

\$1.00

hp

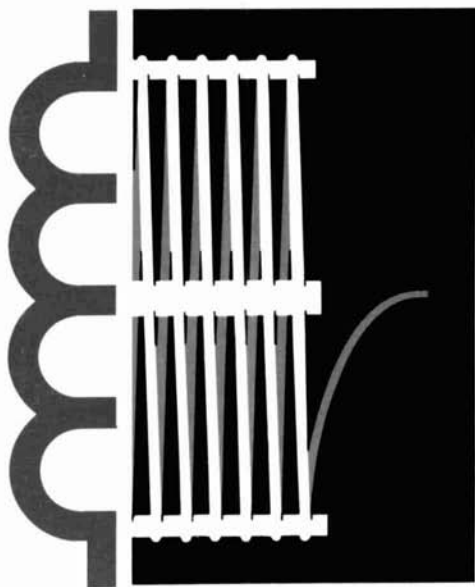
focus
on
communications
technology . . .

ham radio

magazine

AUGUST 1975

500-WATT POWER AMPLIFIER FOR 160 METERS

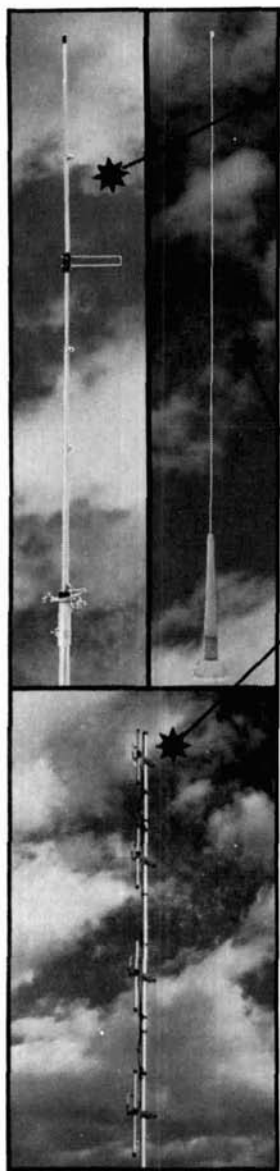


this month

- fm alignment techniques 14
- programmable keyer memory 24
- solid-state 432-MHz linear amplifier 30
- adjustable IC voltage regulators 36

BUY OUR ANTENNA... OPEN THE BOX... ASSEMBLE IT EASILY...

IT WORKS



NEW FM GAIN RINGO RANGER...you'll say "IT WORKS", when you try this exciting new antenna! Ringo Ranger is even better than the popular Ringo. Ranger has more gain for extended range. Easily mounted on a mast or existing tower, Ranger consists of a one eighth wave phasing stub and three half waves in phase to concentrate your signal at the horizon where it can do you the most good. Your present AR-2 can be extended with a simply installed RANGER KIT.

ARX-2	100 watts	146-148 MHz	\$26.50
ARX-220	100 watts	220-225 MHz	\$26.50
ARX-450	100 watts	435-450 MHz	\$26.50
ARX-2K	Ranger Kit		\$10.95

NEW FM MOBILE ... Fiberglass 5/8 wave professional mobile antenna for roof or trunk mount. Superior strength, power handling and performance.
AM-147T 146-175 MHz mobile \$29.50

NEW 4 POLE...economically priced for primary repeater or home QTH, this antenna has been proven in hundreds of repeater installations. It is a four dipole gain array for mast or tower mounting. It has sealed coax harness for direct 52 ohm feed.

The antenna can be adjusted for a 180° or 360° radiation pattern. Another unmatched antenna value by Cush Craft.

AFM-4D	1000 watts	146-148 MHz	\$52.50
AFM-24D	1000 watts	220-225 MHz	\$48.50
AFM-44D	1000 watts	435-450 MHz	\$46.50

center support mast not included

IN STOCK WITH YOUR LOCAL DISTRIBUTOR



cushcraft
CORPORATION

621 HAYWARD ST., MANCHESTER, N.H. 03103



happiness or your money back !

Once you actually use an **ALPHA 374** on the air, we don't think you'll be willing to part with it. *QST* (April 1975) says, in part, "A combination of modern compact components and a judicious use of . . . space has resulted in an amplifier fully capable of continuous operation at the legal power limit. It is also . . . hardly larger than the average ssb transceiver . . . The **ETO ALPHA 374** was used almost daily for . . . months, including two contest weekends when it was subject to constant use. At no time did the writer feel that the amplifier capabilities were even close to being taxed . . . In the **BANDPASS** mode, high-power operation requires no more adjustment than that involved in operating the exciter."

But don't take our word (or even *QST*'s) for it. You can actually check out a new **ALPHA 374** in your own station without risk! Buy one now from ETO (or a participating dealer). Use it for a few days. Then if you decide that you're willing to go on operating without a '374, return it for prompt refund of your purchase price. If there's any risk involved, it's ours!

Why not call or write ETO or your dealer right now for full details of this limited-time offer, and a reprint of *QST*'s 4-page report? (Dealer participation is optional, and the number of **ALPHA 374**'s available under this offer is limited.) **ALPHA 374, \$1295.**

NOW AVAILABLE . . . THE NEW ULTIMATE in ultra-deluxe, high performance linear amplifiers: **ALPHA 77D**. Substantially huskier and an even more superb performer than its renowned predecessors. Call or write for the full **ALPHA 77D** story. "THE ULTIMATE" \$2695.



ETO EHRHORN TECHNOLOGICAL OPERATIONS, INC.
BROOKVILLE, FLORIDA 33512
(904) 596-3711

KLM ANTENNAS . . .

They're heard when others aren't

Some well known band openers are:

- KLM's 20 METER 5 ELEMENT "BIG STICK"
- KLM's 6 METER 8 & 11 ELEMENT
- KLM's 2 METER 12, 14 & 16 ELEMENT
- KLM's 220 MHz 14 ELEMENT

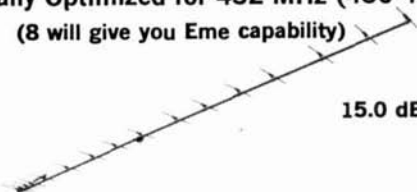
AND NOW

Winner in the 1975 West Coast VHF-UHF Antenna Measuring Contest . . .

