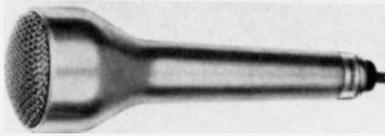
SONOTONE

CM Series Ceramic Mics

CM-10A High-Z; omnidirectional; response 30-12,000 Hz; sensitivity -56 dB; 7' shielded cable\$18.40
 CM-1050WR Low-Z; wide-range response; recommended imp. 250,000 ohms, usable at 33,000 ohms; response 30-10,000 Hz; sensitivity -58 dB\$19.45
 CM-1050SR Low-Z; speech-range response; ideal for all speech applications; recommended imp. 33,000 ohms; usable at 10,000 ohms; response 170-9500 Hz; sensitivity -62 dB\$19.45

DM10 Series Dynamic Mics

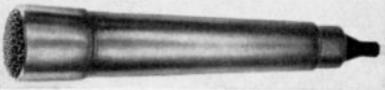
DM10-100 Impedance 50,000 ohms; response 8-16,000 Hz; sensitivity -57 dB\$24.50
 DM10-200 Impedance 10,000 ohms; response 8-16,000 Hz; sensitivity -63 dB\$24.50



DM10-500 Impedance 200 ohms; response 40-18,000 Hz; sensitivity -58 dB ..\$24.50
DM10-550 Impedance 200 ohms; response 40-18,000 Hz; sensitivity -58 dB, with sw.\$25.50

DM70 Series Dynamic Mics

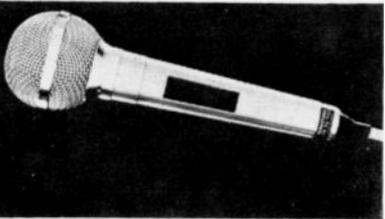
Slim design; dynamic microphones.
DM70-150 Impedance 50,000 ohms; response 50-15,000 Hz; sensitivity -58 dB,



with sw.\$29.50
DM70-200 Impedance 10,000 ohms; response 50-16,000 Hz; sensitivity -66 dB\$27.50
DM70-500 Impedance 200 ohms; response 40-18,000 Hz; sensitivity -59 dB\$27.50
DM70-550 Impedance 200 ohms; response 40-18,000 Hz; sensitivity -59 dB, with sw.\$29.50

DM70-B Series Dynamic Ball Mics

Ball type, dynamic, slim line microphones.
DM70-100-B Impedance 50,000 ohms; response 50-15,000 Hz; sensitivity -58 dB; built-in wind screen\$39.00
DM70-150-B Impedance 50,000 ohms; response 50-15,000 Hz; sensitivity -58 dB; built-in windscreen & switch\$42.50
DM70-200-B Impedance 10,000 ohms; response 50-16,000 Hz; sensitivity -66 dB; built-in windscreen\$39.00



DM70-250-B Impedance 10,000 ohms; response 50-16,000 Hz; sensitivity -66 dB; built-in windscreen & switch\$42.50
DM70-500-B Impedance 200 ohms; response 40-18,000 Hz; sensitivity -59 dB; built-in windscreen\$39.00
DM70-550-B Impedance 200 ohms; response 40-18,000 Hz; sensitivity -59 dB; built-in windscreen & switch\$42.50

CDM80 Dynamic Cardioid Mic

Dual-impedance 50,000/200 ohms; response 80-12,000 Hz; sensitivity -59 dB



at 50,000 ohms, -61 dB at 200 ohms; with switch\$43.50

"Studio 70" Dynamic Mics

Lavalier and multi-application microphones.
70-L Low-Z; omnidirectional; imp. 150-

600 ohms; response 40-18,000 Hz; sensitivity -59 dB\$53.50

70-H High-Z; omnidirectional; imp. 50,000 ohms; response 50-15,000 Hz; sensitivity -59 dB\$53.50

Various microphones listed are available with desk stands and in matched pairs for stereo recording.

SONY/SUPERSCOPE

F-98 Cardioid Dynamic Mic

Wide-range mic with thin tapered design & removable stand. Complete with cord & connecting plug\$19.50

C-22 Solid-State FET Capacitor Microphone

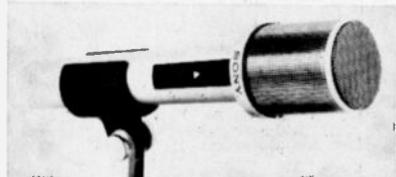
Field-effect transistor eliminates need for external power supply. Features built-in re-



placeable 9-volt battery; response 30-20,000 Hz; with 20-foot cable, clip-on holder & carrying case\$99.50

F-121 Cardioid Dynamic Mic

Response 30-18,000 Hz; four impedances: 50, 250, 600, 10,000 ohms. "On-off" switch



located on handle with electrical safety lock. With 20-foot cable, desk stand, clip-on holder and carrying case\$99.50

STANFORD/MB

MB-150 Dynamic Microphone

Omnidirectional, 200 ohms; 80-16,000 Hz; output 0.12 mV/ μ bar. 5 $\frac{1}{8}$ " long x 1 $\frac{1}{2}$ " dia.\$16.00

MB-170 Dynamic Microphone

Omnidirectional, 700 ohms; 50-15,000 Hz; output 0.24 mV/ μ bar. 5 $\frac{1}{8}$ " long x $\frac{7}{8}$ " dia.\$18.00

MB-190 Dynamic Microphone

Omnidirectional, 500 ohms; 100-10,000 Hz; output 0.22 mV/ μ bar. Shaped like fountain pen. 4 $\frac{1}{8}$ " long x $\frac{9}{16}$ " dia.\$40.00

MB-270 Dynamic Microphone

Cardioid pattern, 200 ohms; 70-15,000 Hz; output 0.15 mV/ μ bar. 5 $\frac{1}{8}$ " long x 1 $\frac{1}{2}$ " dia.\$47.00

MB-215 Dynamic Microphone

Cardioid pattern, 200 ohms; 50-18,000 Hz; output 0.15 mV/ μ bar. 5 $\frac{1}{8}$ " long x 1 $\frac{1}{2}$ " dia.\$80.00

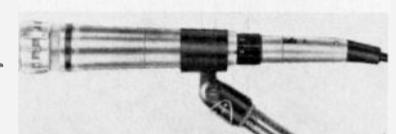
MB-115 Dynamic Microphone

Omnidirectional, 200 ohms; 40-20,000 Hz; output 0.15 mV/ μ bar. 6 $\frac{3}{16}$ " long x 1 $\frac{1}{2}$ " dia.\$80.00
There are other models and almost all can be obtained with "on-off" switch, remote switch, in stereo versions & with various cable lengths, at additional cost. Check mfr. for prices.

TURNER

500 Dynamic Mic

Cardioid design; response 40-15,000 Hz; output -55 dB; high or 150 ohms select-



ed at terminal end of cable. 20' cable.\$54.00
S-500 Same except with "on-off" sw.\$54.40

701 Dynamic Mic

Cardioid design; response 100-13,000 Hz; output -56 dB. Has "on-off" sw. & built-in pop/blast filter. High impedance only.\$37.20

700 Dynamic Mic

Hi-low impedance combination; unidirectional cardioid; pop/blast filter; response 40-15,000 Hz; output -55 dB; 20-25 dB discrimination over entire freq. range; built-in wind screen; "on-off" sw. 20' cable. Satin chrome finish\$55.20

35 Lavalier Mic

Hi-low impedance combination; 70-12,000 Hz response. Supplied with 3-cord shielded cable, lavalier clip & cord. $\frac{3}{4}$ " x 3".\$39.00

2800 Dynamic Mic

Omnidirectional; high impedance; 70-12,000 Hz response; output -63 dB. 12' cable\$12.00

UNIVERSITY SOUND

2000 Series Omnidirectional Mics

Variable impedance, dynamic design. Response 50-14,000 Hz; 50 or 20,000 ohms; sensitivity -143 dB; output level 50 ohms: 50 dB/1mW/10 dynes/cm²; 20,000 ohms 28 mV/10 dynes/cm²; hum reference -120 dB/.001 gauss; 1 $\frac{3}{32}$ " dia. For home recording.

Model 2000 With stand adapter\$26.85

Model 2040 With switch & stand adapter\$30.60

Model 2050 With switch & swivel stand adapter\$33.45

8000 Series Cardioid Mics

Variable impedance, dynamic design. Shock mounted for home recording. Response



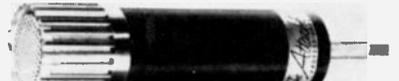
70-15,000 Hz; 250-20,000 ohms; sensitivity -154 dB; output level 250 ohms: 60/mW/10 microbar, 20,000 ohms 8.5 mW/10 microbar; 1 $\frac{3}{32}$ " dia.

Model 8000 With stand adapter\$34.95

Model 8100 With switch & stand adapter\$37.95

6000 Attaché Cardioid Lavalier Mic

Dynamic design; response 50-15,000 Hz; 150 ohms impedance; sensitivity: -151 dB;



output level: -57 dB/1 mV/10 microbar. Supplied with neck cord\$39.75

5000 Series Super-Cardioid Mic

Highly directional, dynamic type. Response 25-18,000 Hz; variable impedance 250 & 20,000 ohms (wired at plug); sensitivity -147 dB (EIA); output @ 250 ohms -54 dB/1 mW/10 μ bar; at 20,000 ohms 13 mV/10 μ bar. Over-all size is 2 $\frac{3}{16}$ " dia. x 9 $\frac{3}{8}$ " long.

Model 5000 has wired-in cable & stand adapter\$51.60

Model 5020 has stand adapter & detachable cable\$56.95

Model 5050 has "on-off" switch, swivel-type stand adapter, and detachable cable\$59.95

HEADPHONES DIRECTORY

AKG

K-60 Stereo Headphones

Dynamic, moving coil driver units; frequency compensated to match hearing char-



acteristics; response 20-20,000 Hz ± 3 dB; imp. each driver 600 ohms; designed for use on 4 to 10,000 ohms without matching transformer; require 0.001 W input for sound pressure level of 112 dB. Ear cushions rotatable for comfort\$39.50

K-20 Stereo Headphones

Budget version of K-60. Same response, sensitivity, and wide-range impedance matching features of K-60\$19.50

CLARK

Model 100 Stereo Headset

Moving-coil (dynamic) design with plastic diaphragms; response 20-10,000 Hz ± 3



dB; distortion less than 2% @ 100 phn level; sensitivity 1 mW @ 1000 Hz produces 100 dB (reference .0002 microbar); max. input 1 W/phone; 8 ohms; has 20 dB av. cushion attenuation to white noise; stereo or mono; supplied with 8' cable and 2-circuit plug\$45.00
300, 600, and 1200 ohm models also available.

