

#### LABORATORY TEST REPORT ON Test and Evaluation of Various Phonograph Cartridges INTRODUCTION

At your request, we have measured the performance and evaluated groups of phonograph cartridges in various price categories. All of the cartridges are intended for professional use (e.g., in broadcast or recording studio applications) and were therefore judged somewhat differently from the manner in which we would evaluate phono cartridges intended for home high fidelity system use. Specifically, the relatively higher tracking forces recommended (and at which these cartridges were tested) is not regarded as a negative feature of the cartridges, but is neccessary in view of the heavy duty use of such pickups.

The cartridges were divided into three basic groups. Group I consisted of an Audio-Technica Model ATP-1, a Stanton Model 500AL, a Shure Bros. Model M44-7 and a Shure Bros. Model M44C. Group II consisted of an Audio-Technica Model ATP-2, a Stanton Model 600A and a Shure Bros. Model SC35C. Group III consisted of an Audio-Technica Model ATP-3 and a Stanton Model 681SE.

**TESTS AND METHODOLOGY** The most fundamental of all tests concerning a phono cartridge is its frequency response or, more properly, its amplitude versus frequency characteristic. All response measurements were made using a CBS Technology Center Test Record, #STR-130, which contains both spot frequencies and continuous frequency sweeps, and which has been recorded with the inverse of the RIAA playback curve so that, with cartridge output singnals fed to a correctly equalized phono preamplifer, a "perfect" phono cartridge would deliver flat response over the entire audio range.

All of the cartridges tested are of the moving magnet or moving iron type (as opposed to moving coil) and therefore require specific load impedances if they are to yield "flat" response. In all cases, we loaded the cartridges with 47,000 ohm resistances, and with that value of capacitance which yielded the flattest overall response. This seemed to be a fair approach, since the range of loading capacitances required for the various cartridges was very wide (up to 500 pF for some Shure Bros. models and as little as 275 for some of the Stanton models). Frequency response curves are presented as part of the report for each of the cartridge groups. We have also ranked the overall response of the cartridges within each test group. Frequency response rankings, as well as all of the other performance characteristics measured, are summarized in comparisons of performance of the cartridges within each test group.

Lateral and vertical IM distrotion measurements for each cartridge were made using a CBS Technology Center test record #STR-112. This same test disc was used to test each cartridge for square wave reproduction. A photocopy of the information contained on the jacket of this disc is included in this report as Appendix A, and should be read for a complete understanding of the meaning of the IM and square wave tests.

Trackability, a term originated by Shure Brothers, describes the ability of a given cartridge/stylus combin-

ation to properly trace or track heavily recorded passages in a recording. Shure Bros. has prepared a test disc which allows us to test for trackability in terms of stylus velocity (centimeters per second) at high, medium and low frequencies. This disc bears the catalog number TTR-103. Information regarding the contents of this disc and how it is used to determine trackability is contained in Appendix B, a photocopy of the user's manual which is included with the test disc. An alternate disc was also used to obtain a somewhat different measure of trackability, in which the ability of the cartridge to track a progressively louder lateral and vertical signal is expressed in decibels (dB).

Channel balance and nominal cartridge output levels were measured for each cartridge using Shure Brothers test record TTR-107 which contains separate left and right channel bands, each recorded at a velocity of 5 centimeters per second, at a frequency of 1 kHz. Cross-talk levels, expressed in dB, were also determined using this disc.

The durability ranking which we have applied to cartridges within each test group is based upon a subjective evaluation of the way in which each cartridge is constructed and the ruggedness of the stylus assembly of each of the cartridges. To be sure, all of the cartridges tested were designed for professional, rather than for home use and are therefore more ruggedly built than are the more delicate cartridge types intended for lightweight tracking forces and for installation in low mass arms. Nevertheless, in our view, certain of the cartridges tested seemed capable of withstanding more physical abuse than others, and we have ranked the

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Editor's Notebook

Here we are in a new year already and I still haven't sent out my Christmas Cards Screamer.

Have you ordered you NRSC updates yet? Everybody seems to be getting on the bandwagon and I think it's a real good thing for A.M. Radio which has become the stepchild in recent years.

Dave Metz is back with a new series this issue on Building a "Cart Machine" of all things.

We're hoping that 1988 brings you a prosperous new year.

Bob Stobel C.P. Editor



#### ELECTRONIC INDUSTRIES INCORPORATED 19 E. IRVING, OSHKOSH, WI 54901 OUT-OF-STATE

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#### NEWS RELEASE 25Hz Tone Processor Changes Hands

800-558-0222

Zercom Corporation of Merrifield, Minnesota has purchased the rights to manufacture and sell the M.W. Persons 25Hz Tone Processor. In announcing it, Zercom President Jeff Zernov said he was pleased to add the Tone Processor to the company's line of successful boardcast products. M.W. Persons will continue to market the Programmer 3A Live Assist Controller.

Zercom, a quality electroncis manufacturer, broke into broadcast equipment in 1981 with the purchase of the famous Maxi-Tel remote broadcast console. Since then, the product has evolved into the Max-Z and Max-ZII. Other products recently introduced include the Gain Box and Zercom's inexpensive Telephone Hybrid. The new Zercom 25Hz Tone Processor is available in the standard unbalanced audio version at \$390.00 or with active balanced inputs and outputs at \$460.00. The Tone Processor was originally intended as an automation interface for reel to reel music playback decks that do not contain 25 Hz switching tone detectors and filters. The Processor is also being used on satellite networks for station signaling.

For further information contact Jeff Zernov at 218-765-3151 or Mark Persons at 218-829-1326.

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#### (cont'd from pg. 1)

test cartridges in each group accordingly.

#### TEST RESULTS--GROUP I CARTRIDGES

The Audio-Technica ATP-1 ranked first in smoothness of frequency response characteristics. Though there was some attenuation at high frequencies for this cartridge, it exhibited virtually no severe resonant peaks such as the ones plotted for the Shure Bros. M44C, M44-7 and the Stanton 500AL. While the resonance peaks in these cartridges might well have been attenuated by different load impedances, such correction would have also resulted in severe dips in the response at frequencies just below ronance.

At all but the highest levels of recording (+18 dB), the Audio-Technica ATP-1 exhibited the lowest levels of lateral and vertical IM distortion. For example, at a + 15 dB level, lateral in for the ATP-1 measured 3.0% as against 6.6% for the Stanton 500AL, 7.0% for the Shure M44-7 and 6.0% for the Shure M44C. The ATP-1 was best of the group in terms of high frequency trackability (30 cm/sec), while at mid and low frequencies, the Stanton 500AL measured best (31.5 and 30 cm/sec respectively) over-all, while the Shure M44C did best at mid frequencies only (40 cm/sec).

At mid frequencies, the Audio-Technica ATP-1 exhibited the best channel separation (crosstalk); 28.9 dB, as opposed to 27.9 dB for the Shure M44-7, 25.4 for the Shure M44C and 23.5 dB for the Stanton 500AL. The Audio-Tehnica ATP-1 ranked first in square wave response capability, with least evidence of overshoot and ringing. As for overall durability, we ranked both the Shure M44C and the Audio-Technica ATP-1 in first place, followed by the Stanton 500AL (third place) and the Shure M44-7 (fourth place).

We would rate the Audio-Technica ATP-1 as the best of this group in overall performance and durability, with the Stanton 500AL and the Shure M44C equally ranked for second place.

#### TEST RESULTS--GROUP II CARTRIDGES

In this group of cartridges, consisting of an Audio-Technica ATP-2, a Stanton 600A and a Shrue Bros. SC35C, the Audio-Technica Model ATP-2 was rated as having the smoothest frequency response, with the Shure Model SC35C equally ranked, and the Stanton 600A taking third place in this important specification. The Stanton 600A exhibited lower IM distortion levels, both in lateral and vertical modulation tests, with the Audio-Technica ATP-2 ranked second and the Shure unit ranked third. The Audio-Technica ATP-2 ranked highest with respect to high frequency, mid frequency and low frequency trackability. The Shure SC35C ranked second in high frequency trackability, while both the Shure and the Stanton models were identical in mid and low frequency trackability (25 cm/sec at mid frequencies as against 31.5 cm/sec for the Audio-Technica ATP-2, and 19 cm/sec at low frequencies as against 24 cm/sec for the ATP-2).

The Shure SC35C exhibited the best channel balance for this group (0.3 dB difference between channels), followed by the Stanton 600A (0.5 dB) and the Audio-Technica ATP-2 (0.8 dB). The Audio-Technica ATP-2 exhibited the best channel separation (26.1 dB at mid frequencies) compared with 23.9 dB for the Stanton 600A and 20.6 dB for the Shure SC35C.

Best square wave response for this group was exhibited by the Stanton 600A, followed by the Audio-Technica ATP-2 and the Shure SC35C in that order. We rated the ATP-2 and the Stanton 600A as being equal in terms of durability and ruggedness, with the Shure SC35C ranked somewhat lower in this respect.

We would rank the Audio-Technica and the Stanton models as being approximately equal, on an overall basis, since the higher trackability of the ATP-2 is offset by the lower IM distortion of the Stanton 600A.

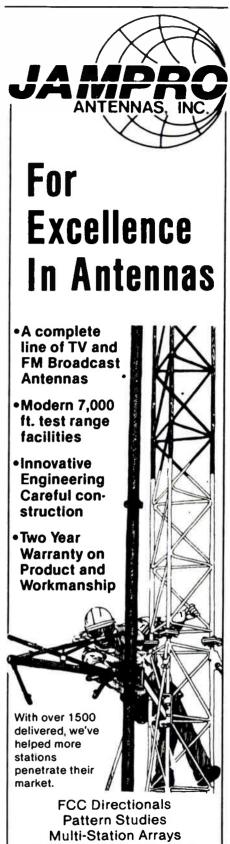
#### TEST RESULTS--GROUP III CARTRIDGES

This group of cartridges included an Audio-Technica ATP-3 and a Stanton 681SE. The Audio-Technica ATP-3 proved to have a somewhat smooth response although both samples exhibited excellent overal response.

The Stanton 681SE proved to have the lower IM distortion, for both lateral and vertical IM tests. While the Audio-Technia sample was poorer in trackability at high frequencies, it equalled the Stanton 681SE in mid and low frequency trackability. In terms of channel balance the Audio-Technica cartridge ranked first (0.5 dB for the ATP-3 and 1.0 dB for the Stanton 681SE), and first in channel separation; the Audio-Technica ATP-3 had a separation of 27.0 dB at 1 kHz, while the Stanton 681SE had a separation of 26.2 dB.

The Audio-Technica ATP-3 delivered the most accurate square wave, followed by the Stanton 681SE. As for durability, we would rank the ATP-3 and the Stanton 681SE equally. On the basis of performance alone, the ATP-3 is the winner in this group.