KLM'S NEW 432 — 16 Element Long Boom (12')

Specifically Optimized for 432 MHz (430-440)

(8 will give you Erme capability)



15.0 dB over dipole

Also . . . Brand New for the 420-450 MHz Band

4 NEW AMPLIFIERS

- PA 10-35C 10 WATTS INPUT 35 WATTS OUT
- PA 2-40C 2 WATTS INPUT 35 WATTS OUT
- PA 10-70C 10 WATTS INPUT 70 WATTS OUT
- PA 2-70C 2 WATTS INPUT 70 WATTS OUT

And . . . Don't forget our NEW ECHO II

2 METER SSB/CW TRANSCEIVER & LINEAR AMPS.

NEW ECHO II OPTIONS AVAILABLE:

PREAMPS ASSEMBLED	\$20.95
PREAMPS INSTALLED IN ECHO II	\$25.95
USB/LSB ASSEMBLED	\$22.95
USB/LSB INSTALLED IN ECHO II	\$27.95



See Your Local KLM Dealer
For The New Spring '75 Catalog
Or Write

KLM ELECTRONICS

1600 DECKER AVE.
SAN MARTIN, CA. 95046
408-683-4240
408-226-1780

August, 1975
volume 8, number 8

staff

James R. Fisk, W1DTY
editor-in-chief

Patricia A. Hawes, WN1QJN
assistant editor

J. Jay O'Brien, W6GO
fm editor

James A. Harvey, WA6IAK
James W. Hebert, WA8OBG
Joseph J. Schroeder, W9JUV
Alfred Wilson, W6NIF
associate editors

Wayne T. Pierce, K3SUK
cover

T.H. Tenney, Jr., W1NLB
publisher

Fred D. Moller, Jr., WN1USO
advertising manager

offices

Greenville, New Hampshire 03048
Telephone: 603-878-1441

ham radio magazine is
published monthly by
Communications Technology, Inc
Greenville, New Hampshire 03048

subscription rates

U.S. and Canada: one year, \$8.00
two years, \$13.00; three years, \$18.00
Worldwide: one year, \$10.00
two years, \$17.00, three years, \$24.00

Foreign subscription agents
Canada

Ham Radio Canada
Box 114, Goderich
Ontario, Canada, N7A 3Y5

Europe
Ham Radio Europe
Box 444
194 04 Upplands Vasby, Sweden

France
Ham Radio France
20 bis, Avenue des Clarions
89000 Auxerre, France

United Kingdom
Ham Radio UK
Post Office Box 64, Harrow
Middlesex HA3 6HS, England

African continent
Holland Radio, 143 Greenway
Greenside, Johannesburg
Republic of South Africa

Copyright 1975 by
Communications Technology, Inc
Title registered at U.S. Patent Office
Printed by Wellesley Press, Inc
Framingham, Massachusetts 01701, USA

Microfilm copies of current and
back issues are available from
University Microfilms
Ann Arbor, Michigan 48103

Second-class postage
paid at Greenville, N.H. 03048
and at additional mailing offices



contents

8 160-meter linear amplifier

S. Albert Segen, W2BP

14 fm alignment techniques

Joseph J. Carr, K4IPV

24 programmable keyer memory

Andrew B. White, WA9LUD

30 solid-state 432-MHz linear power amplifier

Lance G. Wilson, WB6QXF

36 adjustable voltage regulator ICs

Douglas R. Schmieskors, WB9KEY

39 calibrated keyer time base

George W. Jones, W1PLJ

42 latch circuit for transmitter control

William P. Laming, W0LPQ

46 fet-controlled battery charger

G. Kent Shubert, WA0JYK

50 QRP transmitter

Edward M. Noll, W3FQJ

56 RTTY audio-frequency keyer

William H. King, W2LTJ

4 a second look

94 advertisers index

50 circuits and techniques

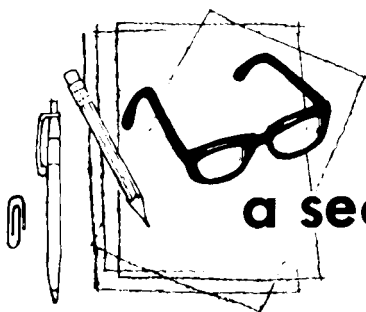
83 flea market

60 ham notebook

62 new products

94 reader service

6 stop press



a second look

by Jim
fisk

It doesn't seem possible, but it was only ten years ago that the price of field-effect transistors finally dropped to the point where it became possible to use them in amateur radio projects. Those early fets, which were limited to audio frequencies, were soon replaced by devices which worked well into the high-frequency range, and later, to vhf and uhf. Now, advances in gallium arsenide (GaAs) technology have produced field-effect transistors which exhibit an *available* gain of 18 dB and minimum noise figure of 4 dB at, get this, 10,000 MHz.

If this sounds like science fiction, consider the fact that these 10-GHz fets are only the tip of a much larger iceberg — by the end of the year it's expected that advanced devices will move into the 15-GHz region, and in several years, possibly to 25 or 30 GHz. Although practical circuit experience is still somewhat limited, many researchers feel that these new devices combine the best characteristics of Schottky and tunnel diodes, but without the isolation problems inherent in two-terminal devices.

Although these fets are usually thought of as small-signal devices, cellular GaAs fets have been combined to form very efficient linear amplifiers which rival the best bipolar linears down to about 4 GHz (gain is so high at lower frequencies it's practically impossible to build unconditionally stable amplifiers).

Most of the research so far has been devoted to single-gate fets, but dual-gate

structures have been built and they show great promise. Their noise figure is a bit higher than the single-gate fet, but the dual-gate version has higher gain. Furthermore, the dual-gate GaAs fet has a large gain modulation range so it's suitable for use with agc.

In addition to their use as linear amplifiers, these fets are finding applications as oscillators and mixers for integrated microwave receiver front ends. Since the GaAs fet exhibits a large dynamic range with conversion gain, it may eventually replace diode mixers at microwave frequencies. As an example of an fet mixer, scientists at Raytheon recently showed an 8-GHz GaAs fet mixer with a 7.8 dB noise figure and third-order intercept point at +18 dBm. Low-level tunnel-diode mixers for this same frequency have a noise figure which is about 1 dB lower, but gain is also lower and the third-order intercept point is only +5 dBm. However, other researchers have shown that the noise figure of the fets can be reduced considerably by cooling and predict that 1 to 2 dB noise figures will eventually be possible at 10 GHz.

So we come full circle . . . ten years ago a 1 or 2 dB noise figure at 144 MHz was just barely possible, but only if you were willing to use a complex parametric amplifier.

Jim Fisk, W1DTY
editor-in-chief

DIGITAL!



DV-21

The perfect companion for your IC-21A, the DV-21 is an all new unique digital VFO to complete your ICOM 2 meter station. The DV-21 will operate in 5 or 10 KHz steps over the entire 2 meter band. It can also scan either empty frequencies, or the frequencies being used, whichever you select. Complete, separate selection of the transmit and receive frequencies, is as simple as touching the keys. When you transmit, bright easy to read LEDs display your frequency. Release the mic switch, and the receive frequency is displayed. There are also two programmable memories for your favorite frequencies. You won't believe the features and versatility of the DV-21 until you've tried it. It's new, and it's from ICOM.



Distributed by:



ICOM

ICOM WEST, INC.
Suite 3
13256 Northrop Way
Bellevue, WA 98005

ICOM EAST, INC.
Suite 307
3331 Towerwood Drive
Dallas, TX 75243



REPEATER LINKING (Docket 20073) okayed by the FCC, will be permitted after July 11th. Limitations are that linked repeaters must operate on the same band (cross-banding linked repeaters will be covered later with Docket 20113), license of each repeater in a linked system must submit a new system network diagram showing all stations in the system.