Model 200 Stereo Headset

Permanent magnet design; response 20-17,000 Hz. Sensitivity 1 mW input @ 1000 Hz produces 105 dB per earpiece (reference .0002 μ bar). Max. input 1



W/phone; 8 ohms. Has 2-circuit stereo plug\$26.95

Model 250 Stereo Headset

With volume control, otherwise same as Model 200\$32.00

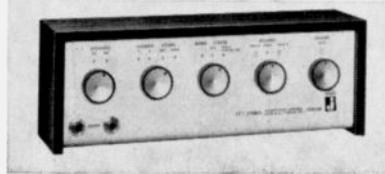
Model 1000 Stereo Headset

14 karat gold-plated hardware; earpiece dome simulated walnut grain\$85.00

JENSEN

CC-1 Headphone Control Center

4-8 ohm electrodynamic phones; operates with any 10-watt/channel amplifier; stereo



design; new "Space-Perspective" design provides complete controls for personal listening; controls—speaker "on-off," left- or right-channel only or stereo with channel reversal; mono or stereo with choice of "Space-Perspective" or regular; balance; volume; $4\frac{1}{4}$ " h. x $11\frac{1}{4}$ " w. x 3" d.\$69.00

HS-2 Stereo Headphones

For stereo or mono listening; response 20-17,000 Hz, 4 ohms, 1 mW input required



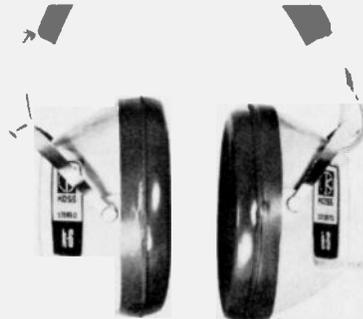
for adequate listening, 8-foot input cable and 3-conductor phone plug. Accessory jack panel is M-1648.

HS-2 Stereo headphone\$24.95
M-1648 Jack panel\$ 4.95

KOSS

K-6 Stereophones

4 ohms (can be used with 4, 8, 16 ohm outputs); 10-15,000 Hz. Sensitivity 1 V at

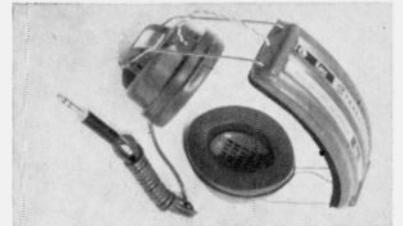


400 Hz; will produce 127 dB sound pressure (0.0002 dyne/cm²). Max. input 10 W/ch r.m.s. (60 W/ch dynamic power). Weight 15 oz (less cord)\$26.50

Model SP-3XC "Stereophones"

Extremely sensitive $3\frac{1}{2}$ " sound reproducers mounted in each earpiece; response 10-15,000 Hz; impedance 4-16 ohms; comes complete with adapter plate that connects to any system that will drive

speakers\$24.95



Model SP-100 Same as Model SP-3XC except for impedance of 100 ohms; for special and multiple installations\$24.95

Model SP-5SM "Stereophones"

Stereo and monaural phones in one; switch in lavalier changes operation from stereo to monaural or vice versa\$24.95

KO-727 "Stereophones"

Wide-range 10-15,000 Hz design; 4-ohm imp but can be used for 4, 8, or 16 ohms.



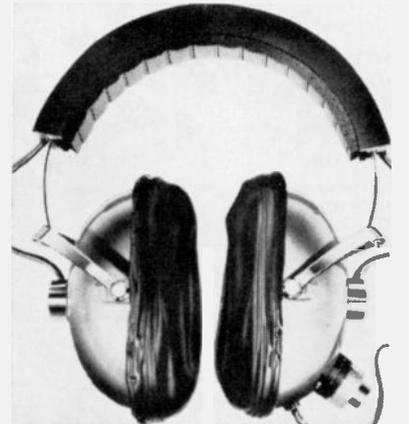
Sensitivity 1 V applied to driver will develop 127 dB of sound pressure relative to 0.0002 dyne/cm². Max. input 60 W/ch music power. Dist. 1% at max. output. Supplied with 10' 4-cond. cable\$34.95

Model T-1 Junction Box

Contains matching transformers for monitoring; 600-10,000 ohm outputs; two output jacks for Stereophones\$7.95

Model Pro-4A Headset

Response 30-20,000 Hz; max. input 10 watts/channel (60 W/channel music pow-



er); distortion less than 1% at maximum output; 4 ohms (600 ohms available); 10-foot coiled cord; rugged, shock-proof and fluid-filled ear cushions\$50.00

t-10 Listening Station

Wires to amplifier; will accept two sets of stereo phones with separate volume controls. Has speaker "on-off" sw. Walnut cabinet. 4-16 ohms\$24.95

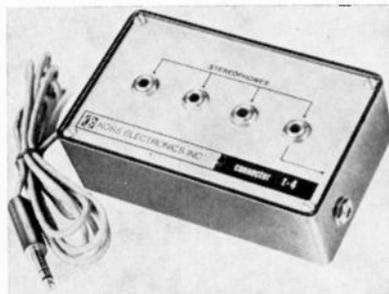
Model T-5 Remote-Control Listening Station

Junction box for connecting Stereophones to existing stereo or mono system; impedance



4-16 ohms; has jacks for two sets of Stereo-phones; one volume control for each ear; on-off speaker switch for personalized listening\$9.95

t-4 Connecting Box



Junction box for five stereo headsets. Has 10' cord\$6.95

PML

D-42 Headphones

Dynamic type for mono or stereo; response 30-20,000 Hz; dist. 2% @ 5 mW; impedance 200 ohms/phone (400 ohms in series; 100 in parallel)\$24.95

SANSUI

Model SS-2 Stereo Headphones

High-moving-coil design; response 20-18,000 Hz; 3-phase plug for use with amplifiers of varying wattages\$19.95

SHARPE

Model HA-8A Stereo Phones

20-15,000 Hz, 2 watts, 8 ohms impedance per phone; sensitivity: 100 dB re. 0.002 dyne/cm² @ 0.06 V input.\$19.95

Model HA-10-A Headphones

Stereo design; 8 ohms imp.; response 30-15,000 Hz ±3 dB; 2 W max. input.\$35.95

HA-10-Mk II Dynamic Headphones

Stereo design, with liquid-filled noise-attenuating ear seals. Response 30-15,000



Hz ± 3 dB; input power max 2 W ea. phone; 8 ohms ea. phone; sensitivity 115 dB reference .0002 dyne/cm.² at .05 volt input; max. HD 0.8%\$45.00

HA-660/Pro Stereo Headphones

Features dynamic drivers with response 20-20,000 Hz ± 3 dB. Impedance 8 ohms standard, 500 ohms optional. Fuses are used to protect headphones from overload. Supplied with 4-conductor cord & stereo plug\$60.00

HA-770/GP Dynamic Headphones

Stereo design; 20-20,000 Hz ±3 dB; 8 ohms/phone (500 ohms optional); max.



input 1.5 W/phone per channel; matched, individually calibrated drivers, configured dampers & attenuators; liquid-filled ear cushions; volume controls and overload fuses; 24 k white-gold finish; response curves furnished with each unit\$100.00

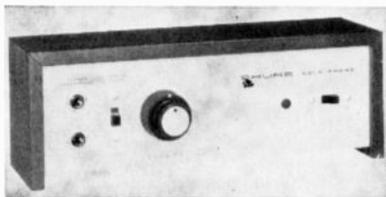
HA-9 Stereo Dynamic Headphones

Response 15-20,000 Hz; 8 ohms each phone; sensitivity: dB re 0.0002 dyne/cm² at 0.013 V input; max. input 2 W/phone\$24.95

SHURE

SA-1 "Solo-Phone"

Stereo amplifier for headphones permits 2 sets of headphones to be used simultanc-



ously; has its own balance control; dual input for tape/tuner or phono; phono input 47,000 ohms equalized for mag. cartridge. Tuner input 250,000 ohms; output 8 ohms, 100 mV; with walnut case. 10 1/4" x 3 1/2" x 3 3/8" d\$45.00

SA-1F "Solo-Phone" Same basic performance as Model SA-1 except panel mtg. Panel opening 10 1/4" x 4 3/8" x 3 3/8" deep\$57.00

SA10 "Solo-Phone" Portable

Combines a 4-speed record changer & a stereo amplifier specifically for headphone



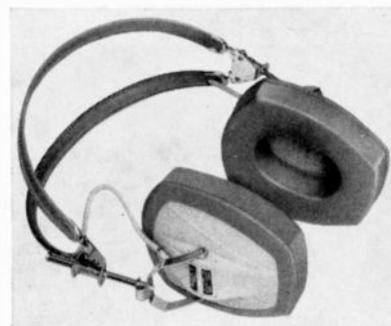
listening. Plays up to 8 records intermixed 7", 10" & 12" and may be used manually; two sets of headphone jacks are provided.

120 V operation\$99.95
SA-10M Same as Model SA10 except has Garrard 4-speed manual turntable. Accommodates 7", 10", and 12" records at 4 speeds\$99.95

SONY/SUPERSCOPE

DR-3A, DR-3C Headphones

Dynamic stereo design provide full-range frequency response. Available in 8 ohms



(DR-3A) or 10,000 ohms (DR-3C). Both models are complete with adj. headband; vinyl-covered foam ear cushions. Supplied with connecting cord and binaural phone plug.

DR-3A\$22.50
DR-3C\$27.50

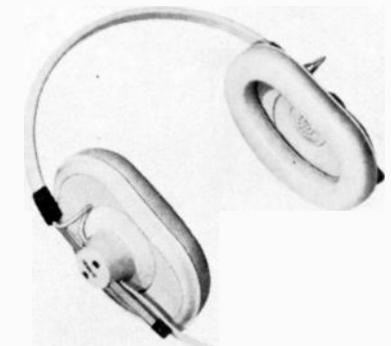
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MB-K61 Headphones

16 ohms; stereo or mono. Response 20-16,000 Hz. Cushions are fluid-filled. Supplied with 8' cable & phone plug. Weight 12.35 ounces\$14.95

MB-K660 Headphones

16 ohms; stereo or mono. Response 20-17,000 Hz. Cushions are fluid-filled. Supplied



with 8' cable & phone plug. Weight 8.82 ounces\$17.95

MB-K660 Headphones

16 ohms; stereo or mono. Response 16-20,000 Hz. Cushions are fluid-filled. Supplied with 8' detachable cable & phone plug. Max. constant load 400 mV.\$65.00

SUPEREX

ST-M Stereo "Masters" Headset



Low-impedance; 8-16 ohms; has two-way sound reproducers each phone—dynamic low freq. & ceramic high freq.; response 20-20,000 Hz; frequency response adjustable by control on ea. phone; complete with crossover network\$29.95
 Model ST-M-24 15,000 ohm impedance\$40.00
 600, 2000, or 50,000 ohms also available.

ST-S Stereo "Standard" Headset
 Dynamic reproducer for 30-15,000 Hz response; adjustable headband and plastic ear



cup; has built-in surge protection....\$24.95
 Model ST-SH Same as ST-S except high impedance\$29.95
 600, 2000 & 50,000 ohms also available.