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#### Senate Kills Transfer Tax in Response to NAB Grassroots

In decisive victory for broadcasters, the U.S. Senate Thursday night defeated industry-opposed tax on broadcast station transfers 66-28. after fairness doctrine codification had been dropped from proposal by transfer tax author Sen. Ernest Hollings (D-SC). Key floor vote followed debate against transfer tax by: Sen. John Danforth (R-MO); Finance Committee Chairman Lloyd Bentsen (D-TX); Sen. Bob Packwood (R-OR); Sen. Pete Domenici (R-NM). ranking minority member of Budget Committee, and others. Key argu-ments against transfer "fee" included the inappropriate manner in which proposal was introduced by Commerce Committee Chairman Hollings, without hearings, and after committee's own deadline for markups.

Floor vote was remarkably close to estimate made by NAB lobbyists Thursday morning. Industry victory followed several weeks of one of the most intense, multi-faceted and unified NAB broadcaster lobby campaigns in the industry's history. Hollings' station transfer "fee" (clearly viewed as a "tax" by broadcasters and most lawmakers) sought to impose minimum of 2% tax on a station transfer, with additional 2% for stations changing hands in under three years, and additional 1% tax if a station was found to have "violated" fairness doctrine, which original proposal would have "violated" fairness doctrine, which original proposal would have codified. (Fairness codification is still pending in House-passed Continuing Resolution.)

After two years, revenue raised by tax was to be earmarked for public broadcasting. NAB, which has long advocated long-range funding for public colleagues, said such a method of funding at the expense of commercial broadcasters was ill-advised; better funding methods should be pursued, NAB said, with full hearings in next session of Congress.

#### Jules Cohen to Receive NAB Engineering Award

WASHINGTON, Dec. 11--The National Association of Broadcasters' Engineering Conference Committee has selected Jules Cohen, president, Jules Cohen & Associates, Washington, DC, to receive NAB's Engineering Achievement Award. Cohen will receive the award at the Saturday, April 9, engineering luncheon during NAB's annual convention April 9 - 12 at the Las Vegas Convention Center.

Committee Chairman T. Arthur Bone, vice president, engineering, Knight-Ridder Broadcasting, Inc., East Providence, RI, said, "Jules is considered an engineer's engineer and is held is high regard throughout the broadcast industry. This award honors him for a tremendous number of contributions over a forty-year career."

Following his release from the Navy, Cohen entered the field of consulting engineering and has been in that profession for 42 years. During 35 of those years, he has been either sole principal, a partner, or an officer in a consulting engineering firm. His work has included propagation studies, interference design and adjustment, satellite earth station studies, the planning and placement of communications structures, radio and TV studio and transmitter plant layouts, and extensive work involving the engineering aspects in Federal Communications Commission rules.

He was the author of Appendix C of the Cable Television Advisory Committee Panel II report to the Commission. The report dealt with the problem of echoes in television systems. As chairman of the engineering committee concerned with interference to TV broadcasting from noncommercial FM stations, he played a major role in the development of the rules adopted by the FCC governing the assignment of FM stations in the frequency band from 88.1 to 91.9 MHz.

He represented television broadcast interests as co-chairman of the Technical Analysis Working Group of the Land Mobile Radio/UHF Television Technical Advisory Committee. He represented radio broadcast interests in fighting the 1979 proposals to reduce AM channel spacing to 9 kHz. During the past ten years, he has worked extensively in the field of nonionizing radiation effects.

Cohen has a B.S. degree in electrical engineering from the University of Washington, Seattle. He is a member of Tau Peta Pi, the engineering scholastic honorary; the National Society of Professional En-

gineering; the Institute of Electrical and Electronic Engineers; the Society of Motion Picture and Television Engineers; the Bioelectromagnetics Society; the Electromagnetic Energy Policy Alliance, and is a past president of the Association of Federal Communications Consulting Engineers.

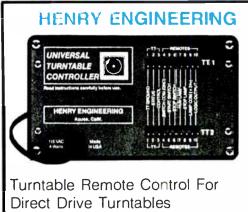
NAB serves a membership of more than 5,000 radio and 940 television stations, including all the major networks.

#### NRSC Stations...From Indiana, (Pennsylvania) to Elkhart, (Indiana)

NAB salutes these AM stations that have recently adopted the new NRSC Standard:

KOTZ, Kotzebue, AK; KAMJ, Phoenix; KSFO, San Francisco; KTIM, San Rafael, CA; KFIY, Tulare, CA; KLMR, Lamar, CO; WBGC, Chipley, FL; WFAM, Augusta, GA; WLSQ, Dalton, GA; WMAY & WCVS, Springfield, IL; WTRC, Elkhart, IN; KWLO, Waterloo, IA; WTAG, Worcester, MA; WHMI, Howell, MI: WLRC, Walnut, MS; KTTT, Columbus, NE; KCBN & KPLY, Reno, NV; WGIR, Manchester, NH; WCTC, New Brunswick, NJ; WKYK, Burnsville, NC; WKGX, Lenoir, NC; WNNC, Newton, NC; KNDC, Hettinger, ND; KCCS, Salem, Or; WCCS, Indiana, PA; WLBR, Lebanon, PA; WIEZ, Lewistown, PA; WRSC, State College, PA; WILK, Wilkes-Barre, PA; WWAZ, Providence, RI; WGOW, Chattanooga, TN; KQRO, Cuero, TX; KQSA, San Angelo, TX; WJOY, Burlington, VT; WKZN, Crozet, VA; WTAR, Norfolk, VA; WVWI, St. Thomas, VI; KELA, Centralia, WA; WWVA, Wheeling, WV.

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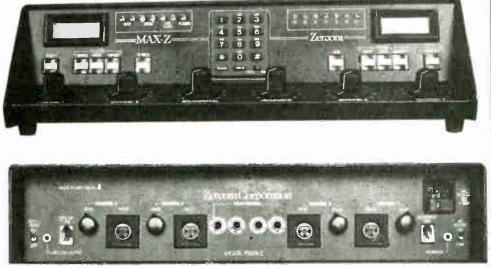


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#### AM STEREO EXCITERS Delta Motorola

#### ALIGNMENT TAPES

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Line/Distribution ATI **Audio-Metrics** Conex LPB Micro-Trak **Radio Systems** Ramko Russco Shure Tellabs **Power Amplifiers** Bogen Crown Micro-Trak Ramko Russco Soundcraftsman **Symetrix** Urei

#### **ANTENNAS**

Annixter-Mark Bogner Celwave ERI Jampro LBA Scala

#### **AUDIO CONSOLES**

Arrakis ATI Audio Technica Autogram Broadcast Electronics Electro Voice/Tapco Howe LPB Micro-Trak Radio Systems Ramko Russco Sennheiser Shafer Shure Soundcraft Tapecaster Tascam TOA Urei

#### AUDIO PROCESSORS Audisar Sescom Stancor

#### **BROADCAST LINE CARD**

AUDIO PROCESSORS (Cont.) Aphex ATI **Broadcast Electronics** CRL DBX Dorrough Energy-Onix Eventide Inovonics JBL/Urei LPB Marti Modulation Sciences **Orban Optimod** Ramko Symetrix Texar Urei Valley People

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AKG Atlas Atus **Audio-Metrics Electro Voice** Luxo Shure

MONTIORS Belar Delta Gorman-Redlick Inovonics Potomac TFT



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#### RECORDING TAPE Ampex Audiopak Fidepac

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#### REMOTE PICKUP EQUIP.

Celwave (Antennas) GLB (Preselectors) Marti Scala (Antennas)

#### REMOTE CONTROL

Advanced Micro-Dynami s Delta Gentner Marti otomac Symetrix TFT

#### SCA EQUIPMENT

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# STUDIO-TRANSMITTER

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Broadcast Electron Dynamax Key Cart Otari Ramko Tapecaster

#### TAPE ERASERS & ACCESSORIES Broadcast Electronics Editall Fidelipac Garner Nortronics (Heads) R.B. Annis

#### TAPE RECORDERS & PLAYERS Fostex Otari Revox Studer Tascam/Teac Tape-A-Thon

Technics

#### TELEPHONE INTERFACES Audio-Metrics Comrex

ESE Gentner Russco Symetrix Telex Tellabs Zercom

#### TEST EQUIPMENT

Autogram B & K Coaxial Dynamics Digi-Max Electro Impulse Fidelpac Fluke Potomac Sennheiser Simpson Tektronix Xedit

#### TONE ARMS

Audio-Metrics Audio Technica Broadcast Electronics LPB Micro-Trak Russco Technics

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#### TURNTABLE PREAMPS

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1	NS-9203 Heads	34.25				
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1	NS-9223 Heads	33.88				
1	NS-9226 Heads	33.88				
2	NS-CH3NB Contactor Head NS-QM-704 10 pack	16.18 4.00				
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2	NS-QM-703 10 pack	4.00				
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2	NS-CC-70 Plug	4.30 3.25				
1 2 3 4 2	NS-CC-77 Connector NS-TC-54 Clips	4.10				
4		6.58				
2	NS-TC-191 Clips NS-QK-18 Mounting Assy	13.23 1.33				
1	NS-QK-19 Mounting Assy	1.33				
1	NS-QK-38 Mounting Assy	1.15				
	NS-QK-66 Mounting Assy	1.15				
1 5 2 4	NS-QK-74 Mounting Assy NS-QK-79 Mounting Assy	2.38 1.85				
	NS-QK-93 Mounting Assy	1.85				
4	NS-QK-94 Mounting Assy	7.20				
6 15	NS-QK-95 Mounting Assy NS-QK-102 Mounting Assy	3.48 3.73				
1	NS-QM-102 Head Cleaner	3.75				
3	NS-AT-210 Alignment Tape	3.87				
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<ol> <li>2 SJ-35J0001 Knob</li> <li>2 SJ-37J0001 Control</li> <li>6 SJ-58J0002 Octal Socket</li> </ol>	.38
6 SJ-58J0002 Octal Socket	1.11
<ol> <li>SJ-66J0092B Transformer</li> <li>SJ-C-2 Compressor</li> </ol>	34.71
2 SJ-C-2 Compressor	22.75
1 SJ-HP-1 High Pass Filter	18.80
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2 SJ-LA-4 Line Amp	42.50
1 SJ-LP-1 Low pass Filter	19.33
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1 SJ-MIC-5 Microphone	20.00
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1 SJ-NAB-2 Tape Pre-Amp	16.50
1 SJ-NAB-3 Tape Pre-Amp	16.50
1 SJ-PA-2 Power Amp	37.00
<ul> <li>2 SJ-PA-3 Power Amp</li> <li>3 SJ-PH-2 Magnetic Phono Pre-A</li> <li>2 SJ-PS-1 Power Supply</li> <li>2 SJ-SA-2 Pre-Amp</li> <li>2 SJ-SF-1 Shelving Filter</li> <li>2 SJ-SWO-2 Oscillator</li> <li>4 SJ-TC-2 Tone Control</li> <li>6 SJ-MI-8 Audio Transformer</li> </ul>	41.75
3 SJ-PH-2 Magnetic Phono Pre-A	Amp 16.50
2 SJ-PS-1 Power Supply	28.09
2 SJ-SA-2 Pre-Amp	16.50
2 SJ-SF-1 Shelving Filter	16.50
2 SJ-SWO-2 Oscillator	22.88
4 SJ-TC-2 Tone Control	11.67
6 SJ-MI-8 Audio Transformer	13.00
<ul> <li>3 SJ-MI-22 Audio Transformer</li> <li>2 SJ-MI-53 Audio Transformer</li> </ul>	13.00
2 SJ-MI-53 Audio Transformer	9.75
1 SJ-MI-59 Audio Transformer	4.67
6 SJ-MI-69 Audio Transformer	12.25
2 SJ-MI-71 Audio Transformer 1 SJ-MI-75 Audio Transformer 2 SJ-MI-76 Audio Transformer 5 SJ-MI-82 Audio Transformer	9.90
1 SJ-MI-75 Audio Transformer	12.25
2 SJ-MI-76 Audio Transformer	12.25
	15.37
1 SJ-MI-93 Audio Transformer	12.25
1 SJ-MI-94 Audio Transformer	12.25
6 SJ-MI-112 Audio Transformer	12.25
1 SJ-RP-3 Audio Transformer	20.00

.