Repeater Automatic Control (Docket 20112) also approved, requires that repeaters operated without a control operator must record their transmissions for later review, incorporate procedures to shut the system down for "malfunctions or improprieties." No modification of existing repeater licenses is required by the terms of the Report and Order, which goes into effect July 28th.

"Closed Repeaters" (defined as "repeaters used only by persons specifically authorized by the control operator") are exempted from the requirements for recording and review — such systems typically require some form of coded access.

HIRAN DOCKET is definitely warming up as FCC's Office of Chief Engineer has asked Amateur And Citizen's Division for its list of coast area frequency coordinators. Lab and/or field testing to determine interference potential is a strong possibility, and if such tests get complicated they could further delay any decision on whether HIRAN will end up in the 420-450 MHz Amateur band.

WARC 1979's last open slot, chairmanship of 1296 MHz and up Task Force, has been filled by Chuck Dorian, W3JPT. Initial work of some WARC groups has begun with mailings and telephone discussions.

MID-CONTINENT AMSAT NET is moving from 3850 to 7280 kHz for its regular 9:00 PM Tuesday night (0200Z Wednesday morning) sessions, at least for the summer. This should reduce QRN and propagation problems, may encourage some additional participation from AMSAT members not on 75 meters.

Another Mode Jump occurred in OSCAR 7 on June 22nd. Any listener who heard the satellite go from Mode A to Mode B or simply didn't find it on the scheduled mode as expected could help AMSAT by dropping a note to Box 27, Washington, D.C. 20044.

New Satellite Amateur Band proposed by Bob Haviland, W4MB, head of the WARC '79 Task Force on 27-1296 MHz amateur allocations. A "propagation optimum" exists in the 900-MHz region, so Bob proposes a secondary amateur allocation for space communications only in the 33cm area. He also proposed that satellite allocations in other amateur bands be broadened.

Another AMSAT Project Leader is sought, this time to oversee design and construction of low cost 2- or 10-to-BC band converters (with bfo) for use in schools with AMSAT's educational program.

SEVERE RESTRICTIONS ON TRANSMITTERS proposed for Texans. A set of regulations restricting all rf electromagnetic radiation has been written up by the Texas State Department of Health Division of Occupational Health and Radiation Control. They would effectively prohibit hand-held or even mobile transmitter use in the state because of their unreasonably low levels of permitted exposure. In addition, the proposed regulations would severely limit the power output of fixed stations — and would, of course, cover public service and broadcast as well as Amateur and CB.

Whether A State even has the power to make such restrictions is questionable — the Communications Act of 1934 gives the Federal government jurisdiction over radio communications — but if the proposal should be adopted anyway, a lengthy (and expensive to the taxpayer) court battle would undoubtedly result.

When price is no object...

VHF Engineering is still No.1



\$129.95 buys the best . The HT-144B VHF Engineering Walkie-Talkie Kit

RECEIVER:

Sensitivity
typically 2mV squelch threshold
 .35mV for 20 db/or quieting
Selectivity Adjacent channel interfer-
 ence: 60 DB down at 30 KC
Audio output ... 1 watt
No. of channels 4

TRANSMITTER:

Typically 2 watts output
Modulation True FM
No. of channels 4 (.52 simplex included at
 no extra charge)

POWER REQUIREMENTS:

12 volts D.C.
10 cell battery holder included (Accepts
AA size)
External battery charger terminal

OPTIONAL ACCESSORIES:

Nicad battery pack \$29.95
Nicad battery charger 4.95
"Rubber Duckie" Ant. with
BNC connectors 12.95

REPEATER



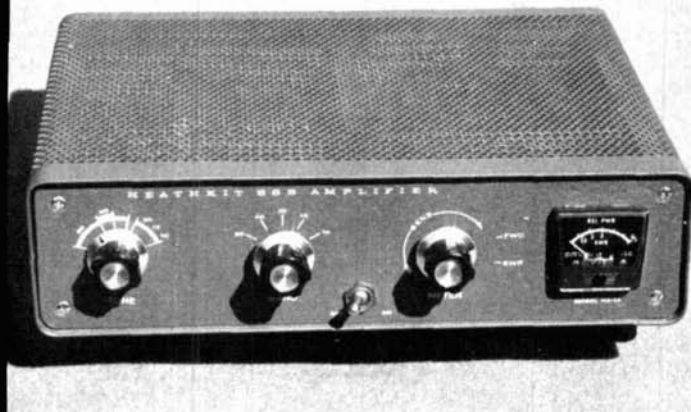
RPT-144 Complete Kit \$364.95
Wired and Tested \$595.00

Vhf engineering

320 WATER ST. • PO BOX 1921 • BINGHAMTON, NY 13902 • 607-723-9574

DIVISION OF BROWNIAN ELECTRONICS CORP.





500-watt power amplifier for 160 meters

Modifying the
Heath HA-14
or SB-200
for top-band
operation

With the recent decrease in sunspot activity and fewer DX openings on 10 and 15 meters, interest in the 160-meter band operations has increased markedly. And, in the future, with Loran A vacating the band, we can expect full use of 160 meters with restoration of full power.

I first got on 160 in late 1968, completed my 160-meter WAC in 1973 and my 160-meter country total now stands at 74 with nearly half on ssb. The

160-meter band is now my primary amateur interest and in April, 1972, I went on a one-operator, seven-country, 160-meter DXpedition into the eastern Caribbean.¹

Amateur stations in the states and provinces along the Atlantic and Pacific coasts are generally restricted to 100 watts input power at night and 500 watts during the day. The idea of 500 watts of daytime power is very appealing, particularly for use during those short periods around sunrise and sunset when long-range DX contacts can be made on occasion.

Sometime ago I picked up a Heath HA-14 linear rf power amplifier for use on 10 through 80 meters. The HA-14, known as the "Kompact KW," was originally designed for mobile use although separate ac and dc power supplies were available. It appeared that the HA-14 could be modified for operation on 160 meters, so another was obtained. The HA-14 is no longer in production but units invariably turn up at amateur flea markets and auctions. The current pro-