ST-PRO-B Stereo Pro Headset

Coaxially mounted dynamic reproducer for low frequency and ceramic for high frequency in each earpiece; 4 to 6 ohms; 18-22,000 Hz, 30 mW, maximum power 2 watts\$50.00
 ST-PRO-H High-impedance 600, 2000, 15,000, 50,000 ohms\$55.00

"The Communicator" Headphones
 Mono design using dynamic elements. Response 100-10,000 Hz; 4 to 16 ohms imp. Model COM-S\$13.95

ST-C "The Challenger"

Stereo design; 4-16 ohms imp. with response 40-15,000 Hz. Max. power 2 W. Dynamic type with 7' cord\$19.95

ST-VC Stereo Headset

Designed for the hard-of-hearing; has separate volume controls; response 30-



15,000 Hz; nominal power 15 mW; max. 2 W; has 7' cable & standard stereo plug; dynamic design\$27.95

TELEX

ASH-1 "Amplitwin" Headphone
 Stereo design with built-in battery-operated solid-state amplifier. Has low & high



level inputs on each ear cup. Will operate direct from phono cartridges, tape heads & tuners. Response 16-15,000 Hz\$79.50

"Serenata" Stereo Headset

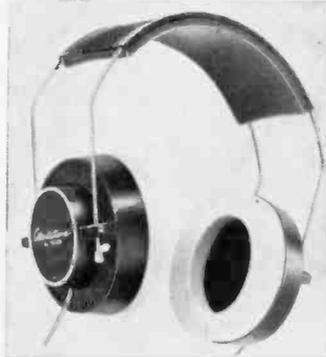
Features tone control; comfort control buttons to adjust earphone pressure; liquid



cushions; Mylar cone drivers. Response 20-20,000 Hz; 4-16 ohms; 8' detachable cord & plug\$59.95
 "Serenata II" Same except without tone control & detachable cord. Also available in 600 ohms\$44.95

"Adjustatone" Stereo Headset

Features 3 1/2" speakers; plastic earcups; comfort foam cushions; response 10-15,000



Hz; 4-16 ohms, 8' cord & plug\$15.95

"Combo" Stereo Headset

Same as "Adjustatone" but with removable foam-filled vinyl cushions\$19.95

ST-20 Stereo Headset

Revised version of former design features one-piece headband & remote control of stereo balance & volume. Response 16-15,000 Hz; 4-16 ohms; 8' cord & plug\$34.95

ST-10 Same except does not include individual controls\$24.95

Stereo Control Kit

Remote control of stereo program; allows speakers to be switched on or off and sound level to be adjusted at each earpiece; comes complete with instructions for installation & 15 ft. cord. STC-1\$10.50

"Encore" Stereophone

Response 50-18,000 Hz. Has 8' cord, 3-circuit molded plug & removable foam-filled cushions\$ 9.95

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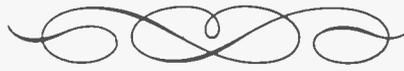
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AT THIS late date, nearly two decades after the introduction of prerecorded tape as a medium of home entertainment, it seems hardly necessary to expound certain virtues of tape *vs.* disc reproduction. A reel then can be put on a single twelve-inch long-playing disc—is still frequently enough ignored by the tape industry itself to warrant some comment here. The increasing use of the 3¾-ips speed for prerecorded tapes has improved the industry's performance in this respect to some degree. But even at the 3¾-ips speed, there are tape releases that contain no more material than can be found on a twelve-inch disc.

All the manufacturers are guilty of this transgression, but some are guiltier than others. Angel, for example, which in many respects pioneered longer-playing musical tapes at the 3¾-ips speed, is nevertheless sometimes content to ignore the slower-speed's advantage. Cases in point that come to

mind immediately are the tapes of Barbirolli's performance of the Beethoven "Eroica" Symphony and Boult's of Holst's *Planets*. Each is contained on an individual 3¾-ips reel; they could have been combined on one reel, the Beethoven on one sequence, the Holst on the other—thus allowing each work to be heard straight through with no artificially imposed breaks in continuity.

To my way of thinking, the longer playing time of prerecorded tape is one of its primary advantages over disc reproduction. For the manufacturers themselves to be indifferent to this fact is to stunt the potential growth of the tape medium. For this reason, most of the reels in the following enumeration of my favorite twenty-five tapes are longer-playing programs, whether at 3¾ ips or 7½ ips. Only a really outstanding disc-length reel can qualify in such a list—and I am surprised to find as many as five among my favorite twenty-five.



MY 25 FAVORITE TAPES

By Martin Bookspan

Beethoven: *Missa Solemnis*. Soloists, Chorus and New York Philharmonic/Bernstein. Columbia M2Q 509, 7½ ips. Bernstein's highly charged reading excites all the participants. The performance has enormous drama and power, and the recorded sound on tape is extremely vivid.

Beethoven: *Symphony No. 9*. Soloists, Chorus and Vienna Philharmonic Orchestra/Schmidt-Isserstedt. London 90121, 7½ ips. This is the most satisfactory performance of the Ninth Symphony on tape. Schmidt-Isserstedt stresses the warmth and nobility of the score, the orchestra and chorus respond to his every wish, and the vocal quartet—headed by Joan Sutherland and Marilyn Horne—is the finest ever to have participated in a recording of the music. The whole is brilliantly engraved in sound that is clear, full, and rich, with a wide dynamic range.

Berg: *Wozzeck*. Dietrich Fischer-Dieskau, Evelyn Lear and other soloists, with Chorus and Orchestra of the German Opera, Berlin/Böhm. Deutsche Grammophon P 8991, 7½ ips. This already classic performance of Berg's masterpiece makes an overwhelming impression on tape, perhaps because there is only one break to interrupt its inexorable flow.

Berlioz: *Romeo and Juliet*. Soloists, Chorus and Boston Symphony Orchestra/Munch. RCA FTC 7003, 7½ ips. Of all Munch's masterly Berlioz recordings, this performance of *Romeo and Juliet* is arguably his finest. He responds with equal sensitivity to the intimate and extrovert qualities of the music, and the processing in the tape medium is a model of the authentic chorus and orchestra sound of Boston's Symphony Hall.

Bernstein: *Chichester Psalms; Facsimile*. Chorus and New York Philharmonic/Bernstein. Columbia MQ 789, 7½ ips. Bernstein's *Chichester Psalms* is surely one of the most beautiful works in all music. It is a deeply felt spiritual communication, ideally performed here under the composer's direction and with a marvelous

sense of airiness in the tape reproduction. *Facsimile* is an earlier, more ponderous score that is also well-served by the open sonic textures.

Brahms: *Piano Concerto No. 2; Tchaikovsky: Piano Concerto No. 1*. Vladimir Horowitz, with NBC Symphony Orchestra/Toscanini. RCA TR3-5027, 3¾ ips. On this single reel (in monophonic sound) are combined the prodigious concerto collaborations by Toscanini and his son-in-law. The sound is immeasurably richer than the discs of the 1940's disclosed, and the whole enterprise is part of a unique RCA project that from time to time gives us on tape immortal performances from the pre-tape and pre-stereo era.

Britten: *War Requiem*. Soloists, choruses and London Symphony Orchestra/Britten. London 90067, 7½ ips. This score gains in stature as it becomes more familiar. The composer-conducted performance is superb, and the various levels of sound that contribute so effectively to the overall impact of the music are delineated most successfully by the highly expert recording technology. The tape issue is even more successful in this regard than the corresponding two-disc album.

Bruckner: *Symphony No. 8*. Vienna Philharmonic Orchestra/Solti. London 80201, 7½ ips. Bruckner, perhaps more than any other symphonic composer, benefits from the longer playing time afforded by the tape medium. The huge vaults of Bruckner's architecture demand uninterrupted spans. This glowing performance and recording are absolutely stunning on tape.

Chopin: *Waltzes, miscellaneous piano pieces*. Artur Schnabel. RCA TR3-5013, 3¾ ips. Heard in uninterrupted succession, as made possible by this superbly processed tape, the Chopin Waltzes emerge as an elaborate and many-sided apotheosis of his piano style. In these, as well as in the over-sequence miscellaneous pieces, Schnabel is at the very top of his form. A cherishable reel.

Dvořák: *Symphonies Nos. 6 and 7*. London Symphony

Orchestra/Kertész. London 80189, 7½ ips. These performances are among the best in the complete Kertész-London Symphony traversal of all the Dvořák symphonies. On this tape each score is heard uninterrupted; the quality of the orchestral playing is awesome in its discipline, and the sound is luxuriously full and rich.

Hatikvah on Mount Scopus. Vocal soloists, chorus, Isaac Stern and Israel Philharmonic Orchestra/Bernstein. Columbia MQ 954, 7½ ips. This tape recaptures in thrilling fashion the impact of the extraordinary series of concerts conducted in Israel by Leonard Bernstein in July, 1967, shortly after the end of the six-day Arab-Israeli War. Isaac Stern gives a radiant performance of the Mendelssohn Violin Concerto, and the last movement of Mahler's Second Symphony is heard (sung in Hebrew) in a resplendent performance by the Tel Aviv Philharmonic Choir with Netania Davrath and Jennie Fourel. The emotional immediacy of the moment is extraordinary. Most moving of all is the playing and singing of the national anthem of Israel, the *Hatikvah*, as recorded at the concert given in the amphitheater atop Mount Scopus. This reel has rare documentary and musical qualities.

Haydn: Symphonies Nos. 99-104. Vienna State Opera Orchestra/Wöldike. Vanguard-Everyman 1916, 3¾ ips. Here, on one reel, are all six of the second set of "London" Symphonies Haydn composed for the British impresario Johann Peter Salomon. They are stylishly performed and impeccably recorded. Especially marvelous is the performance of the last symphony, No. 104 in D Major. An indispensable reel.

Horowitz at Carnegie Hall. Music by Schumann, Chopin, Scriabin and others. Vladimir Horowitz (piano). Columbia M2Q 745, 7½ ips. Like the "Hatikvah on Mount Scopus" reel, this is another on-location recording that captures the full excitement and drama of an occasion—in this case, the now-fabled return of Vladimir Horowitz to the concert stage on May 9, 1965, after an absence of twelve years. Horowitz is simply overwhelming in everything he plays here, and the engineering and tape processing are excellent.

Mahler: Das Lied von der Erde. James King and Dietrich Fischer-Dieskau with Vienna Philharmonic Orchestra/Bernstein. London 90127, 7½ ips. The flaming conviction of a totally committed performance, superior recording technology, and crystal-clear tape processing all combine to make this one of the outstanding reels in the catalog.

Mozart: Don Giovanni. Elisabeth Schwarzkopf, Joan Sutherland, Giuseppe Taddei and others with the Philharmonia Orchestra and Chorus/Giulini. Angel Y4S 3605, 3¾ ips. Though a product of the early years of stereo recording, this performance benefits from expert and practical utilization of the stereo medium. Giulini delivers one of the greatest accounts of the music in my experience, and the joy of having the two acts of the opera uninterrupted for home listening—one act per sequence—is one of the most extraordinary experiences in recorded music.

Mozart: Four Horn Concertos; R. Strauss: Two Horn Concertos. Dennis Brain, with the Philharmonia Orchestra/Karajan (in the Mozart) and Sawallisich (in the Strauss). Angel YZS 3669, 3¾ ips. These performances originated in pre-stereo times, but they have been electronically reprocessed for stereo reproduction, and the sound is quite serviceable. The playing is miraculous, and the reel is one of the finest available memorials to Dennis Brain's art.

Mozart: Quartets Nos. 14-19. Juilliard String Quartet. Epic E3C 854, 3¾ ips. The six Mozart string quartets dedicated to Haydn, all contained on a single tape reel.

The performances by the Juilliard players are immaculate, and the sound on the tape is remarkably full and lifelike.

Prokofiev: Symphonies Nos. 4 and 6. Moscow Radio Symphony Orchestra/Rozhdestvensky. Angel Y2S 4105, 3¾ ips. Though the Moscow Radio Orchestra is not exactly a virtuoso organization by American standards, the conviction of the playing in these two masterful scores is irresistible. Rozhdestvensky has emerged in the past few years as perhaps the most impressive Prokofiev conductor now before the public. The recording and tape processing are both very impressive.