# ATARI PARTS INVENTORY CLOSE—OUT

1         AF-C018124 Flex circuit         1.57         4         AF-C012084 Boot         .49           1         AF-C01108 Hole cove label         .25         5         AF-C018128 Aux         .49           1         AF-C01138 Characterian         .25         5         AF-C01177 Crystal         .19           1         AF-C011310 Tatch spring         .25         3         .47-C010173 Crystal         .19           1         AF-C01201 Latch spring         .25         3         .47-C010173 Crystal         .19           1         AF-C01201 Latch spring         .25         3         .47-C010180 Crystal         .19           1         AF-C01201 Latch spring         .25         3         .47-C010180 Crystal         .19           1         AF-C01201 Latch spring         .25         .47-C01209 Crystal         .19         .50           2         AF-C01208 Dr Experime         .30         .3         .47-C012260 Cr         .13           2         AF-C01288 Hole Hole crystal         .149         .47-C012260 Cr         .13           3         AF-C01289 Fire button         .30         .3         .47-C012260 Cr         .39           3         AF-C01289 Fire button         .30         .47-C012260 Cr         .39	QTY	DESCRIPTION	PRICE	QTY	DESCRIPTION	PRICE
1         AF-CO14106 Hole cover label         25         3         AF-CO18128 Kauss, Function Keys         .60           1         AF-CO1298 Heartshiname plate         1.56         3         AF-CO10177 Crystal         .109           1         AF-CO1178 Constrain hame plate         .25         3         AF-CO10171 Crystal         .66         .60           1         AF-CO1298 Learnshield         .41         1         AF-CO10105 IC 6507         .497           1         AF-CO12991 Learnshield         .41         1         .60005         .50           1         AF-CO12901 Learnshield         .43         8         .47-CO10150 IC 6507         .497           1         AF-CO12901 Learnshield         .49         1         .47-CO10150 IC 6507         .50           2         AF-CO12017 Crystal         .4000         .50         .50         .50         .50           1.0         AF-CO12017 Crystal         .4000         .50         .51         .47-CO1239 IC         .51         .51           2.0         AF-CO1299 IC         .53         .47-CO1239 IC         .52         .51         .47         .51         .47           2.0         AF-CO1299 IC         .53         .47         .51         .47				10	AF-CO12241 Channel Select Switch	
1         AF-C01298 Heatsinh name plane         1.36         3         AF-C010174 IC INS06         .60           1         AF-C01470 Lot for spring         25         3         AF-C01074 IC INS06         .60           1         AF-C01483 Inner shield         .41         1         AF-C01074 IC INS06         .60           1         AF-C01278 Rear Shield         .43         8         AF-C01074 IC INS06         .60           1         AF-C01278 Rear Shield         .43         8         AF-C01081 IC ISS         .717           1         AF-C01299 I Iens         N/A         2         AF-C01081 IC ISS         .80           2         AF-C01239 I Ire button         .30         3         AF-C012296 IC ISS         .80           3         AF-C0188 I ISS         3         AF-C012296 IC ISS         .80         .80           3         AF-C0188 I ISS         3         AF-C01298 IC ISS         .80         .29           4         AF-C01487 Interoix switch         .16         .30         .4         .40         .29           4         AF-C01488 Index testifter         .39         .4         .4F-C01289 IC ISS         .39           4         AF-C01488 Index testifter         .39         .4         .4F	1	AF-CO18124 Flex circuit	1.57	4		
AF-CO1470 Latch spring         123         3         AF-CO1074 (C1)N0866         60           AF-CO1788 Constrained         41         1         AF-CO10741 (C1)N086         60           T         AF-CO1788 Rear Shield         1.63         8         AF-CO10150 (C 5607         4.97           T         AF-CO12791 Lens         N/A         2         AF-CO10150 (C 5607         4.97           T         AF-CO12791 Lens         N/A         2         AF-CO10150 (C 5607         4.97           T         AF-CO12791 Rear Shield         1.48         AF-CO10150 (C 64050         .50           AF-CO12500 (Fre button         3.0         3         AF-CO12290 (IC         1.109           AF-CO1388 Dided IN 5391         .25         3         AF-CO12290 (IC         6.70           AF-CO14387 Dided IN 5391         .25         3         AF-CO12290 (IC         4.33           AF-CO14387 Dided IN 5391         .25         3         AF-CO12399 (IC         3.93           AF-CO14387 Dided Eventment         1.16         3         AF-CO12399 (IC         3.93           AF-CO14388 Dided erettifier         .39         4         AF-CO12399 (IC         3.93           AF-CO14388 Dided erettifier         .30         AF-CO14391 (IC         5.85	1	AF-CO14106 Hole cove label	.25	5	AF-CO18128 Aux. Function Keys	
1         AF-CO1434 Inner shield         .41         1         AF-CO1045 IC 657         4.97           1         AF-CO1278 Res Shield         I.63         8         AF-CO10745 IC 6532         7.17           1         AF-CO1278 Res Shield         I.63         8         AF-CO1085 IC 6532         7.17           1         AF-CO1290 I Lens         N/A         2         AF-CO10816 IC 6532         7.17           1         AF-CO1290 I Lens wild state         15.00         8         AF-CO1290 IC 53.20         5.80           2         AF-CO1280 I Fire button         .30         3         AF-CO1299 IC 53.20         5.80           6         AF-CO1280 I Fire button         .30         3         AF-CO1299 IC 53.20         5.80           7         AF-CO14386 Inductor         .25         3         AF-CO1299 IC 53.20         5.80           7         AF-CO14387 Interfacts witch         1.15         3         AF-CO1299 IC 53.20         3.93           4         AF-CO14387 Interfacts witch         1.15         3         AF-CO1239 IC 33.33         3.93           4         AF-CO14387 Interfacts witch         1.15         3         AF-CO1239 IC 55.20         3.85           5         AF-CO14183 Interfacts witch         1.13	1		1.36			
AF-CO1279 Rear Shidd         1.63         8         AF-CO10190 I C 6502         4.97           1         AF-CO1290 I Ens         N/A         2         AF-CO10190 I C 6532         7.17           1         AF-CO1290 I Ens         N/A         2         AF-CO10180 I C 6532         7.17           1         AF-CO1200 I Ens         N/A         2         AF-CO1200 I Ens         N/A           2         AF-CO1212 I 2-Key switch set         1.49         1         AF-CO1290 I C         5.80           6         AF-CO1200 I Ens tonton         .30         3         AF-CO1290 I C         5.30           0         AF-CO1290 I C         .51         3         AF-CO1290 I C         4.33           5         AF-CO1498 Enservich         1.15         3         AF-CO1299 I C         3.33           4         AF-CO1498 Enservich         .50         4         AF-CO1499 I C 6520         3.43           5         AF-CO1478 Enservich         .40         2         AF-CO1479 I C 6520         3.45           6         AF-CO1478 Enservich         .40         2         AF-CO1479 I C 6520         3.45           6         AF-CO1478 Enservich         .40         2         AF-CO1478 I C 6520         3.45	1	AF-CO14170 Latch spring	.25	3	AF-CO10174 IC IN3086	
1         AF-CO1278 Rear Shield         1.63         8         AF-CO10150 IC 6507         4.97           1         AF-CO1299 Lens         N/A         2         AF-CO1016 IC 4050         .50           1         AF-CO1201 Relay solid date         15.10         8         AF-CO1811 IC 4050         .50           1         AF-CO1812 L2-Key switch set         1.49         1         AF-CO1299 IC         .50           6         AF-CO12080 IF rebutton         .30         3         AF-CO12980 IC         .13.94           20         AF-CO13980 Dover switch         .15         3         AF-CO1299 IC         4.35           5         AF-CO14397-01 Power switch         1.15         3         AF-CO1299 IC         4.35           4         AF-CO14397-01 Power switch         1.60         2         AF-CO1299 IC         3.33           4         AF-CO14780 Dover switch         1.80         4         AF-CO14780 IC         3.35           5         AF-CO14780 IC concortor leader         1.28         2         AF-CO14780 IC         3.35           5         AF-CO14780 IC concortor leader         1.28         2         AF-CO14780 IC         3.45           6         AF-CO14780 IC concortor leader         1.28         2	i		.41	1	AF-CO10444 IC	
1         AF-CO12991 Lens         N/A         2         AF-CO10816 IC 6532         7.17           1         AF-FC010321 Load pad assy.         2.86         4         AF-CO10816 IC 6505         .50           2         AF-CO112032 Load pad assy.         2.86         4         AF-CO12099 IC         5.80           1         AF-FC012090 Fire button         .30         3         AF-CO122940 IC         1.19           10         AF-CO12396 Inductor         .25         1         AF-CO122960 IC         6.70           10         AF-CO14386 Inductor         .25         3         AF-CO12990 IC         5.39           4         AF-CO14396 Cover         .75         2         AF-CO12990 IC         3.93           3         AF-CO14387 Intendox witch         1.60         2         AF-CO12990 IC         3.93           4         AF-CO14787 diode de         .40         2         AF-CO14771 C 6502         3.85           6         AF-CO14777 diode Ied         .30         4         AF-CO14777 IC 6502         3.85           6         AF-CO14777 diode Ied         .30         2         AF-CO14777 IC 6502         3.85           6         AF-CO14777 diode Ied         .40         2         AF-CO14777 IC 6502	1		1.63	8	AF-CO10745 IC 6507	
1         AF-COI 4704         Relay solid date         15.10         8         AF-COI 8137 Ti C         N/A           2         AF-COI 8126         12-Key switch set         1.49         1         AF-COI 8137 Ti C         N/A           2         AF-COI 8126         12-Key switch set         1.49         1         AF-COI 2019 File         11.09           10         AF-COI 828         Inductor         .25         1         AF-COI 2016 C         13.94           20         AF-COI 1828         Inductor         .25         1         AF-COI 2016 C         .57           21         AF-COI 4897 of 10-wer switch         1.15         3         AF-COI 4899 IC         .53           3         AF-COI 4898 of doer rectifier         .30         4         AF-COI 4898 IC         .37           3         AF-COI 47818 Of doer rectifier         .30         4         AF-COI 4788 IC         .37           4         AF-COI 4781 Oracle rectifier         .30         4         AF-COI 4788 IC         .37           5         AF-COI 4781 Oracle rectifier         .38         .48         .48         .47         .47         .38           6         AF-COI 4781 Oracle 126         .48         .47         .47         .48	1		N/A	2	AF-CO10150 IC 6532	