Albert Segen, W2BP, 101 Collins Avenue, Pleasantville, New Jersey

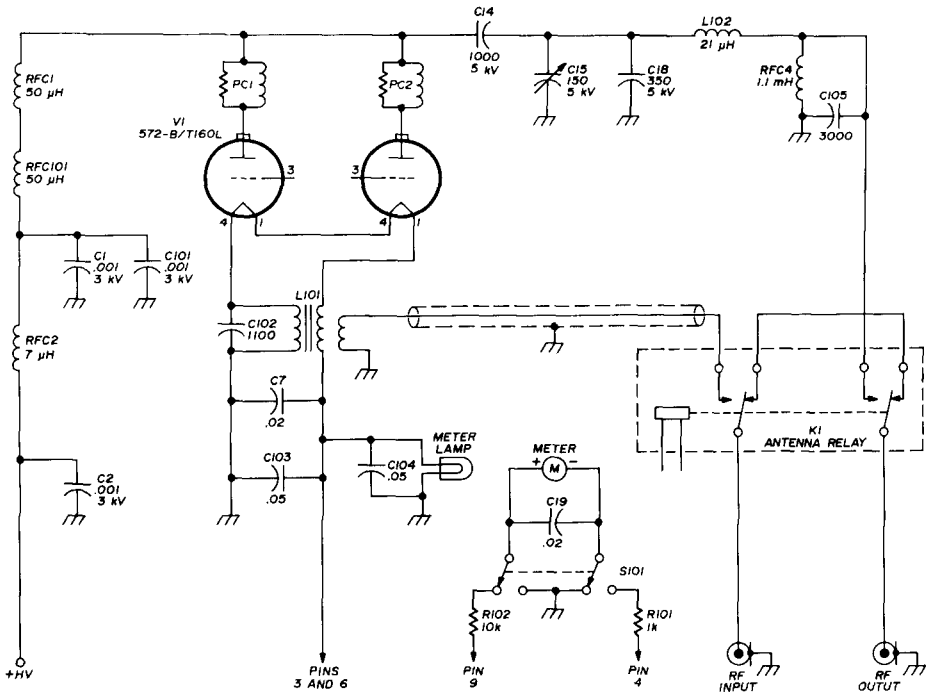


fig. 1. Schematic of the Heath HA-14 modified for operation on 160 meters. Components with 100-series part number (R101, C101, etc.), are added.

duction Heath SB-200 is much like the HA-14 rf circuit; modifications unique to the SB-200 will be treated later in this article.

The modifications described are for a 1 kW ssb amplifier operating over the range from 1800 to 2000 kHz. Some performance will be compromised when the amplifier is used at a CW level of 500 watts input.

design factors

Before modifying a proven unit like the HA-14, I felt it was appropriate to go through some of the basic design calculations for the output pi-network. Using a plate supply voltage of 2100 volts and an input of 1 kW peak ssb in class-B linear operation, the plate load impedance was calculated to be about 2800 ohms. This plate impedance requires a pi inductance of about 21 μ H and a tuning capacitance around 440

pF.² Happily, these values could be accommodated in the space available within the HA-14.

With the HA-14 operating at 500 watts input on CW, the plate load impedance is essentially doubled, requiring an inductance far larger than the room available in the HA-14. Therefore, using component values calculated for 1 kW ssb input, amplifier efficiency is somewhat lower at 500 watts CW but there still is a worthwhile power increase.

modifications

A schematic diagram for the 160-meter HA-14 power amplifier is shown in fig. 1. As there are no changes required in the grid circuit, that portion of the amplifier is not included in the diagram. The values of the original plate choke, RFC1, and bypass capacitor, C1, are not high enough for operation on 160 meters. The addition of choke

RFC101 in series with RFC1 and capacitor C101 in parallel with C1 solve this problem. The location of these parts is shown in **fig. 2**.

All components in the plate circuit tank compartment are removed except the variable capacitor and the wiring harness. I chose not to destroy the original coil and was able, with care, to disassemble the multideck bandswitch by loosening all the assembly screws. This allowed the original coil to be removed without cutting any coil connections to the deck switch.

The output capacitor, C105, consists of three capacitors in parallel which are mounted on the rear wall of the compartment. One is a husky 2000 pF mica while the others are 500 pF postage-stamp micas (see **fig. 3**). Do not skimp on the quality or size of these capacitors as considerable rf current flows at this point.

The pi network inductance, L102, has 37¼ turns, the quarter turn used to provide mechanical support as can be seen in **fig. 3**. When initially cut from a B&W 3026 air inductor (2 inch [51 mm] diameter, 8 turns per inch, [3.1 turns per cm], 10 inches [25cm] long), 39 turns were used. Almost two turns were unwound at the antenna end of the coil to permit the use of the polystyrene support rods as short standoff insulators for support at the left side of the compartment. A ceramic standoff insulator at the antenna end provides further mechanical support.

The 350 pF capacitor (C18 in the original circuit) is used as part of the plate tuning circuit and is mounted on a piece of aluminum strip along with the coupling capacitor, C14. Capacitor C18 is installed on the right side of the compartment and acts as a support for the hot end of inductor L102.

All the input coils and capacitors are removed at the same time the original tank circuit is removed. I was not successful in designing an input pi-network with essentially flat vswr over the range

of 1800 to 2000 kHz without some sort of retuning at each end of the band. The circuit I finally worked out proved to be simple, effective and used a minimum of parts — inductive coupling of the exciter into the bifilar filament choke. The bifilar choke remains in place as in the original HA-14 except that a third winding is carefully wound onto the bottom end (see **fig. 4**).

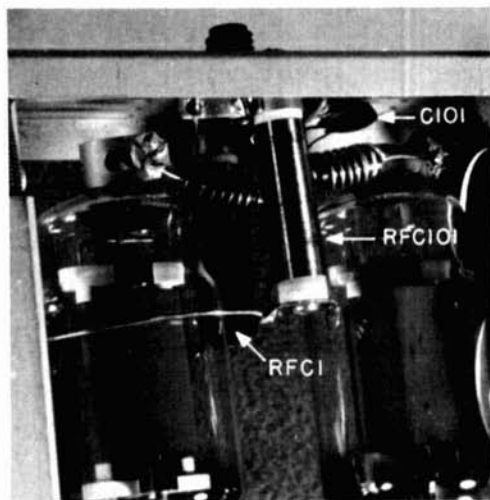


fig. 2. High-voltage compartment of the HA-14 showing the added plate choke and bypass capacitor.

This input assembly, which is labeled L101 in **fig. 1**, is resonated to 160 meters by capacitor C102 (three 300-pF and one 200-pF mica capacitors in parallel). Do not try to get away with too few capacitors here as there is an appreciable rf current flow. The third winding on the bifilar choke consists of 6½ turns of number-20 (0.8mm) stranded, insulated wire, held in place by Duco cement.

measuring dc power input

The HA-14 has no provision for measuring either plate voltage or plate current, but this is easily corrected. Whatever the merits the vswr bridge may have had when the HA-14 was used

in an automobile, for fixed-base operations everyone should have a decent vswr bridge. The HA-14 meter has six divisions which readily permits full-scale readings of 6000 volts and 600 mA. The vswr function was abandoned.

The vswr switch and variable resistor were removed, a new rotary two-pole two-position deck switch was installed, and a meter circuit arranged for moni-

didn't have a one-ohm resistor, I used ten 10-ohm resistors in parallel. Fig. 5 shows the location of the resistor bank, R201, in the circuit. The hot end of the resistor is then wired to pin 1 of the HP-24 octal power socket and then through the new power cable to pin 4 of the HA-14 connector. Within the HA-14 a wire is run from pin 4 on the power socket through the cable bundle to R101 and then to S101.

The HA-14 ALC threshold level is set by a resistive voltage divider across the high-voltage line (R1 thru R7) in the HP-24 power supply. A level of approximately 6 volts dc is brought through pin 9 to the right-hand terminal of the strip seen in fig. 4 and makes an ideal point to use for measuring plate voltage. From that point a 10k resistor, R102, goes to switch S101; S101 is used to switch between plate voltage and plate current readings. While a dpdt toggle switch could be used for S101, I used a rotary switch so the front panel of the HA-14 would retain its original appearance.