Puccini: Madama Butterfly. Renata Scotto, Carlo Bergonzi, and others, with Rome Opera Chorus and Orchestra/Barbirolli. Angel Y3S 3702, 3¾ ips. Sir John Barbirolli's meltingly lyrical way with this most popular of all operas written in the twentieth century is one of the great accomplishments of recorded music. The principals are glorious in their roles, and the recorded sound is vibrant.

Saint-Saëns: Symphony No. 3. Berj Zankochian (organ) and Boston Symphony Orchestra/Munch. RCA FTC 2029, 7½ ips. The athletic excitement of Munch's reading and the virtuoso playing by Zankochian and the Boston Symphony demand recording of the most exalted technical accomplishment. That is precisely what the engineers and processors have provided here—a reel with an enormous musical and technological wallop.

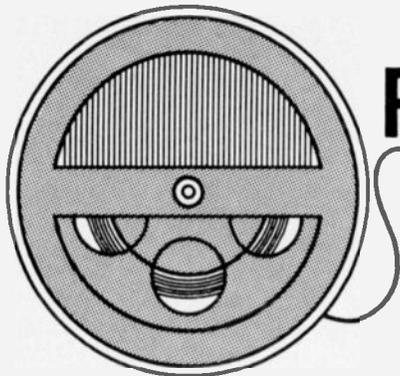
Shakespeare: Hamlet. Richard Burton, Hume Cronyn, and others. Columbia DOQ 665, 3¾ ips. As a souvenir of the never-less-than-impressive Broadway production of a few years ago, this Richard Burton production of Shakespeare's great tragedy is a unique document. The transfer of the performance to the medium of recording has been most successfully accomplished, and on tape the three-and-one-half-hour playing time with only one interruption works wonders in sustained tension and emotion.

Sibelius: Symphonies Nos. 1 and 2. Vienna Philharmonic Orchestra/Maazel. London 80162, 7½ ips. Maazel and the marvelous Vienna Philharmonic deliver absorbing accounts of these two scores—dramatic, romantic, and exciting. The orchestra is given voluptuous sound reproduction and the tape sonics are simply gorgeous.

R. Strauss: Der Rosenkavalier. Elisabeth Schwarzkopf, Christa Ludwig, Otto Edelmann and others with the Philharmonia Orchestra and Chorus/Karajan. Angel Y4S 3563, 3¾ ips. Recorded more than ten years ago, this performance of *Der Rosenkavalier* is one of the classics of disc literature. And to have the entire opera complete on a single reel makes the tape medium a true partner in the extraordinary artistic experience.

Vaughan Williams: Symphonies Nos. 2 and 8; Elgar: Enigma Variations. Hallé Orchestra/Barbirolli. Vanguard Everyman 1915, 3¾ ips. Three great orchestral scores by English composers are given extremely idiomatic performances on this reel. The Vaughan Williams "London" Symphony and Elgar's "Enigma" Variations are better here than in Barbirolli's rerecordings of both works for Angel. Vanguard's sound, though lacking somewhat in fullness, is never less than agreeable. A splendid reel.

Verdi: Requiem. Soloists and the Philharmonia Chorus and Orchestra/Giulini. Angel ZB 3649, 7½ ips. Giulini invests his performance of this great work with a dignity and simplicity that are most winning. He has an excellent vocal quartet (Schwarzkopf, Ludwig, Gedda, and Ghiaurov) and the engineers have registered it all in imposing sound that has great power and extraordinary dynamic range.



PRERECORDED TAPE ROUNDUP

REVIEWS OF SOME OF THE MOST OUTSTANDING
PRERECORDED STEREO TAPES
RELEASED DURING RECENT MONTHS

BACH: *Trio Sonatas (complete, BWV 525-30)*. E. Power Biggs (pedal harpsichord). COLUMBIA © MQ 975 \$7.95.

Performance: Worthy
Recording: Excellent
Stereo Quality: First-rate
Speed and Playing Time: 7½ ips; 74'23"

The pedal harpsichord, a two-manual instrument with a pedal mechanism, makes a very good impression here in Bach's six trio sonatas, which are more usually heard on the organ. True, this instrument does not have the sustaining power or the variety of registers that the organ does, but Biggs succeeds in making the pedal harpsichord an effective alternate (there is some possibility that the sonatas might have been intended originally for either a pedal harpsichord or pedal clavi-chord). The instrument has been recorded extremely vividly here, and I am delighted that Columbia has chosen to release the tape (minus the disc album's two solo concertos, BWV 592/3) at a speed of 7½ ips, rather than at a slower speed, which might likely have resulted in flutter.

BEETHOVEN: *Concerto No. 5 in E-flat, Op. 73 ("Emperor"); Concerto No. 4 in G, Op. 58*. Artur Schnabel (piano); Boston Symphony Orchestra, Erich Leinsdorf cond. RCA VICTOR © TR3 5019 \$10.95.

Performance: Good
Recording: Good sound but lots of hiss
Stereo Quality: Okay
Speed and Playing Time: 3¾ ips; 70'37"

I like these performances, particularly that of the "Emperor." Oddly enough, Schnabel is often at his best in (for him) less familiar repertoire—where the mannerisms have not formed over the years. He approaches this music with a fresh combination of dignity and zest; there is no false reverence for "classical" style but the kind of straight-forward brio that allows the pianist's remarkable natural musicianship to come through. The orchestral approach is—the usual cliché about Leinsdorf the super-technician notwithstanding—rather hearty and gruff, and this is not inappropriate to the "Emperor" (it doesn't work quite so well in the G Major).

As in the case of the recent tape transfers of the Schnabel-Leinsdorf Brahms concertos, you get a lot of music on a reel but also a lot of hiss. If you are as sensitive to tape hiss as I am, you may want to cut the treble even at the cost of sacrificing some of the highs. Otherwise the recorded sound is good,

and the transfers are generally superior to those of the Brahms concertos.

BEETHOVEN: *Quintet in E-flat Major for Piano and Winds, Op. 16*. **MOZART:** *Quintet in E-flat Major for Piano and Winds (K. 452)*. Vladimir Ashkenazy (piano), London Wind Soloists. LONDON © LCL 80188 \$7.95.

Performance: First-class
Recording: Very good
Stereo Quality: Good with one reservation
Speed and Playing Time: 7½ ips; 52'11"

To the best of my knowledge neither of these piano and wind quintets has been available on tape before, although there have been some excellent disc couplings of these two pieces. The combination of Ashkenazy and the London Wind Soloists (Jack Brymer, clarinet; Terence MacDonagh, oboe; Alan Civil, horn; William Waterhouse, bassoon) is a felicitous one. The pianist plays most beautifully (although I think his Mozart could show a little more personal involvement), and the wind execution is exquisite in blend, tone, and precision. I had the distinct impression that the disc version of this coupling did not spread the piano quite as much as one hears on this tape, and for this reason I prefer the greater naturalness of the disc. In no way, however, is the tape to be considered in itself other than satisfactory.

DONIZETTI: *Lucrezia Borgia*. Montserrat Caballé (soprano), Lucrezia; Ezio Flagello (bass), Alfonso; Alfredo Kraus (tenor), Gennaro; Shirley Verrett (mezzo-soprano), Orsini; Giuseppe Baratti (tenor), Rustighello; Robert El Hage (bass), Astolfo; other soloists; RCA Italiana Opera Orchestra and Chorus, Jonel Perlea cond. RCA VICTOR © TR38001 \$17.95.

Performance: Compelling
Recording: Very good
Stereo Quality: Not spectacular
Speed and Playing Time: 3¾ ips; 134'42"

As an operatic production, this album must be counted a success, not least because of the efforts of Montserrat Caballé in the title role. All the other principals are in good voice as well, and the performance has a lot of dramatic and vocal eloquence.

Caballé, of course, is the mainstay, and although her portrayal of the morally ambivalent Lucrezia is temperamentally rather placid, it is impossible not to be affected by the

lovely sounds she emits. The final *cabaletta*, after the death of Lucrezia's son, also affords this outstanding singer some opportunities for vocal display, and she acquits herself quite stunningly.

Finally, it must be noted that Jonel Perlea holds his forces together very well and effectively conveys both the gracefulness and the dramatic vigor of the score. Regarding the recording, this is one of the first to be issued by RCA Victor in 3¾ ips, and the results are surprisingly good. Disc and tape versions are more closely matched than with many tapes of this speed, the only obvious exception being a slightly thicker, less open sound in the massed ensembles and some slight loss of highs (*i.e.*, cymbals are clearer and have more presence on the disc set). Stereo is only moderately well used for suggestion of movement or depth. The disc-version libretto can be obtained at no charge by sending the usual postcard.

DVORÁK: *Symphony No. 6, in D Major, Op. 60; Symphony No. 7, in D Minor, Op. 70; Carnival Overture, Op. 92*. London Symphony Orchestra, István Kertész cond. LONDON LCK 80189 \$11.95.

Performance: Excellent
Recording: Attractive
Stereo Quality: Good
Speed and Playing Time: 7½ ips; 91'28"

DVORÁK: *Symphony No. 8, in G Major, Op. 88*. Berlin Philharmonic, Rafael Kubelik cond. DEUTSCHE GRAMMOPHON DGC 9181 \$7.95.

Performance: Good
Recording: Good
Stereo Quality: Fair to good
Speed and Playing Time: 7½ ips; 35'37"

The trouble with the Dvořák D Major Symphony (formerly No. 1, now correctly numbered 6) is that great chunks of it are so obviously cribbed from Beethoven and Brahms that it is really a bit embarrassing. Still, its very thievery has a certain innocent air about it that is almost charming, and the work as a whole gives pleasure—and, most particularly, in this excellent performance, matched up with equally fine readings of the great D Minor Symphony (the old No. 2) and the *Carnival Overture*. These are first-class renditions, full of spirit, beautifully shaped by Kertész and the London players; they are admirably recorded and, with over an hour and a half of Dvořák on the tape, it constitutes an excellent buy.

There's barely a third as much music on

the DGG tape of the G Major Symphony (No. 8, formerly No. 4), and the Berlin musicians lack some of the finesse and sheer beauty of sound that their English colleagues provide. Still, this is by no means an inferior recording; quite the contrary. Kubelik, a Bohemian himself after all, has a fine feeling for the pulse and lyric flow of this music, and for the singing qualities that are its special claims to glory. The DGG stereo sound is typically resonant, but without much directionality. I prefer the English use of stereo, which clarifies the music without loss of quality. The Ampex transfers are all well done.

GERSHWIN: *An American in Paris*; "I Got Rhythm" Variations; *Rhapsody in Blue*; *Cuban Overture*; *Concerto in F*. Earl Wild (piano); Boston Pops Orchestra, Arthur Fiedler cond. RCA VICTOR Ⓢ TR3 5006 \$10.95.

Performance: Light and bright
Recording: Bright and reverberant
Stereo Quality: Fair
Speed and Playing Time: 3¾ ips; 87'30"

All of the "serious Gershwin" with orchestra is included here, except for the Second Rhapsody. There is no other tape of the "I Got Rhythm" Variations, and to my surprise, none of the Concerto either. However, Leonard Bernstein offers formidable rivalry in his Columbia taping of the *Rhapsody in Blue* and *American in Paris*.