1         AF-FA100021 0.ad pad assy.         2.86         4         AF-CO12090         N/A           2         AF-CO18126 1/-key switch set         1.49         1         AF-CO12296 IC         5.80           6         AF-CO18200 Fire button         .30         3         AF-CO12296 IC         13.94           20         AF-CO12386 Ibide 1N 5391         .25         3         AF-CO12396 IC         6.70           10         AF-CO14387 Influction         .75         2         AF-CO12399 IC         5.39           3         AF-CO14397 Concertor passitch         1.60         2         AF-CO12399 IC         3.93           4         AF-CO14378 Concertor passitch         1.60         2         AF-CO12399 IC         3.93           3         AF-CO14378 Concertor passitch         1.60         2         AF-CO12399 IC         3.93           4         AF-CO1477 diade Id         .40         2         AF-CO14379 IC 6502         7.40           5         AF-CO14778 diade Id         .40         2         AF-CO14379 IC 6502         7.40           6         AF-CO14778 diade Id         .39         2         AF-CO14379 IC 6502         7.40           6         AF-CO14780 IS Giade Id         .40         1         AF		AF-CO14704 Relay solid state	15.10	8	AF-CO10816 IC 4050	.50
2         AF-CO18126 12-Key switch set         1.49         1         AF-CO1299 IC         5.80           10         AF-CO1296 IC         11.09           10         AF-CO1236 IC         13.94           10         AF-CO1236 IC         6.70           10         AF-CO1236 IC         6.70           10         AF-CO1236 IC         6.70           11         AF-CO1236 IC         5.70           12         AF-CO1237 ID-Power switch         1.15         3         AF-CO12399 IC         3.93           3         AF-CO14387 Interlock switch         1.60         2         AF-CO12399 IC         3.93           3         AF-CO1478 ID-Onexer switch         1.89         4         AF-CO14780 ID         3.93           3         AF-CO1478 ID-Connector Power jack         .89         4         AF-CO14780 ID         3.85           6         AF-CO14780 ID-Connector Power jack         .89         4         AF-CO14780 ID         3.85           6         AF-CO14780 ID-Connector Power jack         .40         4         AF-CO14780 ID         3.85           6         AF-CO14780 ID-Connector Power jack         .40         4         AF-CO14780 ID         3.85           6         AF-CO14780 SO ID <td>1</td> <td></td> <td>2.86</td> <td>4</td> <td>AF-CO14377 IC</td> <td></td>	1		2.86	4	AF-CO14377 IC	
6         AF-C02091 Fire buttom         30         3         AF-C012991 IC         11.09           10         AF-CO1388 (Node IN 5391         25         1         AF-C012296 IC         6.70           10         AF-CO1388 (Node IN 5391         25         3         AF-CO12296 IC         6.70           10         AF-CO14387 (Interlock switch         1.60         2         AF-CO12399 IC         5.39           4         AF-CO14381 (Interlock switch         1.60         2         AF-CO12399 IC         3.93           3         AF-CO14375 (Interlock switch         1.60         2         AF-CO12399 IC         3.93           3         AF-CO14775 (Interlock switch         1.60         2         AF-CO14775 (Interlock switch         3.93           3         AF-CO14775 (Interlock switch         1.89         4         AF-CO14775 (Interlock switch         3.85           6         AF-CO14778 (Interlock switch         1.40         2         AF-CO14797 (Interlock switch         3.85           5         AF-CO14780 IC         1.126         3         AF-CO14790 IC         3.85           6         AF-CO14780 IS         1.00         1         AF-CO14790 IC         3.85           6         AF-CO14781 IN         1.01			1.49	1	AF-CO12099 IC	
10         AF-CO1236         1         AF-CO12260         1C         6.70           10         AF-CO17388         FORDers witch         1.5         3         AF-CO12399         1C         4.35           10         AF-CO14397         Interlock switch         1.15         3         AF-CO12399         IC         5.29           4         AF-CO14387         Interlock switch         1.60         2         AF-CO12399         IC         3.93           3         AF-CO14387         Interlock switch         1.60         2         AF-CO14399         IC         3.93           3         AF-CO1478         IConnector power jack         89         4         AF-CO14798         IC         3.85           6         AF-CO1478         IConnector power jack         89         4         AF-CO14798         IC         3.85           6         AF-CO1478         IConnector leader         1.28         2         AF-CO1479         IC         3.85           6         AF-CO14780         IC         1.85         3         AF-CO14808         IC         1.85           7         AF-CO14808         IC         1.4520         IC         1.85           7         AF-CO14808			.30	3	AF-CO12294 IC	
20         AF-C01298 Didde IN 391         .25         3         AF-C01296 IC         6.70           10         AF-CO14397-01 Power switch         1.15         3         AF-CO12499 IC         5.39           4         AF-CO14397-01 Power switch         1.60         2         AF-CO12399 IC         3.39           4         AF-CO14398 diode recifier         .50         4         AF-CO12399 IC         3.39           5         AF-CO14718-01 Connector power jack         .89         4         AF-CO12399 IC         3.39           6         AF-CO14718-01 Connector leader         1.28         2         AF-CO14707 IC 6502         7.40           5         AF-CO14778-03 Socket         .40         2         AF-CO14370 IC 6502         7.40           5         AF-CO14780 diode         .40         1         AF-CO14389 IC 651C         11.26           6         AF-CO14808.05 diode         .40         1         AF-CO14381 IC 50         5.0           6         AF-CO14808.05 diode         .40         1         AF-CO14382 IC 141532         .60           7         .60         AF-CO14302 IC 74509         .60         .60         .74         .74           7         .60         AF-CO14304 IC 7465138         .90		AF-CO14384 Inductor	.25	1	AF-CO122960 IC	
10       AF-CO11399 IC       4.35         5       AF-CO11399 ID       5.29         4       AF-CO14387 Interlock switch       1.60       2       AF-CO12399 IC       3.93         3       AF-CO14387 Interlock switch       1.60       2       AF-CO12399 IC       3.93         3       AF-CO14715 Connector power jack       .89       4       AF-CO12399 IC       3.93         3       AF-CO14715 Connector power jack       .89       4       AF-CO14715 IC 6520       7.40         5       AF-CO14771 diode led       .40       2       AF-CO14717 IC 6502       7.40         5       AF-CO14808.01 diode       .40       1       AF-CO14805 IC 1       11.26         6       AF-CO14808.01 diode       .40       1       AF-CO14802 IC 141512       .60         6       AF-CO14808.01 diode       .40       1       AF-CO14802 IC 141512       .60         6       AF-CO14808.01 diode       .40       1       AF-CO14803 IC 141512       .60         6       AF-CO14808.01 diode       .40       1       AF-CO14301 IC 141512       .60         7       AF-CO14808.01 diode       .40       1       AF-CO14301 IC 141512       .60         7       AF-CO1490.01 CM314		AF-CO17988 Diode IN 5391	.25		AF-CO12296 IC	
4       AF-CO14397 Interlock switch       1.60       2       AF-CO12399 IC       3.93         4       AF-CO14398 diode rectilier       .50       4       AF-CO12399 IC       3.93         3       AF-CO14718-O1 Connector power jack       .89       4       AF-CO14795 IC 6520       3.85         6       AF-CO14718-O1 Connector power jack       .89       4       AF-CO14795 IC 6520       3.85         6       AF-CO14778-03 Socket       .54       3       AF-CO14780-01 diode       .40       1       AF-CO14805 IC       11.25         5       AF-CO14000-01 diode       .40       1       AF-CO14805 IC       11.25       .60         6       AF-CO14800-05 diode       .40       4       AF-CO14805 IC       11.25       .60         6       AF-CO16100 Crystal       1.39       2       AF-CO14805 IC       .138       .81         8       AF-CO17994 Switch static strip       N/C       2       AF-CO14341 IC 7465138       .90         2       AF-CO17949 Switch static strip       N/C       2       AF-CO14441 IC 7465138       .90         2       AF-CO17949 Switch static strip       N/C       2       AF-CO14449 Voltage Reg.       .100         2       AF-CO17101 IC CM 2917 <td< td=""><td></td><td>AF-CO14396 Cover</td><td>.75</td><td></td><td>AF-CO11299 IC</td><td></td></td<>		AF-CO14396 Cover	.75		AF-CO11299 IC	
A = CO14398 diode rectifier $S0$ 4         AF-CO12399 IC         3.93           3         AF-CO14715 Connector power jack $S9$ 4         AF-CO147019 Resider Kit         N/C           2         AF-CO14718-01 Connector leader         1.28         2         AF-CO14771 Globeled         7.40           5         AF-CO1478-03 Socket         .54         3         AF-CO14805 IC         11.26           5         AF-CO14808-01 diode         .40         1         AF-CO14805 IC         11.26           6         AF-CO14808-06 diode         .40         4         AF-CO14805 IC         11.26           6         AF-CO14808-06 diode         .40         4         AF-CO14808-07         .50           10         AF-CO1636 diode IN S818         .91         1         AF-CO14808-07         .50           2         AF-CO17995 wich static strip         N/C         2         AF-CO14818-07         .60           2         AF-CO17948 wich static strip         N/C         2         AF-CO14848 Voltage Res.         .80           2         AF-CO17910 IN PT 592         .1.38         9         AF-CO14848 Voltage Res.         .80           2         AF-CO17101 IN PT 592         .1.38         9 <td< td=""><td>5</td><td>AF-CO14397-01 Power switch</td><td>1.15</td><td></td><td>AF-CO12499 IC</td><td></td></td<>	5	AF-CO14397-01 Power switch	1.15		AF-CO12499 IC	
$A_F CO14718$ Connector power jack $B9$ 4         AF-CA023019 Resister Kit         N/C           2         AF-CO14718-01 Connector leader         1.28         2         AF-CO14977 IC 6502         3.85           3         AF-CO14777 diode led         .40         2         AF-CO14979 IC 6502         7.40           5         AF-CO1478-01 Socket         .54         3         AF-CO14905 IC         3.85           6         AF-CO14080-01 diode         .40         1         AF-CO14405 IC         11.26           6         AF-CO14080-05 diode         .40         4         AF-CO14305 IC         .50           7         AF-CO14080-16 diode IN \$818         .91         1         AF-CO14302 IC CM324         .281           8         AF-CO17994 Switch static strip         N/C         2         AF-CO14304 IC 7465138         .90           1         AF-CO1794 RP Modulator         4.03         1         AF-CO14304 Voltage Reg.         .100           2         AF-CO17951 IN NF \$92         1.38         9         AF-CO14304 Voltage Reg.         .100           2         AF-CO17950 IC M347         1.81         1         AF-CO14305 IC 4052 S.         .20           2         AF-CO14316 IC         .80         1	4	AF-CO14387 Interlock switch	1.60		AF-CO12399 IC	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	4	AF-CO14398 diode rectifier	.50		AF-CO12399 IC	
2       AF-C014777 diode ted       40       2       AF-C014377 IC 6502       7.40         5       AF-C014778.03 Socket       .54       3       AF-C014805 IC       11.26         5       AF-C014808.01 diode       .40       4       AF-C014305 IC       11.25         6       AF-C016806.07 systal       1.39       2       AF-C014302 IC CM1331 IC       .50         10       AF-C016304 diode       .40       4       AF-C014302 IC CM1331 IC       .50         10       AF-C016304 diode       .50       2       AF-C014320 IC CM132 LC 740509       .60         200       AF-C01729 Witch static strip       N/C       2       AF-C01432 IC 740509       .60         201       AF-C01721 RF Modulator       4.03       1       AF-C01432 Volta32 EC 740509       .60         2       AF-C017101 IC CM 2917       1.70       4       AF-C01434 Voltage Reg.       .100         2       AF-C017910 IC CM 347       1.81       1       AF-C01438 Voltage Reg.       .100         2       AF-C014450 IC CM347       1.81       1       AF-C01436 IC 4051       .100         2       AF-C014650 IC CM 347       1.81       1       AF-C01438 Voltage Reg.       .100         2       AF-C014650 I	3	AF-CO14715 Connector power jack	.89		AF-CA023019 Resister Kit	