Blinking of the pilot light during modulation or keying is cured by the addition of capacitor C104. More effective rf bypassing at the bifilar choke was accomplished by adding C103. To retain the panel's original appearance, an old variable resistor from my junk box was used to fill the hole left by the removal of the bandswitch.

test procedure

The initial testing of an rf amplifier of this power level requires a good 50-ohm dummy load capable of handling the power. Vswr bridges at both the input and output are essential. It is highly recommended that an rf power output meter be used if overall performance and efficiency are to be determined.

With minimum power output from the exciter, turn on the HA-14. There should be no mistaking the closure of the HA-14 antenna relay when you key the exciter. Rapidly turn the tank capacitor, C15, to resonance as indicated

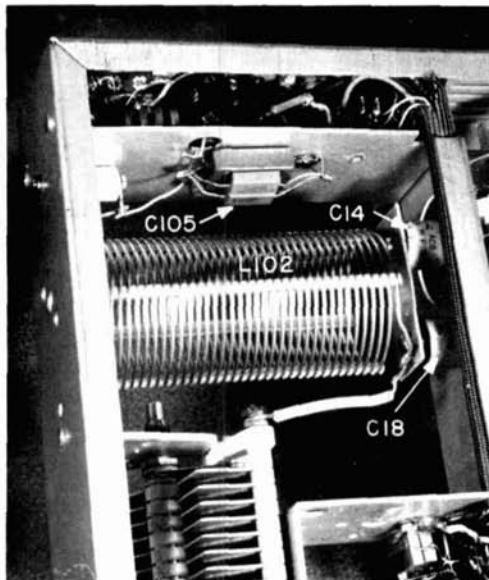


fig. 3. Pi-network compartment of the 160-meter Heathkit HA-14.

toring dc power input. Since another wire is to be added to the power cable to measure plate current with the amplifier meter, a new cable is needed. I used a cable four-feet (1.2m) long with number-14 (1.6mm) wires for the ac and filament lines.

Plate current is measured by inserting a one-ohm resistor in the high-voltage ground return in the Heath HP-24 power supply and using the amplifier panel meter as a voltmeter to measure the voltage drop across the resistor. Open the ground return lead of diode CR14 and insert the one-ohm resistor. Since I

by maximum power output. C15 should be about two-thirds meshed at the 1800-kHz end of the band and near minimum at the 2000-kHz end.

Next test the dc power metering. Because of the high voltage involved, these tests can be extremely dangerous and should never be made without a responsible and knowledgeable person in the shack with you. From Heath specifications and my own tests, the no-load voltage on the power supply is

Next test the input circuit. A vswr bridge between the exciter and the HA-14 should indicate a vswr of 1:1 when the exciter is keyed and the HA-14 is putting out power. If this is not the case, temporarily solder another 100 pF capacitor across C102. If the vswr improves, it means that C102 is not large enough; if the vswr worsens, it means C102 is too large and the 200 pF should be reduced 100 pF. If you find you cannot bring the input vswr to 1:1 by

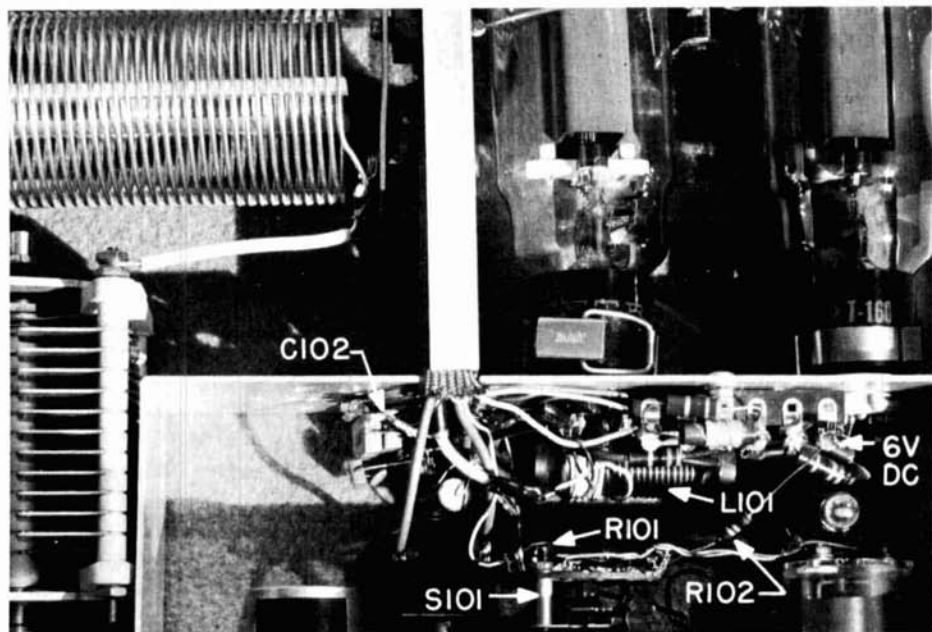


fig. 4. Input network and metering circuit.

about 2500 volts dc. Slight changes in the value of R102 may be necessary to bring the panel meter to a 2500 volt reading (2.5 on the swr scale).

With a reasonably accurate 500 mA meter in series with the high-voltage cable, increase the drive from the exciter to produce 200 mA current flow in the HA-14. The HA-14 panel should indicate 200 mA (2 on the swr scale). A slight adjustment in the value of R101 may be necessary to bring the HA-14 meter into agreement.

adjusting the value of C102, use that value at C102 which brings the vswr to a minimum and work on the third winding of L101, adjusting the number of turns until the vswr is 1:1.

When the input vswr is satisfactory and the output circuit is tuned to resonance, increase exciter drive until the HA-14 plate current is 250 mA; this is 500 watts input. Output power is about 260 watts for an efficiency of about 52 per cent. Amplifier power gain is about 6.7 dB (55 watts drive for 260 watts

output). Increasing exciter drive until the HA-14 plate current is 400 mA produces approximately 800 watts input (the key should be held down no more than 5 seconds). Power output is 450 watts for an efficiency of about 56 per cent. Power gain is about 7 dB (90 watts drive required for 450 watts output).

Now you can connect your antenna. However, the antenna should have reasonably good vswr. If your antenna is

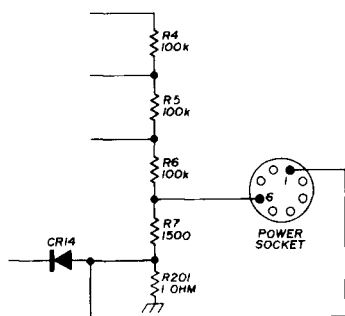


fig. 5. Partial schematic of the Heath HP-24 power supply showing the addition of resistor R201 to permit plate-current monitoring.

not reasonably flat, you are going to run into problems. The variable tank capacitor, C15, because of its limited range, may not be able to bring the tank circuit into resonance if the amplifier load is too far off from 50 ohms resistive.