Arthur Fiedler, with Earl Wild playing glittering solo piano, turns in readings best described as light, bright, and perhaps a shade rigid. *American in Paris* not only comes off the best in performance here, but for me it remains the freshest and wittiest in its musical substance.

This is my first experience with RCA Victor 3¾ ips tape, and the recorded sound is well balanced and free of excessive mid-range equalization. The general miking of the Fiedler performances, however, allows a bit too much reverberation, thus obscuring unnecessarily the musical texture at climactic points of the Concerto and the *Rhapsody*.

HOLST: *The Planets*. The New Philharmonia Orchestra; Ambrosian Singers; Sir Adrian Boult cond. ANGEL Ⓢ Y1S 36420 \$7.98.

Performance: Galactic
Recording: Superb
Stereo Quality: Incomparable
Speed and Playing Time: 3¾ ips; 50'45"

When Holst launched this mammoth seven-movement symphonic suite in 1914, shortly before the outbreak of World War I, he did not regard it as one of his best achievements, and was rather astonished at the tumultuous welcome his music of the spheres received in England and later throughout the world. *The Planets* is the apotheosis of all we have come to think of as science-fiction music, and yet it is distinguished from most works in this category by the formality of its structure, the originality of its melodic content, and the ingenuity of its orchestration. Although the palette of the instrumental coloring is wide and unorthodox, the piece does not rely on weird sounds or "special effects" to seize and hold the listener's imagination. It does so by legitimate dramatic and musical means. If it lacks profundity, it still sweeps us up and

holds us, through its moods and magicality, in a strange fusion of astral and mythological associations. It has not dated.

The recording history of the suite is like a summing-up in miniature of the industry's technological development. Stokowski, Karajan, and Sargent have all contributed vigorous interpretations of the score, but Boult, Holst's fellow Englishman and life-long champion, has made it his own. His *Mars* is simply more martial, his *Jupiter* more jovial, his *Saturn* more saturnine, his *Mercury* more mercurial than the readings by his rivals. When his monophonic recording with the Philharmonic Promenade Orchestra for Westminster replaced an older, 78-rpm version with the BBC Symphony on the HMV label in the early 1950's, it seemed at the time that recorded sound had reached the limit of its possibilities. Then he did it again with the Vienna State Opera orchestra in stereo, and again one was freshly astonished. This



ISTVÁN KERTÉSZ
Leads a first-class Dvořák program

new version leaves all earlier contenders trailing. The orchestra is supremely supple and responsive to this conductor, who actually has found new insights into the manifold details of each tone poem, permitting him to weave a more monumental pattern of the whole through its parts. The sound is particularly thrilling on this tape for the lulling diminuendo passages of *Venus, the Bringer of Peace* and even the final fading murmurs of *Neptune, the Mystic* can be heard with breathtaking clarity, free of the slightest distraction of tiny clicks or phonographic chatter.

MAHLER: *Symphony No. 2, in C Minor* ("Resurrection"). Heather Harper (soprano); Helen Watts (contralto); London Symphony Chorus and Orchestra, Georg Solti cond. LONDON Ⓢ LCK 80187 \$11.95.

Performance: Superb
Recording: Spectacular
Stereo Quality: Unbeatable
Speed and Playing Time: 7½ ips; 80'53"

Before hearing this tape of Mahler's Symphony No. 2, I would have sworn I would never hear a recording of it to approach Bernstein's. And while I'm not prepared to concede Solti's supremacy even now—

Bernstein's sense of the shape of the work and his singularly intense identification with its sentiments are, for me, unique—Solti's version has a lot going for it.

The performance, for one thing, is a miracle of technical precision. If the London Symphony Orchestra has ever played better on records, I haven't heard it do so. And Solti himself imbues the work with a driving intensity that, in London's spectacular recorded sound and stereo, can be hair-raising. Strictly speaking, his performance is rather more disciplined than Bernstein's, but the latter has a gift for making what some might view as excesses in this composer's work believable as abstract musical "theater."

Solti's performance comes closest to matching Bernstein's in the finale. It is held under control, the choral work is unbelievably lucid in both musical and textual detail, and the conductor's restraint and sense of timing make the closing pages uncommonly moving. Helen Watts sings the "Magic Horn" movement nicely, but here I find Jennie Tourel's collaboration with Bernstein unforgettable.

Taken in sum, Solti's recording is a live wire—good enough to make one almost regret the fact that there is a superior one available. The stereo effects, by the way, are as effective as any I have ever heard.

MOZART: *String Quintet, in G Minor* (K. 516). **MENDELSSOHN:** *Octet, in E-flat, Op. 20*. **SCHUBERT:** *String Quintet, in C Major* (D. 956). Jascha Heifetz, Israel Baker, Arnold Belick, Joseph Stepanisky (violins); William Primrose, Virginia Majewski (violas); Gregor Piatigorsky, Gabor Rejto (cellos). RCA Ⓢ TR3 5022 \$10.95.

Performance: Sleek and brilliant
Recording: Close and clear
Stereo Quality: Good
Speed and Playing Time: 3¾ ips; 95'34"

It is the utterly breathtaking performance of the Mendelssohn Octet by this galaxy of virtuosos—recorded along with the other works on this tape following a 1961 series of concerts in Hollywood—that make this package uniquely worth having. The lightness, precision, and tonal warmth simply beggar description; and once you hear the famous Scherzo as played here, you will never again settle for the orchestral version.

A somewhat frantic pacing of the outer movements in the Mozart Quintet leads me to prefer the Griller-Primrose taping on Vanguard as an alternate. A choice between the present reading of the great Schubert Quintet and the nobly lyrical version by members of the Vienna Philharmonic London is a matter of personal taste—the tautly dramatic as against the piercingly lyric.

The recorded sound somewhat lacks the special tonal warmth that can come with a wider range of overtones, but the sonic texture as a whole is admirably clean.

NIELSEN: *Symphony No. 1, in G Minor, Op. 7*; *Saul and David: Prelude to Act II*. **WALTON:** *Symphony No. 1* (1935). London Symphony Orchestra, André Previn cond. RCA VICTOR Ⓢ TR3 5012 \$10.95.

Performance: First-rate
Recording: A-1
Stereo Quality: Good
Speed and Playing Time: 3¾ ips; 83'32"

NIELSEN: *Symphony No. 1, in G Minor, Op. 7; Helios Overture, Op. 17; Pan and Syrinx, Op. 49; Rhapsodic Overture—A Fantasy-Journey to the Faeroe Islands.* Philadelphia Orchestra, Eugene Ormandy cond. COLUMBIA ⑤ MQ 912 \$7.95.

Performance: Taut and brilliant
Recording: Good
Stereo Quality: Very good
Speed and Playing Time: 7½ ips; 54'42"

Both the Nielsen and Walton first symphonies are the work of young men, in their late twenties and early thirties, respectively. Nielsen's trimly built and momentum-filled score fits neatly into the classic-romantic post-Brahmsian mainstream; Walton's somewhat sprawling opus is a curious blend of Elgarian lushness and jazzy Stravinskian rhythmic fireworks. The *Presto con malizia* scherzo is one of the high points of Walton's output.

From every point of view the RCA Victor tape is a first-rate buy. Previn captures beautifully the youthful surge and expressive lyricism of the Nielsen Symphony, giving added dimension to the whole by observing repeats where called for in the score. His performance of the Walton Symphony is altogether masterly in its vigor and brilliance. Indeed, only the somewhat tentative treatment of the splendidly virile excerpt from Nielsen's Biblical opera leaves room for criticism. The orchestral playing is fine, the recorded sound spacious and full-bodied. RCA Victor is to be congratulated on the outstanding quality of its 3¾-ips tape reproduction.

The fancifully orchestrated evocation of the Pan and Syrinx myth and the amusing *jeu d'esprit* on the Faeroe Islands constitute the chief attractions of the Ormandy tape. His fast pacing of the opening pages of the *Helios* Overture deprives this episode of its inherent majesty, and the Symphony—minus repeats—seems rushed and hard-driven. The sound is full and brilliant throughout, though apparently miked more closely than is the case with the Previn tape. All the works on these two reels are making their first appearance in four-track format.

ORFF: *Catulli Carmina.* Judith Blegen (soprano); Richard Kness (tenor); Temple University Choirs, Robert Page director; Philadelphia Orchestra, Eugene Ormandy cond. COLUMBIA ⑤ MQ 930 \$7.95.

Performance: Sensual and spectacular
Recording: Superb
Stereo Quality: Adds pungency
Speed and Playing Time: 7½ ips; 40'40"

Carl Orff, who likes to take old Latin texts and medieval musical means and shine them up with liberal modernistic and theatrical embellishments, is not the most profound of contemporary composers, but his scores pulsate with a theatrical and an animal excitement that are hard to resist. His cantata *Carmina Burana*, with its twenty-five lusty songs celebrating the life of the senses, is intoxicating stuff. And the same is true of its sequel, *Catulli Carmina*, which is based on the life and works of Catullus, the Roman poet of the first century B.C. Presented here with notes and a new translation of the text from Latin into English by Horace Gregory, these songs, brilliantly delineated by the Philadelphia forces in an almost orgiastic interpretation, set fire to the senses like strong wine. The poems deal with the affairs of a rather racy set

of Romans and their bohemian antics, especially the adventures of a woman named Clodia who drives her lover Catullus mad with her wild ways. In the course of the cantata, the goings-on of the younger generation lead a chorus of old men to laugh in derision and warn that "time is not love's bedchamber." The ways of passion and the frank worship of sexuality in the text are set to music so beguiling and explosive (and so ravishingly interpreted here) that the case for wisdom is easily lost to the lovers and their perishable pleasures.

RACHMANINOFF: *Symphony No. 1, in D Minor, Op. 13.* Philadelphia Orchestra, Eugene Ormandy cond. COLUMBIA ⑤ MQ 906 \$7.95.

Performance: Sensational
Recording: Superb
Stereo Quality: Discreet
Speed and Playing Time: 7½ ips; 43'56"

For many years the Rachmaninoff First Symphony, written in 1895 when the composer was twenty-two, was little more than a rumor. The young Rachmaninoff was so depressed by the first performance of the work under Alexander Glazounov in St. Petersburg in 1897 that he wouldn't allow the manuscript to be published, finally tore it up, and refused to write another note for three years. Fifty years later, after the composer's death (1943), somebody found the orchestral parts in the archives of the Leningrad Conservatory. The symphony got a performance in Moscow and Soviet critics cheered, but the musical world in general was not set on its ear. The verdict of British musicologist Robin Hull was typical: "a disaster of youthful pride." Earlier recordings of the work, of which one by the Leningrad Philharmonic still survives in the catalog, did little to enhance its reputation as a meandering, murky orchestrated piece of bad musical tailoring.

Under Ormandy's sympathetic and imaginative direction, it still meanders at times, and still echoes the influences of Tchaikovsky and Rimsky-Korsakov in its self-indulgent romanticism, but it also flowers luxuriantly and reveals its outlines as a dramatically structured and orderly effort rather than a mere amorphous excursion in self-pity and melancholy. And there are hints of the haunting melodies, the peremptory outcries, and the long, lyrical flow of the songful passages that mark his later works and make lovers of his Second and Third Symphonies (like myself) return again and again for refreshment at their musical streams. It is a pleasure to be led through this terrain by Ormandy, a guide who has made himself thoroughly familiar with its geography, and the shimmering, sensuous sound of the Philadelphia, which can drown some works in sonic whipped cream, is entirely appropriate in this performance.