6       AF-C014777 diode ted       .40       2       AF-C014377 IC 6502       .7.40         5       AF-C014808-01 diode       .40       1       AF-C014899 IC       .3.85         3       AF-C014808-01 diode       .40       4       AF-C014802 IC       .13.85         5       AF-C01600 Crystal       .139       2       AF-C014321 IC       .50         6       AF-C016364 diode IN 5818       .91       1       AF-C014321 IC 740509       .60         200       AF-C017294 Switch static strip       N/C       2       AF-C014342 IC 7405138       .99         1       AF-C017294 Switch static strip       N/C       2       AF-C014342 VO1432 IC 740509       .60         200       AF-C01751 IN NF 592       1.38       9       AF-C014348 VO1age Reg.       .80         2       AF-C01751 IN NF 592       1.38       9       AF-C014348 VO1age Reg.       .80         2       AF-C01436 IC C       .80       1       AF-C01437 VO1age Reg.       .80         1       AF-C01436 IC C       .80       1       AF-C01436 IC 4051       1.00         2       AF-C01436 IC C       .80       1       AF-C01437 VO1age Reg.       .80         2       AF-C01436 IC C       .80		AF-CO14718-01 Connector leader	1.28		AF-CO14795 IC 6520	
5       AF-C014778-03 Socket       .54       3       AF-C01478-03 Gocket       .3.85         3       AF-C014808-01 diode       .40       1       AF-C014808-1C       11.26         5       AF-C016010 Crystal       1.39       2       AF-C014320 IC CM324       2.81         10       AF-C015999 capacitor       .50       2       AF-C013320 IC CM324       2.81         8       AF-C015999 capacitor       .50       2       AF-C013431 IC CM324       2.81         200       AF-C015999 capacitor       .50       2       AF-C013430 IC CM324       2.81         900       AF-C01599 vanch static strip       N/C       2       AF-C013430 Voltage Reg.       .100         2       AF-C0121701 IC CM 2917       1.70       4       AF-C014341 Voltage Reg.       .100         2       AF-C01360 IC CM 347       1.81       1       AF-C014351 Cable assy.       2.10         1       AF-C01360 IC CM 347       1.81       1       AF-C014351 Cable assy.       2.10         2       AF-C01360 IC CM 347       1.81       1       AF-C014351 Cable assy.       2.10         1       AF-C01360 IC CM 347       1.80       1       AF-C014351 Cable assy.       2.10         1       AF-C01360 I		AF-CO14777 diode led	.40		AF-C014377 IC 6502	
3       AF-CO14060-01 dott       40       4       AF-CO14362 IC 141532       .60         6       AF-CO16010 Crystal       1.39       2       AF-CO14312 IC       .50         10       AF-CO14362 IC CM324       2.81       .50       .50       .50       .50         200       AF-CO14304 Giode IN \$818       .91       1       AF-CO14304 IC 7465138       .50         200       AF-CO1795 IN NF \$92       1.38       9       AF-CO14304 Voltage Reg.       .100         2       AF-CO1795 IN NF \$92       1.38       9       AF-CO14312 IC 740509       .60         2       AF-CO1701 IC CM 2917       1.70       4       AF-CO14312 IC 7405138       .90         2       AF-CO1710 IC CM 2917       1.70       4       AF-CO14312 IC 7405138       .100         2       AF-CO1436 IC CM 347       1.81       1       AF-CO14312 IC 740513       .100         2       AF-CO1436 IC GM 347       1.81       1       AF-CO14712 Voltage Reg.       .100         2       AF-CO14312 IC 4069       .71       2       AF-CO14712 Voltage Reg.       .100         2       AF-CO14361 IC       .80       1       AF-FA100011 bet       .20         3       AF-CO143141 IC       .50 </td <td></td> <td>AF-CO14778-03 Socket</td> <td>.54</td> <td>3</td> <td>AF-CO14599 IC</td> <td></td>		AF-CO14778-03 Socket	.54	3	AF-CO14599 IC	
5       AF-CO14808-05 diode       .40       4       AF-CO14312 IC 141532       .60         6       AF-CO16010 Crystal       1.39       2       AF-CO14311 IC       .50         10       AF-CO1634 diode IN \$818       .91       1       AF-CO14312 IC 740309       .60         200       AF-CO17951 Switch static strip       N/C       2       AF-CO14312 IC 740309       .60         200       AF-CO17951 IN NF 592       1.38       9       AF-CO14340 Voltage Reg.       .80         2       AF-CO17951 IN NF 592       1.38       9       AF-CO14340 Voltage Reg.       .80         2       AF-CO17950 IC M 347       1.81       1       AF-CO14345 Voltage Reg.       .100         2       AF-CO17950 IC M 347       1.81       1       AF-CO14346 IC 4051       .100         1       AF-CO14361 IC M 347       1.81       1       AF-CO14346 IC 4051       .100         2       AF-CO14361 IC 6069       .71       2       AF-CO14314 IC Board joystick       .95         2       AF-CO14361 IC 6052       .75       2       AF-CO14141 PC Board joystick       .95         3       AF-CO1950 IC 4052       .75       4       AF-R100012 door assy.       .100         3       AF-CO1956 I		AF-CO14808-01 diode	.40	1	AF-CO14805 IC	11.26
6AF-CO16010 Crystal1.392AF-CO14331 IC.5010AF-CO1610 Crystal.911AF-CO1430 IC CM3242.818AF-CO1794 Switch static stripN/C2AF-CO14312 IC 740509.60200AF-CO17294 Switch static stripN/C2AF-CO14312 IC 740509.60201AF-CA01274 RF Modulator4.031AF-CO14344 Voltage Reg.1.002AF-CO17951 IN NF 5921.389AF-CO14348 Voltage Reg.1.002AF-CO1796 IC CM 3471.811AF-CO14712 Voltage Reg.1.002AF-CO1465-01 IC 4069.712AF-CO14316 IC 40b11.001AF-CO1465-01 IC 4069.712AF-CO14165 IC dable assy.2.102AF-CO1465-01 IC 4069.752AF-FA10001 Head assy.4.801AF-CO1465-01 IC 4069.752AF-FA10001 Head assy.4.801AF-CO1465-01 IC 4069.752AF-FA10001 Head assy1002AF-CO1465-01 IC 4052.752AF-CA016741 PC Board joystick.952AF-CO1956 IC 4052.752AF-FA10002 door assy1003AF-CO19156 IC3.756AF-810004 Rubberfoot.207AF-CO1908 IL C48164.911AF-FA10003 eject assy.8.00100AF-FC1000 21 Transistor B857.753AF-FC100013 belt.505AF-FC1000 21 Transistor B857.754AF-FC100019 belt <t< td=""><td></td><td>AF-CO14808-05 diode</td><td>.40</td><td>4</td><td>AF-CO14362 IC 141532</td><td></td></t<>		AF-CO14808-05 diode	.40	4	AF-CO14362 IC 141532	
10AF-C016364 dide IN 5818.911AF-C014320 IC CM3242.818AF-C01599 expacision.502AF-C01212 (C 740509).60200AF-C017294 Switch static stripN/C2AF-C014344 IC 7465138.901AF-CA012174 RF Modulator4.031AF-C014349 Voltage Reg1002AF-C017101 IC CM 29171.704AF-CO14734 Voltage Reg802AF-C015769 IC CM 3471.811AF-CO1436 IC 40611.0001AF-C01436 IC 4069.712AF-CA014851 Cable assy.2.102AF-C014361 IC.801AF-CA014851 Cable assy.4.801AF-CO1790 IC 4052.752AF-CA16741 PC Board joystick.952AF-C019156 IC C.3.756AF-881004 Rubberfoot.203AF-C019156 IC C3.753AF-FC100012 door assy.8.00100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-FC 1000 21 Transister B857.754AF-FC100015 belt.505AF-FC 1000 21 Transister B857.754AF-FC100015 belt.5010AF-32-N3963 Transister.255AF-FC100018 belt.505AF-FC 1000 21 Transister B467.809AF-72-1948 Inductor.2510AF-34-2N3964 Transister.2510AF-72-10018 belt.504AF-34-2N3964 Transister.2510AF-72-10018 belt <t< td=""><td></td><td></td><td>1.39</td><td>2</td><td>AF-CO14331 1C</td><td></td></t<>			1.39	2	AF-CO14331 1C	
8         AF-C015999 capacistor         50         2         AF-C014312 IC 740509         .60           200         AF-C017294 Switch static strip         N/C         2         AF-C01434 IC 7465138         .90           1         AF-C012174 RF Modulator         4.03         1         AF-C014349 Voltage Reg.         1.00           2         AF-C017051 IN NF 592         1.38         9         AF-C017121 Voltage Reg.         .80           2         AF-C01710 IC CM 2917         1.70         4         AF-C017121 Voltage Reg.         .100           2         AF-C01710 IC CM 2917         1.81         1         AF-C014341 IC Voltage Reg.         .100           2         AF-C014361 IC CM 347         1.81         1         AF-C014361 Cable assy.         2.10           2         AF-C014361 IC         80         1         AF-FA100011 head assy.         4.80           1         AF-C01950 IC 4052         .75         2         AF-C016741 PC Board joystick         .95           2         AF-C018081. IC 4816         4.91         1         AF-FA100012 door assy.         1.00           3         AF-C018081. IC 4816         4.91         1         AF-FC100013 belt         .50           5         AF-C0180821. IC 4816         4		•	.91	1	AF-CO14320 IC CM324	2.81
200         AF-C017294 Switch static strip         N/C         2         AF-C014344 IC 7465138         .90           1         AF-C01274 RF Modulator         4.03         1         AF-C014349 Voltage Reg.         1.00           2         AF-C017951 IN NF 592         1.38         9         AF-C014348 Voltage Reg.         1.00           2         AF-C01765 IC CM 347         1.81         1         AF-C014336 IC 4051         1.00           2         AF-C01760 IC CM 347         1.81         1         AF-C014336 IC 4051         1.00           1         AF-C017950 IC 4069         .71         2         AF-CA014351 Cable assy.         2.10           2         AF-C01750 IC 4052         .75         2         AF-CA016741 PC Board joystick         .95           3         AF-C01950 IC 4052         .75         6         AF-RA100012 door assy.         1.00           7         AF-C018081 IC 4816         4.91         1         AF-FA100012 door assy.         8.00           100         AF-C018056 Voltage reg.         .75         3         AF-FC100013 belt         .50           5         AF-FC 1000 21 Transistor B857         .75         4         AF-FC100014 belt         .50           10         AF-S42N3966 Transister <td< td=""><td></td><td></td><td>.50</td><td>2</td><td>AF-CO14312 1C 740509</td><td></td></td<>			.50	2	AF-CO14312 1C 740509	
1       AF-C0112174 RF Modulator       4.03       1       AF-C014349 Voltage Reg.       1.00         2       AF-C017951 IN NF 592       1.38       9       AF-C01412 Voltage Reg.       80         2       AF-C017101 IC CM 2917       1.70       4       AF-C01412 Voltage Reg.       1.00         2       AF-C0146501 IC CM 347       1.81       1       AF-C014381 C4051       1.00         1       AF-C014361 IC 4069       .71       2       AF-C0144851 C4051 assy.       2.10         2       AF-C014361 IC       .80       1       AF-FA100011 head assy.       4.80         1       AF-C014361 IC       .80       1       AF-FA100012 door assy.       1.000         3       AF-C019361 IC 4052       .75       2       AF-FC100013 bett       .90         3       AF-C013623 diode wrap assy.       N/C       5       AF-FC100013 bett       .50         5       AF-FC 1002 12 Transister D467       .80       9       AF-FC100013 bett       .50         5       AF-FC 1000 21 Transister D467       .80       9       AF-FC100013 bett       .50         6       AF-34-2N3966 Transister       .25       5       AF-FC100013 bett       .50         6       AF-34-2N3966 Transister <td></td> <td>•</td> <td>N/C</td> <td>2</td> <td>AF-CO14344 IC 7465138</td> <td>.90</td>		•	N/C	2	AF-CO14344 IC 7465138	.90