Heath SB-200 modifications

The rf circuits in the HA-14 and SB-200 are almost identical. While the HA-14 has C18 (a 350 pF, 5 kV capacitor), the SB-200 has no such capacitor. It can be obtained from a regular parts supplier. Heath is the source of the choke RFC101 (Heath part 45-61, 50 μ H rf choke) used in both the HA-14 and the SB-200 160-meter modifications.

Because of the extensive metering in the SB-200, the metering changes described for the HA-14 are not required.

This saves time and parts when modifying the SB-200. In addition, the vswr bridge is retained.

A variable pi-network output capacitor is used in the SB-200. While a fixed 2000 pF mica capacitor must be added to the output network as in the HA-14, the variable capacitor in the SB-200 should give some added control over antenna loading.

I have not modified a SB-200 but an inspection indicates the following items should be considered: C11 and C19 (bifilar choke bypasses) should be increased to 0.05 μ F. Capacitor C12 may have to be removed. While C102 in the HA-14 has one side grounded, in the SB-200 this 1100 pF capacitor should be placed directly across one of the windings of the bifilar choke.

The bench checks of amplifier gain were substantiated on the air. There were not many reports as daytime activity on 160 meters is quite low. Nevertheless, during one major contest an ssb contact with Hawaii occurred at sunrise with the amplifier in use — my signal was not readable while I was running barefoot.

I estimate that no more than six hours are required to make the modifications to the HA-14 and less for the SB-200. Except for the plate choke RFC101 (which is available from Heath) all parts are quite standard. Parts cost is less than \$15 if all parts are purchased new, the most expensive item being the tank coil, L102. For the SB-200 modification only the 350 pF, 5 kV, capacitor needs to be obtained. No attempt should be made to run the HA-14 at 1000 watts input on CW — the tubes would probably collapse.

references

1. Douglas Stivison, WA1KWJ, "Caribbean 160-meter DXpedition," *Worldradio News*, August, 1972, page 8.
2. Irvin M. Hoff, W6FFC, "High-Frequency Power Amplifier Pi-Network Design," *ham radio*, September, 1972, page 6.

ham radio

vhf fm receiver alignment techniques

Complete discussion of
alignment techniques
for the three
most popular
vhf fm receiver
circuits

There are two seemingly complementary diseases which afflict large numbers of amateurs: "alignaphobia" and "align-
atosis". The first of these is characterized by an absolute terror of making any attempt to align any electronic circuit. The etiology of the disease probably lies in a very conservative (e.g. *don't touch!*) early education in electronics reinforced by a lack of self confidence, the kind nurtured best by

some mystical commodity usually called "experience." The latter disease, on the other hand, causes the victim to inexplicably twist, turn and adjust everything in sight with neither rhyme, reason nor clearly defined purpose. Which is to be most feared is best left to the philosophers. The purpose of this article is to offer a little insight which will help both sufferers along; at least where fm receivers are concerned.

typical fm receivers

Knowledge has a way of alleviating both forms of alignment syndrome provided it is supplied in big enough doses. This need not be frightening as the proper dosage is surprisingly close to that level required to pass the technician/general class examination. Toward that end let us consider first a couple of the more popular fm superheterodyne designs.

Fig. 1 shows the block diagram of one typical superheterodyne fm receiver. The front end converts the 146-MHz vhf fm signals to a lower, more manageable intermediate frequency through a process of heterodyning the rf signal against that from a local oscillator. Most amateur receivers or

Joe Carr, K4IPV, 225 North Glebe Road #3, Arlington, Virginia 22203

transceivers use three to five transistorized i-f amplifier stages and, sometimes, a limiter. Another popular alternative, providing at least as much gain, is the use of one or two very high-gain IC *gain blocks* of which there are several readily available.

The final stage, prior to the audio section, is the fm demodulator. This

against the output of a crystal oscillator to produce a low i-f in the vlf range (typically 455 kHz).

The problem of aligning an fm receiver is primarily in learning to recognize detector types and knowing the proper procedure for that type with which you are confronted. There are three basic types of fm detectors in

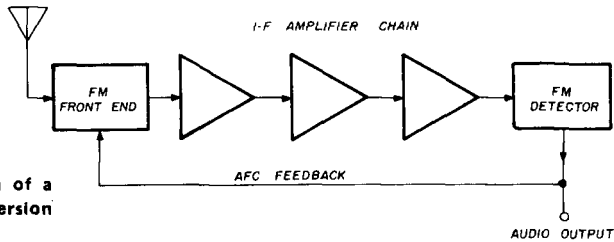


fig. 1. Block diagram of a typical single-conversion fm receiver.

stage processes the frequency-modulated i-f signal to extract the original audio information. In some receivers it also serves to supply the dc feedback control voltage used to drive any automatic frequency control (afc) circuits which might be used in the receiver.

Many fm receivers are actually dual-conversion jobs such as shown in the

general use: discriminator (Foster-Seeley), ratio detector, and quadrature detector. I recognize that others exist but not in sufficient incidence to warrant coverage here.

Fig. 3 shows a simplified but essentially complete version of the Foster-Seeley fm discriminator. In this circuit signal voltages from the primary of T1 are added to signal voltages in the

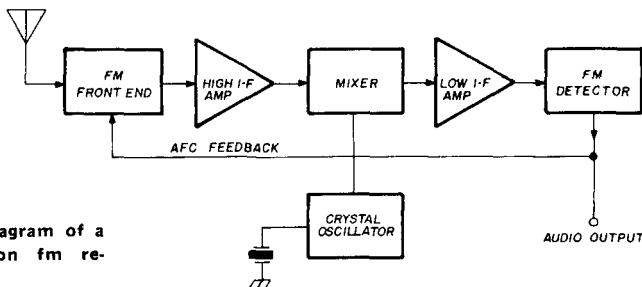


fig. 2. Block diagram of a double-conversion fm receiver.

block diagram of fig. 2. In this system the front end converts the rf signal to the same high i-f (usually 10.7 MHz although other frequencies are sometimes used) as used in single-conversion designs. This signal is then heterodyned

secondary. When the signal frequency is exactly equal to the frequency to which the secondary is tuned the output voltage will be zero. Deviation, whether caused by a shift in carrier frequency or by the process of frequency modula-

tion, will produce a positive or negative output voltage depending upon the direction of frequency shift. This varying output voltage is the audio signal.