SCHUBERT: *Sonata in A Major, Op. 120 (D. 664); Hungarian Melody (D. 187); Sonata in A Minor, Op. 143 (D. 784); Twelve Waltzes, Op. 18 (D. 145).* Vladimir Ashkenazy (piano). LONDON ⑤ LCL 80186 \$7.95.

Performance: Ideal
Recording: Good
Stereo Quality: Good
Speed and Playing Time: 7½ ips; 44'16"

It strikes me that there are few, if any,

pianists of Vladimir Ashkenazy's generation quite like him. The best of the younger ones eschew what is infelicitously described as the Grand Manner in favor of a more intellectual, sharply profiled, even abstract approach (and heaven knows, a good deal of the Romantic repertoire, in particular, has profited from the cleansing). But among the younger pianists, there are also the eccentrics, the ones who *affect* the Grand Manner even though it is suited neither to their temperaments nor their time.

Ashkenazy, almost uniquely, has it both ways. His playing is sharp, intellectually disciplined, and technically formidable. Schubert's A Minor Sonata comes over with the drive and cohesiveness of the best of Beethoven's sonatas. Yet the pianist yields to Schubert's lyricism without inhibition. And how he manages to bring the variety he does to the stultifying repetition in the A Major Sonata is a mystery. The waltzes are played crisply and stylishly, and the *Hungarian Melody* is attractively unmannered.

The recorded sound and stereo treatment are both very good.

SIBELIUS: *Symphony No. 2, in D Major, Op. 43; The Swan of Tuonela, Op. 22, No. 3.* The Hallé Orchestra, Sir John Barbirolli cond. ANGEL ⑤ Y1S 36425 \$7.98.

Performance: Superb
Recording: Excellent
Stereo Quality: Excellent
Speed and Playing Time: 3¾ ips; 53'51"

I am no Sibelius fan, but a performance like this one might even convert me. To my ears this is ideal Sibelius: its Romantic style—very tense, very "held back," big in scope, remarkably pure—might put it above Maazel and Szell for Sibelius fans. Superb orchestral playing and a sonorous recorded sound are effectively transferred to tape.

STRAUSS: *The Blue Danube; Tales from the Vienna Woods; Voices of Spring; Artist's Life; Wine, Women and Song.* London Philharmonic Orchestra, Antal Dorati cond. LONDON ⑤ LCL 75018 \$7.95.

Performance: Top-notch
Recording: Brilliant
Stereo Quality: Attractive
Speed and Playing Time: 7½ ips; 52'29"

Dorati is a superb conductor for the dance, and, after all, Budapest is—or at least used to be—only a short way down the river from Vienna. Dorati doesn't just let this music slip by. Everything is done with great panache, elegance, and style. The English players give him fabulous sound and a beautiful rubato ensemble. Altogether a delightful collection, beautifully put together.

R. STRAUSS: *Salome: Dance of the Seven Veils; Closing Scene.* **WAGNER:** *Die Götterdämmerung: Immolation Scene.* Birgit Nilsson (soprano); Vienna Philharmonic Orchestra, Georg Solti cond. LONDON ⑤ L.O 90129 \$7.95.

Performance: Handsome
Recording: Superb
Stereo Quality: Striking
Speed and Playing Time: 7½ ips; 46'41"

Both sides of this tape come from complete opera recordings that have been available in four-track format for some time. Thus we have here Gerhard Stolze and Grace Hoffman

face of considerable competition (even in the tape medium) principally through its two leads. Caballé sings her "Ab! fors' è lui" and the third-act "Addio del passato" as beautifully as I've ever heard; hers is not an especially dramatic interpretation, but, histrionics aside, the sheer vocalism is breathtaking. Equally impressive is the virile, ringing tenor of Bergonzi—a superb contribution. The American baritone Sherrill Milnes, in the part of the elder Germont, sings with sensitivity though not with great tonal opulence, and the rest of the cast is very worthy. Prêtre's conducting, always well controlled, sometimes concentrates on surface excitement, but I thought his third-act prelude exceptionally well done. The 3¾-ips reproduction is extremely good, and the purchaser is able to obtain a full-size record-album libretto by returning the usual enclosed post card. Recommended.

WAGNER: Die Walküre: Ride of the Valkyries; Siegfried: Forest Murmurs; Das Rheingold: Entrance of the Gods into Valhalla; Die Götterdämmerung: Siegfried's Rhine Journey; Siegfried's Funeral Music. London Symphony Orchestra, Leopold Stokowski cond. LONDON ⑤ LCL 75016 \$7.95.

Performance: Rich and vital
Recording: Handsome
Stereo Quality: A-1
Speed and Playing Time: 7½ ips; 45'56"

Almost the first symphonic records I ever owned, some thirty-five years ago, were the pair of 1929 Victor discs of the Stokowski-Philadelphia performance of Wagner's *Rienzi* Overture, with the orchestral finale of *Die Götterdämmerung* as filler. I remember as vividly as though it were yesterday how overwhelmed I was by the immense power and vitality of the performance (Stokowski was not fussing with tempos in those days), not to speak of the total opulence of the orchestral playing.

I find that the same amazing vitality and much the same beauty of orchestral sonority comes through in far more transparent textures in this London Phase 4 tape done nearly forty years later. In short, it represents Stokowski at his very best—young in spirit, unfussy, and immensely communicative. It is when we get away from the snippets of *Die Walküre*, *Das Rheingold*, and *Siegfried* (superbly played though they are) and into the extended and epic *Götterdämmerung* excerpts that the full measure of Stokowski's Wagnerian interpretation can be taken. He wisely sticks to Wagner's original somber ending of the *Rhine Journey*, with its statement of the Rhinegold motive in the minor key, and begins the Funeral Music at the moment of Hagen's treacherous spear thrust. The result, both as effective editing and musical performance, is powerfully moving, gaining substantially in impact by virtue of its dramatic continuity.

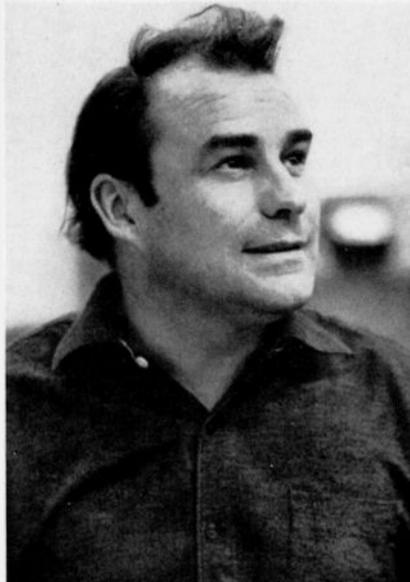
The London Symphony players are in top form all the way, and most of all, I am grateful that the London Phase 4 engineering staff has seen fit to avoid the stereo gimmickry that has marred some of their other efforts. The stereo illusion here is wholly natural, and the recorded sound as a whole has body, a sense of depth, and transparency. This is one of the best Wagner tapes around.

COLLECTIONS

JULIAN BREAM: Guitarist, Bach: Lute Suite No. 1, in E Minor (BWV 996); Lute Suite No. 2, in C Minor (BWV 997, transposed to A Minor); Prelude in D Minor; Fugue in A Minor. Sanz: Pavanas; Canarios. Sor: Fantasy and Minuet. Weiss: Passacaille; Fantasie; Tombeau sur la mort de M. Comte de Logy; Visée: Suite in D Minor. Julian Bream (guitar). RCA VICTOR ⑤ TR3 5014 \$10.95.

Performance: A Bream dream
Recording: Close and alive
Stereo Quality: Modest
Speed and Playing Time: 3¾ ips; 82'20"

I am not at all sure that I agree with Mr. Bream and the anonymous annotator of this album that the Bach lute suites are better off played on the guitar, but since I am a guitar fanatic (I have written several pieces involv-



JULIAN BREAM
A big guitar recital gorgeously played

ing both Spanish and electric guitar) and a Bream fan as well, it would be churlish of me to make any further protest. (If you play the opening number or so—as I did by error—at 7½ ips, you might actually think that Bream is playing the stuff on a lute pitched up an octave; however, this only works for the slow stuff; the fast music comes off with a ridiculous virtuosity that even Bream couldn't manage.) While recommending the tape highly, I would like to protest the presentation. This tape contains the material that originally appeared on two discs, but it makes up for musical generosity with informational skiminess. Gaspar Sanz and Fernando Sor are described only as "Spaniards who devoted themselves to the guitar." Sor is by no stretch of the imagination a composer for the "Baroque guitar" (as implied by an album title), nor were the Bach Prelude and Fugue on the first side written for the "Baroque guitar," or any other kind of guitar for that matter. Sylvius Leopold Weiss was, by all accounts, a lutenist, not a guitarist, and Robert de Visée was apparently the same. There are obviously certain performers, like Bream, whose recordings would sell if the album notes were by Casey Stengel, but it would be courteous of RCA to invest a couple of dollars in a decent and honest presentation

and annotation. Anyway, it's a gorgeous recording with a beautiful sound, and the 3¾ speed not only leaves room for a lot of music but proves remarkably free of noise too.

LEONTYNE PRICE: Prima Donna, Vols. 1 & 2. Purcell: Dido and Aeneas: When I am laid in earth. Handel: Atalanta: Care selve. Mozart: Marriage of Figaro: Dove sono; Don Giovanni: Or sai chi l'onore. Weber: Der Freischütz: Leise, leise. Verdi: La Traviata: Addio del passato; Macbeth: Sleepwalking Scene; Otello: Willow Song; Ave Maria; and ten other arias. Leontyne Price (soprano); RCA Italiana Opera Orchestra, Francesco Molinari-Pradelli cond. RCA VICTOR ⑤ TR 3-5018 \$10.95.

Performance: Superb
Recording: Good
Stereo Quality: All right
Speed and Playing Time: 3¾ ips; 104'25"

Throughout this tape, which is taken from two separate operatic recital discs, Leontyne Price's singing is uncommonly beautiful. She is in excellent voice, and there is not one aria that does not provide evidence of this singer's great artistry, though one might wish that Handel's "Care selve" had not been rendered in such an unstylish, Romantically orchestrated version. The orchestral contributions are competent, but not of the same caliber as Miss Price's performances, and the recording is perhaps a bit muddy on the low end and lacking in brightness, though in general quite satisfactory. Texts and translations can be obtained by sending in the usual post card.

ENTERTAINMENT

THE BEACH BOYS: Wild Honey. The Beach Boys (vocals and instrumentals). *Wild Honey; Aren't You Glad; I Was Made to Love Her; Country Fair; Darlin'; Here Comes the Night;* and five others. CAPITOL ⑤ Y1T 2859 \$5.95.

Performance: Entertaining
Recording: Excellent
Stereo Quality: Good
Speed and Playing Time: 3¾ ips; 24'19"

Having heard several of their records and tapes, I have a feeling that the Beach Boys are going to be around for a while. This tape demonstrates a few of the reasons why. The title song is a fine piece of work with rhythm-and-blues overtones, boasting a very with-it feel in conception and execution. Brian Wilson has composed some good songs here, including *Country Fair*, *Here Comes the Night*, and *Mama Says*. There is quite a bit of creative talent evinced here, sheathed in a personal and honestly contemporary style.