2       AF-CO17951 IN NF 592       1.38       9       AF-CO14348 Voltage Reg.       .80         2       AF-CO1701 IC CM 2917       1.70       4       AF-CO14712 Voltage Reg.       1.00         2       AF-CO1766 IC CM 347       1.81       1       AF-CO14336 IC 4051       1.00         1       AF-CO1465-01 IC 4069       .71       2       AF-CA014851 Cable assy.       2.10         2       AF-CO17950 IC 4052       .75       2       AF-CA016741 PC Board joystick       .95         2       AF-CO18081. IC 4816       .90       1       AF-FA100012 door assy.       1.00         3       AF-CO18081. IC 4816       4.91       1       AF-FA100032 eject assy.       8.00         100       AF-CO18081. IC 4816       4.91       1       AF-FC100013 belt       .50         5       AF-CO17956 Voltage reg.       .75       3       AF-FC100013 belt       .50         5       AF-FC 1000 21 Transister B857       .75       4       AF-FC100013 belt       .50         5       AF-FC 1000 22 Transister D467       .80       9       AF-70-5918 Connector jack       .25         10       AF-34-2N3964 Transister       .25       2       AF-FC100019 Switch       .50         6 <td< td=""><td></td><td></td><td>4.03</td><td>1</td><td>AF-CO14349 Voltage Reg.</td><td></td></td<>			4.03	1	AF-CO14349 Voltage Reg.	
2         AF-CO15769 IC CM 347         1.81         1         AF-CO14336 IC 4051         1.00           1         AF-CO11465-01 IC 4069         .71         2         AF-CA014851 Cable assy.         2.10           2         AF-CO17950 IC 4052         .75         2         AF-CA016741 PC Board joystick         .95           2         AF-CO17950 IC 4052         .75         2         AF-CA016741 PC Board joystick         .95           3         AF-CO19166 IC         .75         6         AF-R81004 Rubberfoot         .20           7         AF-CO18081. IC 4816         4.91         1         AF-FC100013 belt         .50           5         AF-CO1956 Voltage reg.         .75         3         AF-FC100013 belt         .50           5         AF-FC1000 21 Transistor B857         .75         4         AF-FC100015 belt         .50           5         AF-FC 1000 21 Transistor B857         .75         4         AF-FC100015 belt         .50           10         AF-FC 1000 21 Transistor B857         .75         4         AF-FC100015 belt         .50           10         AF-32N3906 Transister         .25         5         AF-FC100019 Inductor         .25           10         AF-34-2N3904 Transister         .25	2	AF-CO17951 IN NF 592	1.38		AF-CO14348 Voltage Reg.	
2AF-CO15769 IC CM 3471.811AF-CO1336 IC 40511.001AF-CO11465-01 IC 4069.712AF-CA014851 Cable assy.2.102AF-CO13461 IC.801AF-FA100011 head assy.4.801AF-CO17950 IC 4052.752AF-CA016741 PC Board joystick.952AF-CO19156 IC.3.756AF-R81004 Rubberfoot.203AF-CO19156 IC3.756AF-R81004 Rubberfoot.207AF-CO18081 IC 48164.911AF-FA100035 eject assy.8.00100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-FC10956 Voltage reg753AF-FC100014 belt.505AF-FC1090 21 Transistor B857.754AF-FC100015 belt.5010AF-F2 1906 21 transister.255AF-FC100018 Inductor.2510AF-F3 29306 Transister.255AF-FC100018 Inductor.2510AF-34-2N3964 Transister.2510AF-FC100018 Switch.504AF-34-2N3964 Transister.2510AF-FC100018 Switch.504AF-CO14388 Switch.567AF-FC100016 cap.2516AF-CO10388 Switch.567AF-FC100260 button.755AF-CO10810 Y Control Cable.70.70.46-CO114150 Tapel 140.506AF-CO10818 Switch.501AF-FC100260 button.755AF-CO10		AF-CO17101 IC CM 2917	1.70	4	AF-CO14712 Voltage Reg.	
1AF-CO14361 IC801AF-FA100011 head assy.4.801AF-CO14361 IC.801AF-FA100011 head assy.4.801AF-CO17950 IC 4052.752AF-CA016741 PC Board joystick.952AF-CO13141 IC.502AF-FA100012 door assy.1.003AF-CO19156 IC3.756AF-881004 Rubberfoot.207AF-CO18081. IC 48164.911AF-FA100035 eject assy.8.00100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-FC10002 21 transistor B857.753AF-FC100015 belt.5010AF-FC 1000 22 transister D467.809AF-79-5918 Connector jack.2510AF-33-2N3906 transister.252AF-FC100019 Switch.5010AF-34-2N363 transister.252AF-FC100019 Switch.504AF-34-2N3904 transister.2510AF-21-101683 Cap.251AF-CO14809 transister.4020AF-FC100016 cap.254AF-CO1394 Cap.248AF-19-411504 Resistor.158AF-CO10394 Cap.248AF-19-411504 Resistor.158AF-CO10394 Cap.248AF-19-411504 Resistor.158AF-CO10394 Cap.248AF-19-411504 Resistor.159AF-CO10373 Slide switch.501AF-CO10726 Cable4.007AF-CO10373 Slide switch<	2	AF-CO15769 IC CM 347	1.81	1	AF-CO14336 IC 4051	
1AF-CO17950 IC100AF-CO16741 PC Board joystick952AF-CO14341 IC.502AF-CA016741 PC Board joystick953AF-CO1956 IC3.756AF-FA100012 door assy.1.003AF-CO19156 IC3.756AF-881004 Rubberfoot.207AF-CO18081. IC 48164.911AF-FA100035 eject assy.8.00100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-FC1000 21 Transistor B877.753AF-FC100015 belt.505AF-FC 1000 22 Transister D467.809AF-79-5918 Connector jack.2510AF-33-2N3906 Transister.252AF-FC100018 Inductor.2510AF-34-2N3563 Transister.252AF-FC100019 Switch.504AF-CO1405 Panel label cover.754AF-FC100016 cap.251AF-CO1398 Switch.567AF-FC100016 cap.254AF-CO10388 Switch.567AF-FC100260 button.755AF-CO10376 Cable.40020AF-FC100176 Cable2.702AF-CO10373 Slide switch.501AF-CO17937 Power supply3.172AF-CO10813 Dust cover switch.151AF-CA014807 TPC board assy.78.807AF-CO10813 Dust cover switch.151AF-CO10813 PV Power supply8.0010AF-CO10822 Inductor.371AF-CO16353 9V Power supply8.00 <td>1</td> <td>AF-CO11465-01 IC 4069</td> <td>.71</td> <td>2</td> <td>AF-CA014851 Cable assy.</td> <td></td>	1	AF-CO11465-01 IC 4069	.71	2	AF-CA014851 Cable assy.	
1AF-CO14341 IC.502AF-FA100012 dor assy.1.003AF-CO19156 IC3.756AF-R81004 Rubberfoot.207AF-CO18081. IC 48164.911AF-FA100035 eject assy.8.00100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-CO17956 Voltage reg753AF-FC100015 belt.505AF-FC 1000 21 Transistor B857.754AF-FC100015 belt.5010AF-FC 1000 22 Transister D467.809AF-79-5918 Connector jack.2510AF-34-2N3906 Transister.255AF-FC100019 Switch.504AF-34-2N3906 Transister.252AF-FC100019 Switch.504AF-34-2N3904 Transister.2510AF-21-101683 Cap.251AF-CO14409 Panel label cover.754AF-FC100019 Switch.504AF-CO14809 Transister.4020AF-FC100016 cap.2516AF-CO10394 Cap.248AF-19-411504 Resistor.158AF-CO10384 Switch.567AF-FC100206 button.755AF-CO10373 Slide switch.501AF-CO10810 Y Control Cable2.702AF-CO10813 Dust cover switch.151AF-CA014807 PC board assy33.3215AF-CO10820 Inductor.371AF-CA014807 PC board assy8007AF-CO10813 Dust cover switch.151AF-CA014807 PC board ass	2	AF-CO14361 IC	.80		AF-FA100011 head assy.	
2AF-CO19156 IC3.756AF-881004 Rubberfoot.207AF-CO18081 IC 48164.911AF-FA100035 eject assy.8.00100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-FC 107956 Voltage reg753AF-FC100014 belt.505AF-FC 1000 21 Transistor B857.754AF-FC100015 belt.5010AF-FC 1000 22 Transister D467.809AF-FC100018 Inductor.2510AF-33-2N3906 Transister.255AF-FC100018 Inductor.2510AF-34-2N3563 Transister.252AF-FC100019 Switch.504AF-34-2N3904 Transister.2510AF-21-101683 Cap.251AF-C014105 Panel label cover.754AF-FC100016 cap.251AF-C010388 Switch.567AF-FC100260 button.758AF-C010384 Switch.561AF-C010810 Y Control Cable2.702AF-C010373 Slide switch.501AF-CA014977 Power supply3.172AF-C010813 Dust cover switch.151AF-CA014155 Top cover assy33.3215AF-C010820 Inductor.371AF-CA01497 PC board assy78.0010AF-C010813 Dust cover switch.151AF-CA01497 PC board assy78.0010AF-C010821 Inductor.371AF-CA014807 PC board assy78.0011AF-C010821 Subt cover switch.15 <td>1</td> <td>AF-CO17950 IC 4052</td> <td>.75</td> <td></td> <td>AF-CA016741 PC Board joystick</td> <td></td>	1	AF-CO17950 IC 4052	.75		AF-CA016741 PC Board joystick	
7       AF-CO18081. IC 4816       4.91       1       AF-FA100035 eject assy.       8.00         100       AF-CA018263 diode wrap assy.       N/C       5       AF-FC100013 belt       .50         5       AF-CO17956 Voltage reg.       .75       3       AF-FC100015 belt       .50         5       AF-FC 1000 21 Transistor B857       .75       4       AF-FC100015 belt       .50         10       AF-FC 1000 22 Transister D467       .80       9       AF-FC100018 Inductor       .25         10       AF-33-2N3906 Transister       .25       5       AF-FC100019 Switch       .50         10       AF-34-2N3563 Transister       .25       10       AF-FC10019 Switch       .50         4       AF-34-2N3904 Transister       .25       10       AF-FC10019 Switch       .50         4       AF-34-2N3904 Transister       .25       10       AF-FC100019 Switch       .50         4       AF-C014105 Panel label cover       .75       4       AF-31-1N4001 diode       .25         1       AF-CO10394 Cap       .24       8       AF-19-411504 Resistor       .15         8       AF-CO10388 Switch       .56       7       AF-FC100016 cap       .25         16       AF-CO10384 Switch	2	AF-CO14341 IC	.50	2		
100AF-CA018263 diode wrap assy.N/C5AF-FC100013 belt.505AF-CO17956 Voltage reg753AF-FC100013 belt.505AF-FC 1000 21 Transistor B857.754AF-FC100015 belt.5010AF-FC 1000 22 Transister D467.809AF-79-5918 Connector jack.2510AF-33-2N3906 Transister D467.809AF-FC100018 Inductor.2510AF-34-2N3563 Transister.255AF-FC100018 Inductor.2510AF-34-2N3964 Transister.25.2AF-FC100019 Switch.504AF-34-2N3904 Transister.25.10AF-21-101683 Cap.251AF-CO14105 Panel label cover.75.4AF-31-1N4001 diode.254AF-CO10394 Cap.24.8AF-19-411504 Resistor.158AF-CO10384 Switch.56.7AF-FC100016 cap.255AF-CO10388 Switch.56.7AF-FC100260 button.755AF-CO10376 Dust Cover.16.2AF-CO10810 Y Control Cable.702AF-CO12242 Channel select switch.45.1AF-CA014807 PC board assy33.3215AF-CO10813 Dust cover switch.15.1AF-CA014807 PC board assy78.0010AF-CO10822 Inductor.37.1AF-CA014807 PC board assy78.0010AF-CO10822 Inductor.37.1AF-CA014807 PC board assy78.0010AF-CO10822 Inductor	3	AF-CO19156 IC	3.75	6	AF-881004 Rubberfoot	
100       AF-CO17956 Voltage reg.       75       3       AF-FC10014 belt       .50         5       AF-FC 1000 21 Transistor B857       .75       4       AF-FC100015 belt       .50         10       AF-FC 1000 22 Transister D467       .80       9       AF-79-5918 Connector jack       .25         10       AF-32-N3906 Transister       .25       5       AF-FC100019 Switch       .50         10       AF-34-2N3563 Transister       .25       2       AF-FC100019 Switch       .50         10       AF-34-2N3904 Transister       .25       10       AF-21-101683 Cap       .25         11       AF-CO14105 Panel label cover       .75       4       AF-31-1N4001 diode       .25         14       AF-CO1394 Cap       .24       8       AF-FC100016 cap       .25         16       AF-CO10394 Cap       .24       8       AF-FC100260 button       .75         5       AF-CO10394 Cap       .24       8       AF-FC100260 button       .75         5       AF-CO10394 Cap       .24       8       AF-FC100260 button       .75         5       AF-CO10376 Dust Cover       .16       .2       AF-CO10726 Cable       .270         2       AF-CO12242 Channel select switch <td< td=""><td>7</td><td>AF-CO1808L IC 4816</td><td>4.91</td><td>1</td><td>AF-FA100035 eject assy.</td><td></td></td<>	7	AF-CO1808L IC 4816	4.91	1	AF-FA100035 eject assy.	
5AF-FC1000 21 Transistor B857.754AF-FC100015 belt.5010AF-FC 1000 22 Transister D467.809AF-79-5918 Connector jack.2510AF-33-2N3906 Transister.255AF-FC100018 Inductor.2510AF-34-2N3563 Transister.252AF-FC100019 Switch.504AF-34-2N3904 Transister.2510AF-21-101683 Cap.251AF-CO14105 Panel label cover.754AF-FC100016 cap.251AF-CO14080 Transister.4020AF-FC100016 cap.2516AF-CO10394 Cap.248AF-19-411504 Resistor.158AF-CO10388 Switch.56.7AF-FC100260 button.755AF-CO10378 Lide switch.501AF-CO10810 Y Control Cable.702AF-CO10373 Slide switch.501AF-CA017937 Power supply3.172AF-CO10813 Dust cover switch.151AF-CA014807 PC board assy78.0010AF-CO10822 Inductor.371AF-CX261.78.0010AF-CO10823 Indo Vailable.35AF-CO16353 9v Power supply4.50	100	AF-CA018263 diode wrap assy.	N/C	5	AF-FC100013 belt	
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# The New Series 2100C A Great Cart Machine Just Got Better!