Another traditional fm detector is the ratio circuit of **fig. 4**. There are two immediate characteristics of this circuit which distinguish it from the Foster-Seeley discriminator: the diodes point in opposite directions and the circuit includes an electrolytic capacitor (**C3**). The capacitor is sometimes referred to as an a-m suppression capacitor as it bypasses amplitude variations sufficiently to reduce the need for a limiter. In the ratio circuit the relative charges on capacitors **C1** and **C2** will have a 2:1 ratio when the i-f frequency is precisely equal to the resonant frequency of the secondary of the transformer. Frequency deviation causes the ratio to change, resulting in an audio output signal.

quadrature detectors

The last type of detector to be considered here is an old friend which has been given a nominal re-birth by the advent of integrated-circuit technology: the quadrature detector. This circuit gets its name from the fact that it

The input stages to the quadrature detector circuit are wideband, high-gain amplifiers which serve to limit the amplitude variations of the input signal. This eliminates a-m components such as

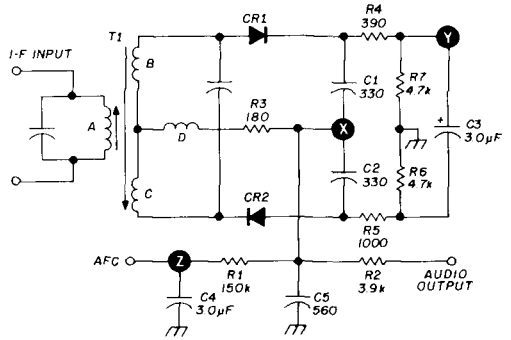


fig. 4. Fm ratio detector is found in many fm receivers.

noise and converts the signal to a series of squarewaves. These square waves have varying periods and durations, the actual value of which depends upon the input frequency and the nature of the modulation.

The square waves from the limiting amplifiers are fed to a splitter section which separates them into two channels. One is fed directly to the synchronous-gated detector while the other is fed to an external (see **fig. 6**) 90° phase shift network. The shifted version is then fed to the alternate input of the gated detector.

One process of the gated detector is to integrate the detector output pulses to extract the audio signal. Be aware that the use of an IC in the detector does not automatically indicate the use of a quadrature circuit. The real telling feature is the phase coil in place of the transformer. There are many types of ICs used in fm i-f stages which also include the detector diodes. An example of such a device is the popular RCA CA3043. These devices are given away by the use of a transformer.

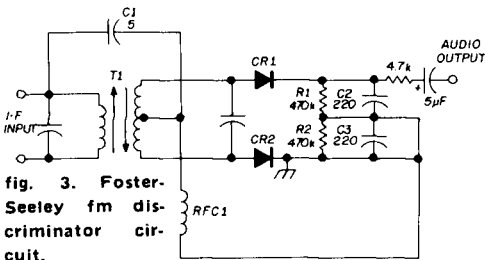


fig. 3. Foster-Seeley fm discriminator circuit.

demodulates an fm signal by combining two versions of the i-f which have a phase difference of 90° (that is, the signals are "in quadrature"). An example of the IC Quadrature Detector (ICQD) is shown in block form in **fig. 5** and as a schematic in **fig. 6**.

alignment instruments

Fm alignment procedures all require some sort of controlled signal source as the standard. Some amateurs may have a complete fm alignment laboratory

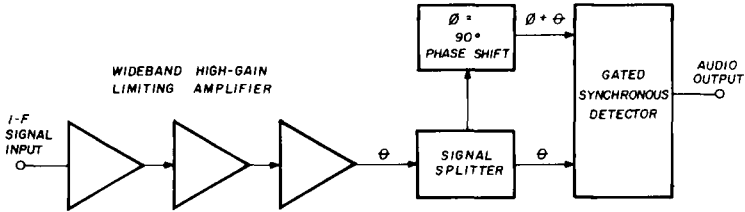


fig. 5. Block diagram of the MC1357P IC fm quadrature detector.

that would make the GE and Motorola two-way radio R&D labs jealous, but such resources are not needed, as will be demonstrated. However, if you have the resources to select a reasonably high grade instrument there are several factors to look for:

1. Low residual signal leakage. It is not very helpful if the signal level leaking around the attenuator or through the

3. Calibrated output level. The usual method is to have a meter with a known *set point* preceding the attenuator. The attenuator is then calibrated in microvolts or dBm.

4. Control over modulation level and some means of indicating amounts. If an a-m only signal generator is being considered, a means is needed for turning off the modulation.

5. Reasonable short-term stability and rugged construction.

There are a number of signal generators available which will suit the needs of the amateur. Some are available at

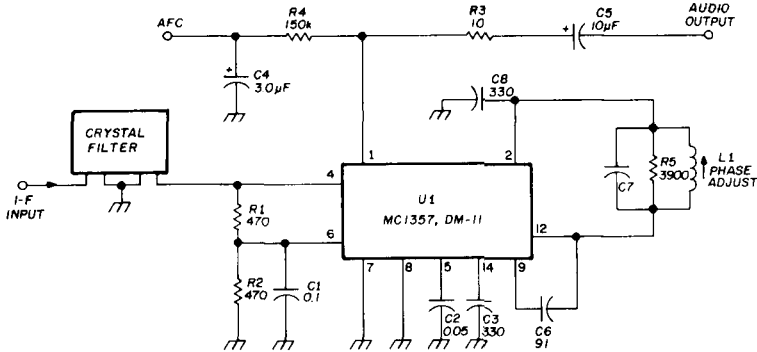


fig. 6. Typical circuitry used with the fm IC quadrature detector.

cabinet flanges can drive your receiver into hard limiting.

2. Reasonably accurate frequency dial or a means of setting to accurate points (i.e. crystal calibrator or a high-level output for a frequency counter).

attractive prices on the surplus market and include the venerable Measurements series (models 60, 80, etc), the surplus TS-497 (military version of the Measurements 80), and the old Boonton 202. Fig. 7 shows an updated version of the model 202 now offered by the Boonton

division of Hewlett-Packard as their model 202H. The main signal generator produces a high quality vhf fm signal at a calibrated output level.

The Univerter in fig. 8 takes the



fig. 7. Hewlett-Packard model 202H fm signal generator (photo courtesy Hewlett-Packard).

output of the 202H and heterodynes it down to lower frequencies for use in i-f alignment. One feature of the Univerter is that it produces a low signal with the same deviation (because it heterodynes rather than divides) and output level as the 202H. This allows the calibrated output to be controlled by the 202H attenuator.

Fig. 9, the Measurements model 800, is an updated fm signal generator. A block diagram of the model 800 is shown in fig. 10. This instrument has proven popular with the commercial vhf fm mobile-radio crowd as it is reasonably portable for installation in a crowded service truck.

As amateurs on limited budgets we often find it necessary and advisable to have available certain contingencies which allow a goal to be realized. While I will readily concede that a kilobuck signal generator might be the *best* way to align an fm receiver, I think it is necessary to offer a viable alternative to those whose resources are limited to a vtvm or vom and a junk box full of parts. If you fall into this category, as

most of us do, the signal generators shown in fig. 11 and fig. 12 are for you.

Fig. 11 is a simple two-transistor crystal oscillator which should oscillate between 1 and 13 MHz or so, depending upon what type of transistor you use. The transistors can be almost any small-signal type offering good gain at the frequency range of interest. One oscillator I built used some vhf pnp Germanium types salvaged from an old Delco car radio. The crystal, Y1, should be chosen to produce either the desired frequency (in the case of the i-f) or a sub-harmonic of the front-end rf frequency. For example, a 10.7-MHz crystal for the i-f and either 6- or 12-MHz crystals which are sub-harmonics of the receiver frequency. The trimmer C_T can be used to zero the crystal frequency. This can be done with a crystal calibrator and a receiver, external counter or another fm receiver known to be correctly tuned to local repeater frequency.