JOHNNY CASH: Johnny Cash's Greatest Hits, Volume 1. Johnny Cash (vocals), orchestra. *I Walk the Line; Orange Blossom Special; Ring of Fire; The Ballad of Ira Hayer;* and eight others. COLUMBIA ⑤ CQ 940 \$7.95.

Performance: Virile, wide-ranging
Recording: Very good
Stereo Quality: Excellent
Speed and Playing Time: 7½ ips; 31'02"

Johnny Cash knew hard times as a boy picking cotton in Arkansas. Part Cherokee, a lineage of which he is proud, he identifies most strongly with those who have to struggle—

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for bread, for identity, for individuality. Accordingly, this selection from the hits that have made Cash himself a monetarily comfortable rebel includes tales of discrimination (*The Ballad of Ira Hayes*), independence (*Johnny Yuma*), and resistance to pressure (*It Ain't Me, Babe*). In fact, no matter what he sings, the personality Cash projects is that of the brooding loner, tough but not at all deadened to feeling, ready for the worst and also ready to take pleasure before the worst comes. He is convincing, whether in the folk or modern country idioms, because, like Sinatra in another milieu, he really does believe the lyrics and makes the songs extensions of his own experiences and fantasies. Not yet forty, Mr. Cash is going to be prominent for a long time and probably, like Sinatra, will continue to broaden his areas of musical conquest.

CHICAGO/THE BLUES/TODAY! Volume I: The Junior Wells Chicago Blues Band; J. B. Hutto and His Hawks; Otis Spann's South Side Piano. *Vietcong Blues; Too Much Alcohol; Married Woman Blues; Marie; Burning Fire*; and ten others. VANGUARD © VGX 9216 \$5.95.

Performance: Rich and lusty
Recording: Good
Stereo Quality: Good
Speed and Playing Time: 3¼ ips; 46'39"

One of the greatest tragedies facing American music is the dying out of its traditions. Rock-and-roll and electrified clatter assault the eardrums constantly, but the roots they grew from have been all but buried forever. Except for the action at Preservation Hall, the New Orleans jazz scene, which once flowered into greatness in the Thirties, is a disgrace. The Memphis and St. Louis and Kansas City musical forms of the Twenties are all but dissolved. Only Chicago remains. Down on the South Side you can still hear the blues, if you are brave enough to risk being shot by snipers in a race war.

Now, thanks to Vanguard, you can avoid the South Side and hear the real thing in comfort through your own stereo speakers. Three of Chicago's best South Side groups have been assembled on this tape to provide an interesting cross-section of what you find available in its clubs and neighborhood bars. The Junior Wells Chicago Blues Band features Junior himself batting out beat-up vocals and playing a funky harmonica. *All Night Long* is the best number on his set, but dig his tribute to Sonny Boy Williamson. It moves. J. B. Hutto sings louder and higher, but his guitar passages are fiery and full of gusto. His *Going Ahead* has an intro that sounds like *One Mint Julep*. He is called a "bottleneck" singer, possibly because his music sounds tight and violent, as though it were let out of a bottle just before it blew the top off.

The most interesting of the three groups is Otis Spann's. Spann is a well-known personality in Chicago. And there is such a great demand for his music that he sometimes even plays uptown in the Loop. He sounds like a cross between Froggy the Gremlin and Madame Spivey, and his piano is hard-driving, funky, and throbbing with soul. This is music right out of the Twenties, with a modern, meat-and-potatoes urgency of now about it. All in all, a most memorable experience.

JUDY COLLINS: *Judy Collins' Fifth Album*. Judy Collins (vocals, guitar); Richard Fariña (dulcimer); Eric Weissberg (guitar); John Sebastian (harmonica); instrumental combo. *Pack Up Your Sorrows; Tomorrow is a Long Time; Thirsty Boots; Mr. Tambourine Man; Lord Gregory; Early Morning Rain; It Isn't Nice*; and five others. ELEKTRA © EKC 7300 \$7.95.

Performance: Beautiful
Recording: Superb
Stereo Quality: Superb
Speed and Playing Time: 7½ ips; 43'37"

Although this tape was recorded two years ago, I think it demonstrates, as well as any of her newer items, Judy Collins' growth as a folk singer. Her early recordings were decidedly folk-commercial in a downbeat, wilted-lettuce sort of way, and she was overshadowed by the more dramatic Joan Baez, who always knew how to sell her own image. Yet, of the two, I think Judy is far and away the better singer and the better interpreter of folk music. Now she has matured, collecting along the way some of the savvy of the more theatrical jazz and concert singers without sacrificing her innocent approach to regional music or her own beautiful perfect pitch.

Her voice has never seemed more fragrant, strong, or radiant than it does in these songs. Her material has been chosen with care, and all of it is good. Bob Dylan's *Mr. Tambourine Man* has a light euphoric quality that is always conspicuously absent in his own recordings. Judy Collins' sensitive but controlled and uncluttered reading of Dylan's *Tomorrow is a Long Time* makes me wish more people would be adventurous and record his songs. Of equally special interest is *It Isn't Nice* (by the vastly underrated singer Barbara Dane), and Judy breezes through it with a slightly salty quality. If I had to select five representative examples of folk music of the Sixties to seal in a time capsule for critics of the next eon to examine, I'd include this Judy Collins tape without a moment's hesitation.

BILL EVANS/SHELLY MANNE/EDDIE GOMEZ: *A Simple Matter of Conviction*. Bill Evans (piano), Shelly Manne (drums), Eddie Gomez (bass). *Stella by Starlight; Laura; Star Eyes; These Things Called Changes*; and four others. VERVE © VVC 8675 \$7.95.

Performance: Skillful, flowing
Recording: Excellent
Stereo Quality: Very good
Speed and Playing Time: 7½ ips; 37'33"

In previous encounters, Bill Evans and Shelly Manne have proved well matched in their skills and expressive bents. Both are concerned with keeping lines of melody and time supple, subtle, and sensitized to shifting dimensions of feeling through careful attention to dynamics. In Eddie Gomez, they have found a bassist of similar preoccupations and disciplined virtuosity. Had it been possible for this trio to stay together, rather than meet only on a recording date, the results might have paralleled the evolution of the Modern Jazz Quartet into the most precise and lithely lyrical of jazz chamber units. In any case, the results of this meeting should be durably satisfying to those who prefer their jazz eminently civilized. My own tastes usually veer toward bolder and more visceral improvising, but there are times when a session like

this is a calming—though still challenging—respite.

ARETHA FRANKLIN: *I Never Loved a Man the Way I Love You*. Aretha Franklin (vocals, piano). *Respect; Drown in My Own Tears; Soul Serenade*; and eight others. ATLANTIC © ALX 8139 \$5.95.

Performance: Thrilling
Recording: Excellent
Stereo Quality: Fine
Speed and Playing Time: 3¼ ips; 32'30"

Dear Aretha:

I am only a poor critic, up to my ears in my lonely room with platters and tapes. Week after week, my costly, sensitive equipment is assailed by countless caterwauling purveyors of pseudo-rock, fake-roll, phony-folk, and country music manufactured in cities. Most of the time, when I turn them on, they turn me off. But then, Aretha, then you came along. Oh, I know I'm not fit to touch the hem of your mini-skirt, but I must speak out, for my heart is full. Since I have heard you, my faith in the human voice has been restored. How can I say what you have come to mean in my life? Sometimes you're happy, and when you are, you communicate so well I don't want you to ever stop singing. Yes, when you feel good, and sing *Good Times* or *Dr. Feelgood*, you make me feel good too, Aretha. Sometimes you're blue, and you sing sad songs like *Drown in My Tears* and *I Never Loved a Man the Way I Love You* and you make it, as old Lorenz Hart put it, "a pleasure to be sad." And then there are times when you pull out all the stops for a bang-up number like *A Change Is Gonna Come*, and you make me believe it. Is it simply because you have a great voice and you know how to use it? Is it your wonderful timing? Is it the honesty in every note you sing? I don't know. I only know that in you the best traditions of gospel singing, blues singing, pop singing, and the talent for blending the meaning of a lyric with the feeling of a tune are all combined. I mean, you've got it. You're great. I hope you don't mind my going on this way; I just had to tell you. Aretha Franklin, I love you. I never loved a woman the way I love you.

STAN GETZ: *Stan Getz with Guest Artist Laurindo Almeida*. Stan Getz (tenor saxophone); Laurindo Almeida (guitar); George Duvivier (bass); Edison Machado, José Sorrez, David Bailey (drums); Luiz Pargo, José Paulo (Latin rhythm). *Young Lady; Outra Vez; Winter Moon; Do What You Do, Do; Sabrd's Samba; Maracatu-Too*. VERVE © VSTC 362 \$7.95.

Performance: Sinuously typical
Recording: Very good
Stereo Quality: Excellent
Speed and Playing Time: 7½ ips; 32'18"

Stan Getz and Laurindo Almeida are a well-matched team, particularly in a program, as here, of Latin-colored jazz. Both are at ease in spinning melodic variations; both have a subtle ear for exactly apt harmonies; and both are at their inventive best in the medium tempos that prevail in this set. The rhythm accompaniment is appropriately supple, and the quality of sound is first-rate. My only reservation is that, as skillful as the music-making is, there is a sameness of mood over the total playing



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time. But for certain occasions, this would make very attractive background music.

IAN AND SYLVIA: *So Much for Dreaming*. Ian and Sylvia (vocals); Ian (guitar and autoharp), David Rae (guitar), Robert Bushnell (electric bass), Al Rogers (drums). *Circle Game; So Much for Dreaming; Wild Geese; Child Apart*; and eight others. VANGUARD Ⓢ VGX 9241 \$5.95.

Performance: Bright-eyed
Recording: Good
Stereo Quality: Artful
Speed and Playing Time: 3¾ ips; 40'01"

Ian and Sylvia are a Canadian couple who sing folk songs and compose creditable facsimiles of them in a familiar vein. They won't raise the roof of your house or crack glasses trying to inspire awe of their vocal powers, but they may win you over, as they easily won me, through the rare, secret ingredient in all their albums: respect for the intelligence of the listener. The program here deals with unpretentious matters: grey winter mornings, love gambled on a woman and "lost like summer wages," the flight of geese, the dreams of children. The sell is soft, the rhythm gentle, the tone humane and serious. A civilized cheer for Ian and Sylvia.

HENRY MANCINI: *The Concert Sound of Henry Mancini; Encore!* Henry Mancini Orchestra. *High Noon; Over the Rainbow; Norwegian Wood; Moon River; Exodus; Born Free; Golden Earrings*; and forty-four others. RCA VICTOR Ⓢ TP3 5038 \$9.95.

Performance: Classic and classy Mancini
Recording: Excellent
Stereo Quality: Excellent
Speed and Playing Time: 3¾ ips; 84'14"

If you can't get to the Hollywood Bowl, where you get Henry Mancini plus stars in the sky, the next best thing is to buy this tape and close your eyes. The stars will come. This massive collection features the best of the fully-orchestrated Mancini works. The first side is divided into four sections: "Academy Award Selections," with the band doing beautiful things on *Over the Rainbow* and playing the best orchestration of *Never on Sunday* I've heard; "A Tribute to Victor Young," featuring seven great songs by the maestro, with some great piano work by Jimmy Rowles in *Stella by Starlight*; "The Music of David Rose," which connects with everything from *Holiday for Strings* to the seldom-heard *American Hoe Down* and *Manhattan Square Dance*; and "Peter Gunn Meets Mr. Lucky," which gets into the jazz groove with some sterling solos.