The quality and value leader is now even better. The new Series 2100C features the innovative Phase Lok V precision head block, an improved cartridge guidance system, a more powerful solenoid and advanced electronics with specifications that meet or exceed 1975 NAB standards.

Now more than ever before, compare prices...compare features. You'll agree that the new Series 2100C gives you more value per dollar than any other cart machine.

Playback: Моно \$1,325 Stereo \$1,425 Record/Play: Mono \$1,995 Stereo \$2,295



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The new 2100C incorporates

the advanced Phase Lok V

head block.

#### **Data Broadcasting Break-Through**

New York, Oct. 14--Tests over two New York City FM radio stations are establishing the feasibility of wide area data broadcasting to inexpensive receivers.

"Data transmission error rates are at least two orders of magnitude better than the standard for telephone lines," reports Eric Small, vice president of engineering for Modulation Sciences, Inc., the Brooklyn broadcast equipment firm conducting the tests.

Test data have been broadcast for about three weeks over a subcarrier

Common Point/Jan. 1988 Page 12 of WBA1's and WPAT-FM's signals. The technique is commonly known in the broadcast industry as SCA (for Subsidiary Communications Authorizations). Regular FM listeners cannot hear the subcarrier or data transmission unless they have a special receiver. Transmission rates were 1200 to 4800 baud.

Key findings from the test are:

\*Error rates have been better than one in ten million  $(10^7)$  as opposed to the telephone standard of one in one hundred thousand  $(10^5)$ . \*Accurate reception extends 30 to 40 miles from the transmission antennas, which are located atop the Empire State Building and the World Trade Center.

\*Simple indoor whip antennas appear satisfactory in many instances.)

\*The analog signal-to-noise ratio (SNR), which is easily measured, reliably predicts digital error rate. This allows easy and accurate monitoring.

\*The "gray area" between accurate and inaccurate reception is very small. (In technical terms, the knee of the error rate curve is sharp.) In other words, the data signal tends to be highly accurate or highly inaccurate, making it easy to tell the difference.

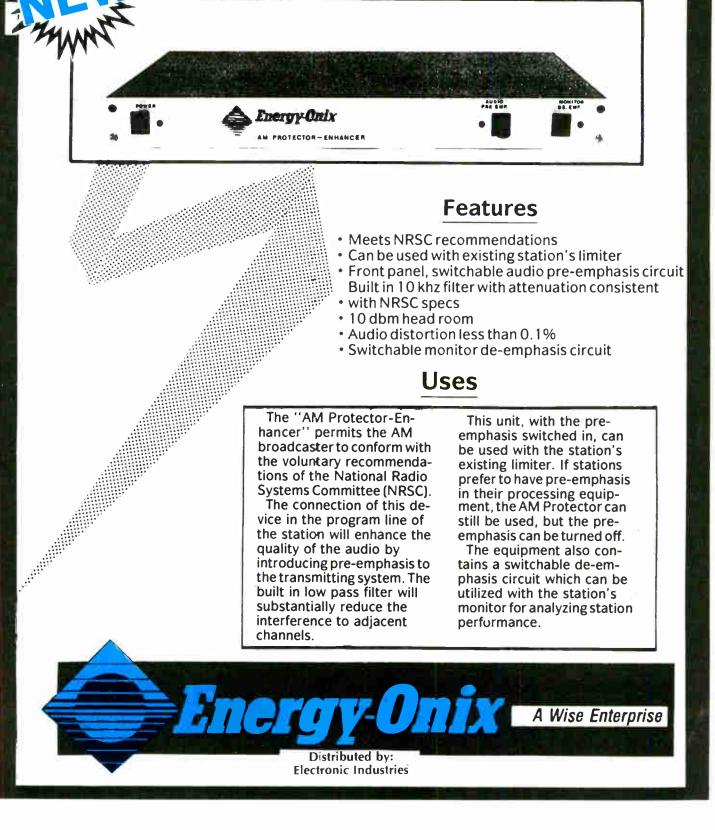
Modulation Science's test were encouraged by recent FCC deregulation of SCA. Both technical aspects and applications were affected. Prior to deregulation, SCA channels were generally used for background music and for talking books for the blind. SCA signals can now be sent to single users. Small believes that it will be economical for organizations which transmit large amounts of data mostly one way. He says that data flowing in the opposite direction can be economically transmitted by telephone if it does not exceed ten percent of the total flow.