Side two starts out with the concert version of Mancini's tribute to the Beatles. Special attention should be paid to the artistic piano of Pearl Kaufman. A "Foreign Film Festival" follows, with such diverse concoctions as *Zorba the Greek* and *Born Free*. "Music from Hollywood" and three compositions from Mancini's movie scores complete the concert. It is light and airy as a summer night, and although the tape takes well over an hour to listen to, it's time well spent.

THE SUPREMES: *The Supremes Sing Rodgers and Hart*. The Supremes (vocals); orchestra. *Lover; The Lady Is a Tramp; Mountain Greenery; My Romance; Thou Swell*; and seven others. MOTOWN Ⓢ MTX 659 \$5.95.

Performance: Great
Recording: Excellent
Stereo Quality: Good
Speed and Playing Time: 3¾ ips; 30'4"

The Supremes are out of sight. On tape or on record I love them. This said, I can only urge you to buy this tape. Rodgers and Hart might not, on first thought, seem to be ideal material for this sleek and compelling group who are generally surrounded by the biggest of big beats. The beat is still there, although in more moderate proportions, and what it does to something like *My Heart Stood Still* is almost unbelievably good. But it is Diana Ross and the Supremes who make this tape a marvel of pop entertainment. They glide through twelve standards from the Rodgers and Hart canon with the sinuous aplomb of an adventuress crossing the lobby of the Hotel Negresco; in other words, they often take their time but they know exactly what they are doing. *My Romance* is my own particular favorite, but then I am sure you will be able to find several of your own. Unreservedly recommended.



IAN AND SYLVIA
Respect for the listener's intelligence

NANCY WILSON: *Lush Life*. Nancy Wilson (vocals), orchestra. *Free Again; Over the Weekend; You've Changed; River Shallow; Sunny; Lush Life; Only the Young*; and four others. CAPITOL Ⓢ Y1T 2757 \$5.95.

Performance: Very good
Recording: Excellent
Stereo Quality: Excellent
Speed and Playing Time: 3¾ ips; 37'07"

At the present moment Nancy Wilson is singing better than she ever has before, and this tape is a nice reminder that beautiful girls very often can sing. The only problem for me in listening to this tape is that Miss Wilson has chosen three songs which in my mind have already received their classic performances: *Free Again* and *Too Long at the Fair* seem to me to be the property of Barbara Streisand, and *When the World Was Young* remains firmly in my memory in a performance by Dinah Shore. Once past those hurdles, however, I enjoyed this recital enormously. Miss Wilson does a lovely job on the André and Dory Previn *River Shallow*, and her handling of the often melodramatic lyric of *Lush Life* is exemplary. *Midnight Sun* didn't move me much, but it's about the

only thing here that didn't. Beautiful girl, beautiful voice, beautiful tape.

THEATER MUSIC

HELLO, DOLLY! (Jerry Herman). Broadway-cast recording. Pearl Bailey, Cab Calloway, Emily Yancy, Chris Calloway, Jack Crowder, others (singers); chorus and orchestra, Saul Schechtman cond. RCA Ⓢ TO3 1006 \$8.95.

Performance: Delicious
Recording: Excellent
Stereo Quality: On-stage realism
Speed and Playing Time: 3¾ ips; 44'45"

It will not come as news at this point that, of the long succession of gifted ladies who have kept *Hellob, Dolly!* running on Broadway since Carol Channing left the title role, none was better cut out for the job than Pearl Bailey. Indeed, I would be hard put to choose which of the two Broadway-cast recordings of this still sparkling musical to keep in my collection if I had to give one up. Can a man be in love with two women at the same time? Miss Channing rasped her way into my heart years ago, and the album she graces glitters with infectious exuberance, well conveyed by top-notch forces in every department. Miss Bailey has transformed the part, taking the edge off the character of the meddlesome match-maker and suffusing it with a warmth and astringency all her own. The all-Negro cast accompanying her is excellent, and brings a mellow, more easy-going quality to the tuneful score. Jack Crowder is not as forceful a Cornelius as Charles Nelson Reilly was, but Emily Yancy has relieved the part of Mrs. Molloy, the milliner, of the operetta-like quality Eileen Brennan found in it, and delivers *Ribbons Down My Back* and *It Only Takes a Moment* with singular ease in a more current idiom. Cab Calloway is altogether right as the prosperous Horace Vandergelder, and Chris Calloway is winning as little Minnie Fay. The chorus and orchestra sound blander under Saul Schechtman's baton than they did when Shepard Coleman was at the helm, but the tunes and the big spectacle numbers such as *Put on Your Sunday Clothes* and *Before the Parade Passes By* are as persuasive as ever—not to mention the title song, with Pearl right up there greeting everybody within earshot, in a style to make the loneliest listener feel absolutely wanted.

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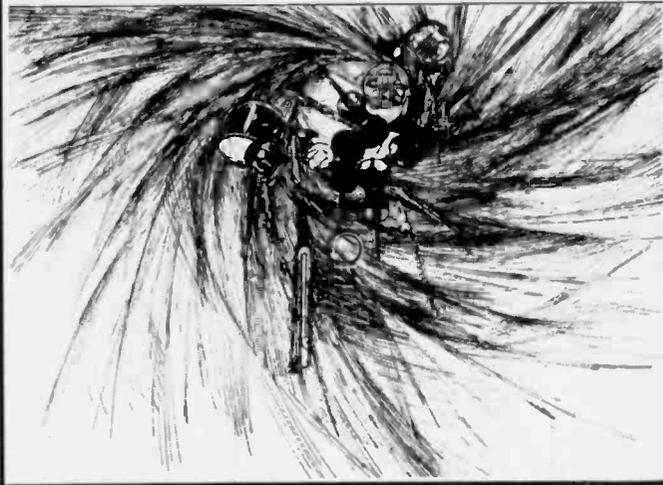
BEETHOVEN: Wellington's Victory (Battle Symphony) (excerpt from the first movement) Westminster • The recording emphasizes extreme directionality. It is a dramatic presentation engineered specifically for stereo reproduction.

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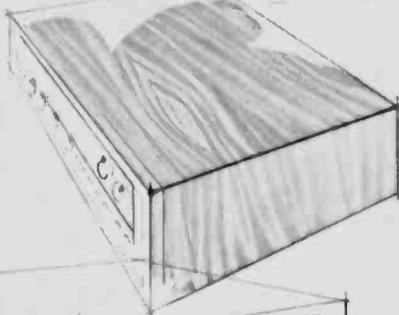
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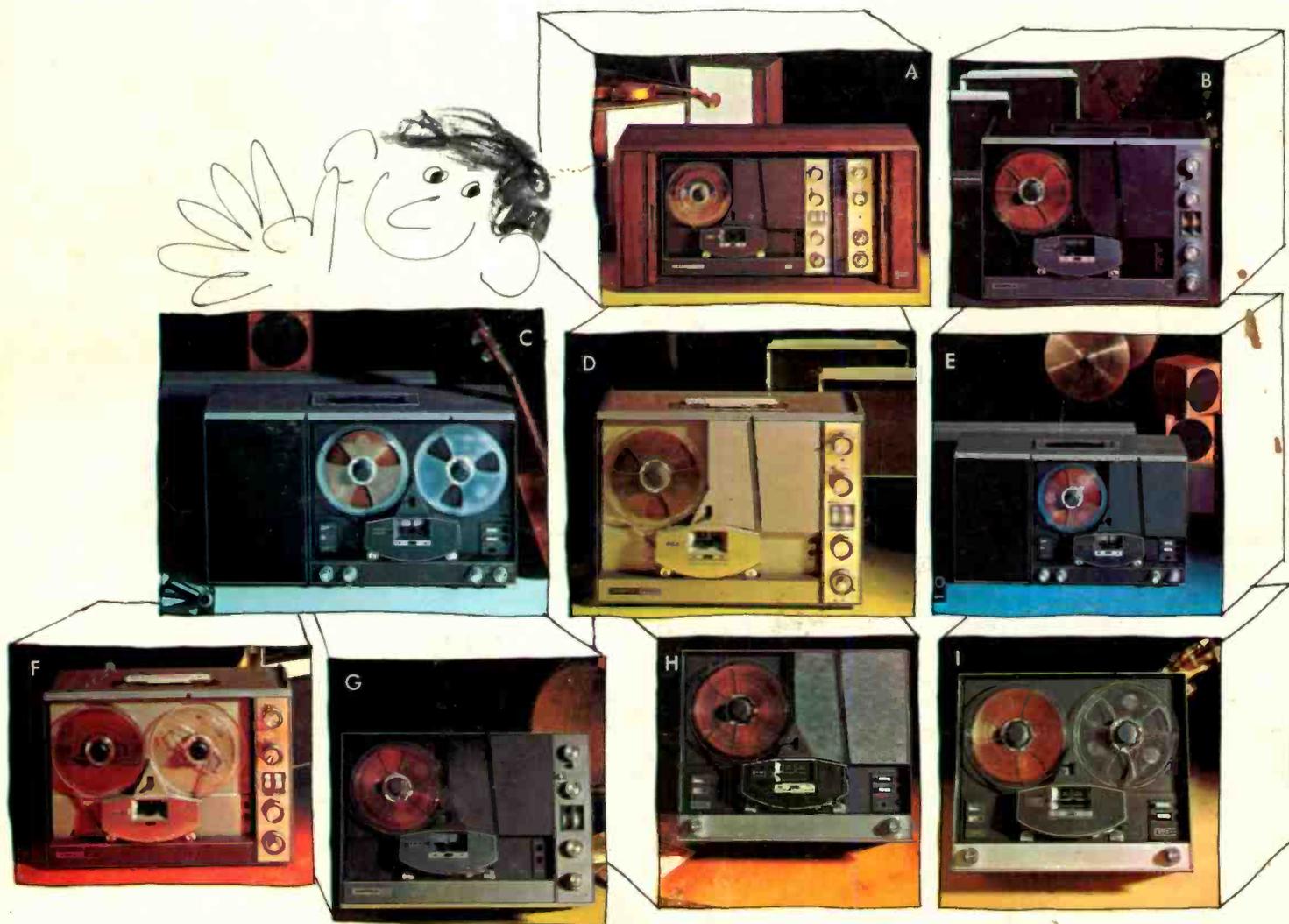
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ELK GROVE, ILLINOIS 60007



A. #985A stereo music center, player/recorder with automatic threading and reverse, stereo FM, FM/AM receiver, \$600* **B.** #2161 portable stereo player/recorder system, bi-directional recording, automatic threading and reverse, \$469* **C.** #761 tape monitor portable stereo player/recorder system, 3 heads, nesting cube speakers, 40 watts peak power, \$329* **D.** #1161 portable stereo player/recorder system, automatic threading and reverse, \$369* **E.** #1461 tape monitor portable

stereo player/recorder system, 4 heads, automatic threading and reverse, nesting cube speakers, 40 watts peak power, \$429* **F.** #861 portable stereo player/recorder system, \$249* **G.** #2150 stereo player/recorder deck, bi-directional recording, automatic threading and reverse, \$399* **H.** #1450 stereo player/recorder deck, 4 heads, tape monitor, automatic threading and reverse, \$299* **I.** #750 stereo player/recorder deck, 3 heads, tape monitor, \$199*. *Manufacturer's suggested list price.