Potentially, the method could result in two new channels per FM station. Up to 10,000 new channels "could replace telephone lines at less cost and with equal or better error rate," says Small.

Some FM data transmission took place previously, but employed telephone-type audio frequency shift techniques. This in turn required a good (greater than 20 dB) signal-tonoise ratio and a relatively expensive decoder. MS1's system apparently overcomes these obstacles. Their method shifts the frequency of the FM subcarrier directly. Also, usable SNRs as low as 12 dB have been feasible, and decoder parts are estimated to costs under ten dollars!

Final results and full details of the tests will be published after the tests are completed. Test equipment included a data version of Modulation Science's recently introduced Sidekick (TM) SCA generator. Prototype models of the Data Sidekick SCA system are available to the broadcasting and data processing industries. A trial system consists of a generator (including a data test generator), two receivers, and an error rate data indicator. The system costs about \$5000.

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AM PROTECTOR-ENHANCER

# **MEMO FROM METZ**



David L. Metz

by

#### "NEW GUTS FOR YOUR CART MACHINE" Part I

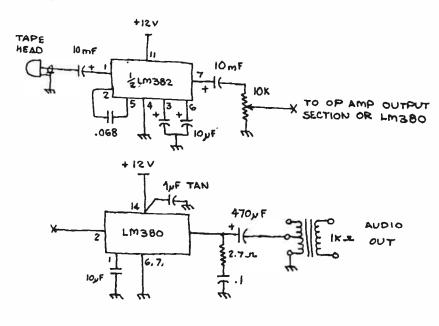
I swear that I have never seen any machine more needlessly complicated than a cart machine. The early vacuum tube ones are the worse. Stripping one can fill up your junk box to over flowing.

Some way or another, I've had two of these monsters from the early days of radio given to me. Both were stripped of all electrical components and then converted to solid state. The result has been two amazingly dependable good sounding machines.

I'm going to give you the circuits in pieces that you can piece together yourself for your own particular application. I'm going to start with the audio section so we can get rid of all those old hot tubes.

First look up last months issue of common point. We're going to use the universal balanced output stage of my skimmer in this design too. The

AUDIO SECTION



Common Point/Jan. 1988 Page 14 heart of the audio section is the National I.M-382. This IC has been around for a coon's age. Originally you found it in gutless wonder automobile eight tracks (remember those?).

I fell in love with this I.C. because it had two good low noise high gain amplifiers in it, good band width and used only one positive unregulated supply. External parts consisted of a few 10 MF capacitors. Maybe not the greatest magnetic tape preamp ever, but it's so simple and cheap, that who cares?

Cl & C5 are DC blocking capacitors, remember this thing operates off a single polarity supply so the output floats at half Vcc. C2 & C3 set the gain by bypassing a negative feedback network inside the IC. C4 tells the IC that it's a equalized NAB tape preamp. That's all there is to it.

Run the output through a 10K pot for a gain control and then through the op-amp output stage from last month and you're done. Need more gain? Increase the value of R2, the feed back resistor in the first op-amp.

What if you don't have a negative polarity power supply for the opamps? You can use another old National IC. They designed this thing for kiddie record players I think. The LM-380 is a one watt audio output stage on a chip. It needs well bypassed regulated 9 to 12 volts to operate. Run its eight ohm output through a matching transformer to drive your line. Can't find a 8 to 600 ohm transformer? Look around for any surplus transformer that runs from 4 to 15 ohms input with a 500 to 1,000 ohm output, it will work fine. And don't forget the center tap is one fourth the impedance of the total winding so you can use it to.

Both the LM-382 and the LM-380 pick up RFI. If you use them in a high RF environment, make sure they are well shielded. Bypass the outputs with coaxial capacitors. Most of the RFI problems come in the output leads!

You should mute the audio output when the cart isn't playing. I did this by switching the audio with the contacts on the cart machines solenoid relay.

Next month I'll use the other half of the LM-382 to build the cue tone detector circuit. After that, the control and switching section.

#### 'That's What Local Radio is All About'

Quote Worth Noting..."As a station owner and operator for the past six years, I feel that radio is more and more becoming an important communicator of ideas and news for my local community. That's what local radio is all about. And, after six years, the money seems to be coming my way, too. That's an indirect form of acknowledgement. I enjoy what I do; I put in I2-hour days and night meetings besides, but I enjoy what I do."

#### Fairness Doctrine Still Applies to Political Candidates

NAB MEMBER ADVISORY: FCC Fairness/Political Broadcasting chief Milt Gross told Federal Communications Bar Association earlier this month that FCC's August action eliminating fairness doctrine did not extend to coverage of political candidates. Doctrine still applies to news reports, news interviews and news programming regarding candidates, unless FCC rules otherwise. (Several weeks ago, FCC Chairman Dennis Patrick had written Congress stating that doctrine also still applies to coverage of non-candidate ballot issues.)

\*\*\*\*

#### **EI Classifieds**

EI Want Ads are free to the readers of Common Point Magazine. To place an ad, simply write it on the Acknowlegement Card that comes with each issue and mail card. WANTED TO SELL

Tellabs 4425 Dual Repeat Coil Card, New, \$44.00. Call E.I. 800-558-0222.

STL Azimuth & Level Set Test Cart, 12,500 Hz, NAB format, stereo, Audiopak A-2 cart, new, \$15.00. Call E.I. 800-558-0222.

Bud RC-7758 casters, extra-heavy-duty type for Bud Series 60, 2000, and Concorde cabinet racks, ball bearing 3<sup>1</sup>/<sub>4</sub>" wheels of hard tread composition, 200 lbs. load rating, 4-hole mtg. \$6.00 each. Call E.I. 800-558-0222. (6 left).

Broadcast Electronics 5302 3-deck momo playback with cue tones, new, \$3150 Call E.1. 800-558-0222.

75 KVA stand-by Generator, gasoline powered \$5,000.00 Paul Zap, St. Marys College, St. Marys, Kansas (913) 437-2471.

Auditronics, 110 A. Console 14 in. 2 out 6 faders w/power supply & patch panel good condition (1 left)

Zerocom, MAXI-TEL remote board, excellent condition (1 left).

Motorola, T74 FM Mobile Transceiver, good condition (1 left).

Genave, GMT2400 Transceiver, good condition (1 left).

General Electric, Prog-line tranceivers, various condition (5 left).

CRL, Sep-400B Audio Processors, excellent condition (2 left).

DBX, 165 Compressor, excellent condition (2 left).

Valley People, DYNA-MITE Microphone processor, excellent condition (1 left).

CBS, Volumax audio processor, good condition (1 left).

CBS, Audimax audio processor, fair (mono) condition (1 left).

Collins, 26J-3 Compressors, good condition (2 left).

Harris, Critereon80Cart, excellent condition (1 left).

Gates, Critereon 80 playback cart decks (mono), good condition (2 left).

Wollensak, T1500 Tape Recorder, good condition (1 left).

Gates (B-7), Turntables, good condition (2 left),

Pioneer, CT-F505 Cassette-Deck, poor condition (1 left).

Northstar, Advantage Computer w/2 disk drives, good condition (1 left).

Star Micronics, Delta-10 printer, excellent condition (1 left).

Qume, Sprint-5 tractor feed printer, good condition (1 left).

Hewlett-Packard, 200 BR Audio Generator, good condition (1 left).

B & W, Distortion meter, good condition (1 left).

Nems-Clarke, 108-E Pahse monitor, good condition (1 left).

Collins, 542-1 Frequency Monitor, good condition (1 left).

Hickok, 800 Tube Tester, excellent condition (1 left).

Various, 6<sup>1</sup>/<sub>2</sub> foot equipment racks, excellent condition (2 left).

Yamaha, Road speakers, poor condition, (2 left).

Ricoh, 301-P adding machine, good condition (1 left). IBM, typewriter, poor condition (1 left). Code-A-Phone, 180 Answering Machine, poor condition (2 left).

Manufacturer unknown, push lawnmower, poor condition (1 left).

FOR SALE: IGM Ram Automation System/4K memory, mono Instacart, mono Go-cart, three ITC 750 Reel to Reel stereo decks, IGM encoder/decoder (you supply printer and keyboard, two spare source cards, extender cards, all manuals, \$9500.00 You pay shipping. Unit out of service on 1/15/88. Works fine, looks fine. Or sell Instracart \$6,000.00 Go-cart \$2,000. ITC 750's \$850 each. IGM Ram unit \$3,000.00 Call 503-267-2121 for more info.

WANTED TO SELL: Class A FM-AM Daytimer 3 acres 2,800 sq. ft. residence & studio combo, 750 sq. ft. transmitter building, equipment in excellent condition-Retiring-\$350,000 neg. J-P Robillard 1803 N. Ist East St. Haynesville, I.A 71038 call 318-624-0105 day or night.

WANTED TO SELL: Mosley TRC 15 remote control. In service in excellent condition, Wendell Wilson KNCK Concordia, Kansas 66901 call 913-243-1414.

FOR SALE: 980' Zone A solid Leg Tower on ground with GUI system, also continental ERI 12 bar CP antenna on 93.1 MHZ. Phone Lennie Dupree 318-445-1234.

WANTED TO SELL: 425 + ft Andrew 3-1/8 inch coax, with connectors top & bottom, plus pressure inlet. 90 hangers and tower leg standoffs. No burns, very good cond. New in '81. (ran 22K in) Respond to: T. Vaubel, KEZT-FM P.O. Box 1647, Ames, 1A 50010. (515) 232-0104.

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# TALKBACK

BUELINGTON, IA--As a new station owner, I really appreciate the equipment listings in Common Point. INDPLS, IN--I contract to WTRE-Greensburg, Indiana and have adopted the NRSC standard. I used the CRL unit however because it has a tilt compensator for plate modulated rigs and its \$100 less than the energy onix unit.

SALINA, KS--I Actually have had our AM station on NRSC for over a year now, and suspect quite a few others have also. Did a lot of checking with a real time analyzer before arriving at very nearly the same curve as NRSC. Guys around here thought I had flipped my whig, hooking up the analyzer to every size and shape of receiver I could find, including the potomac SMR-11 Air Monitor, we're not stereo and feel we sound better than one competitor that is.



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