The low cost of TTL IC logic devices means that the calibrator of fig. 12 can be built for practically peanuts. If the crystal is a 500-kHz type the output can be used as 5-kHz markers in a sweep alignment procedure. If you eliminate the two SN7490P decade dividers and plug in a 455-kHz crystal, the circuit can be used to supply the low i-f frequency used by some receivers. This circuit will oscillate, when selected TTL devices are used, up to frequencies of several MHz.

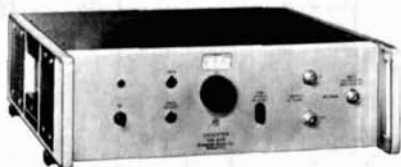


fig. 8. Hewlett-Packard 207H Univerter i-f converter for the model 202H signal generator (photo courtesy Hewlett-Packard).

Please note that the procedures described here, while being reasonably universal, are fairly generalized. They are not an end-all for all receivers. Some radio manufacturers might toss in a few

manuals, or where resources do not permit, following the procedure prescribed here should prove successful.

A typical sweep alignment set-up is shown in fig. 13. The signal generator

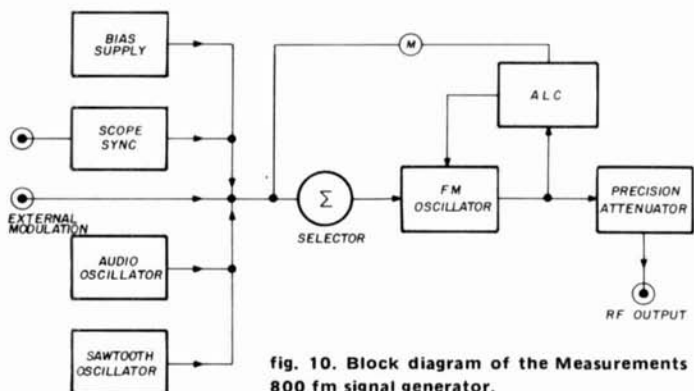


fig. 10. Block diagram of the Measurements 800 fm signal generator.

wrinkles of their own just for fun. If you have a service manual or other source which promotes a certain technique as best, bow to their wisdom and follow it if possible. In the absence of

provides a calibrated, controlled source which is supposed to effectively simulate the input from the antenna. In some manuals a dummy antenna will be specified for interconnection between the generator and the receiver. The marker is a crystal oscillator which is used to provide pips on the oscilloscope trace to aid in identifying specific frequency points. The adder is an isolator which allows interconnection of all the instruments without undue interactions which might tend to make the job impossible. When the audio output from the receiver is added to the detected output from the other sources the oscilloscope will display what is essentially a calibrated frequency response curve for that receiver.

Fig. 14 and 15 show the various curves associated with sweep alignment. The trace in fig. 14A is an i-f response curve. The dip at the top end of the curve will be especially noticeable in wideband equipment. Authorities usually claim that the dip should have a depth of ten percent of the overall amplitude. Let that be a maximum. Do not try what one serviceman acquaint-



fig. 9. Measurements model 800A fm signal generator (photo courtesy Measurements Division, Edison Electronics).

ance of mine did, and create the dip from what was essentially an almost ideal flat response!

Fig. 14B shows the discriminator output curve. Note that the output

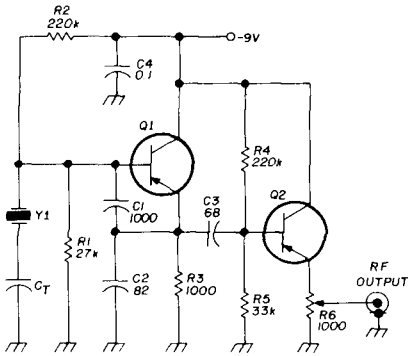


fig. 11. Simple two-transistor alignment oscillator.

voltage goes through zero when the input signal frequency is equal to the resonant frequency of the discriminator transformer secondary. This should give you some ideas as to how an fm deviation meter operates. The curve in fig. 15 is a fairly typical response curve showing a marker pip at the center frequency.

Most receiver manufacturers clearly

state in their literature exactly where they want the i-f alignment signal injected. This might be a jack or test point in the tuner or in the input section of the i-f amplifier strip. Follow their advice if the point is known. In the absence of good data connect the signal generator output to either a capacitor connected to the mixer input or a "gimmick" dropped inside the first i-f transformer. The gimmick, in this context, is simply a short length of *insulated* hook-up wire. About 1/4-inch (6-mm) is bared on one end to make contact with the generator output cable.

One common procedure calls for a zero-center voltmeter (most vtms and fet voltmeters can be made zero center by adjusting the zero control) to a point such as Z in fig. 4. Apply an fm signal to the input and adjust the secondary of the detector transformer to zero volt. The meter will shift positive on one side of the correct setting and negative on the other side. Now adjust the i-f tuning to produce a curve such as that shown in fig. 15. During this operation keep the input signal level well below the limiting point but above the noise to eliminate any ambiguity. Overdriving the receiver (driving it into limiting) has a tendency to broaden the response and obscure the true peak.

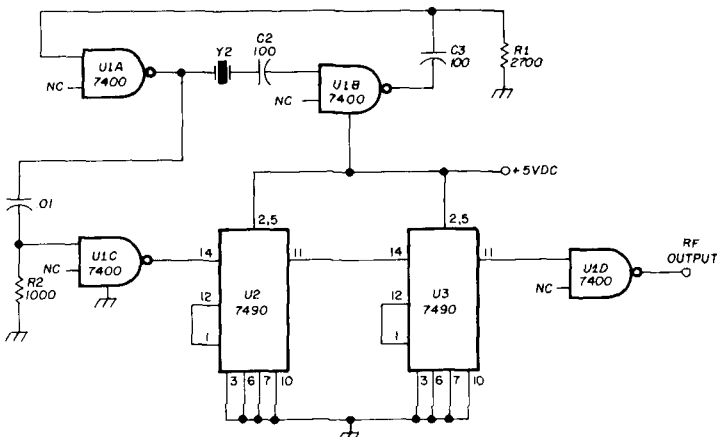


fig. 12. Simple TTL digital logic IC alignment oscillator.

One aspect of the procedure for aligning the secondary of the transformer is that the correct point is established with the least total harmonic distortion. Although that is not the best way to go (unless the proper THD analyzer is available) I have known professional servicemen who could rough in an alignment off the air to an extent that the operator would not know the difference.

The local oscillator in the front end can be set by adjusting the trimmer capacitor across each channel crystal for a zero at point Z when a precisely

audible level. If the input is a common base or gate design one adjustment will be noticeably broader than the other.

non-swept alignment

The use of the transmitter oscillator applied to the receiver alignment in at least one model transceiver implies that it is not absolutely necessary to use a sweep generator. In fact, the non-swept technique, properly applied, will yield comparable results. However, it must be noted that sweep alignment is preferred by high-fidelity buffs because of the interaction of the i-f alignment and the

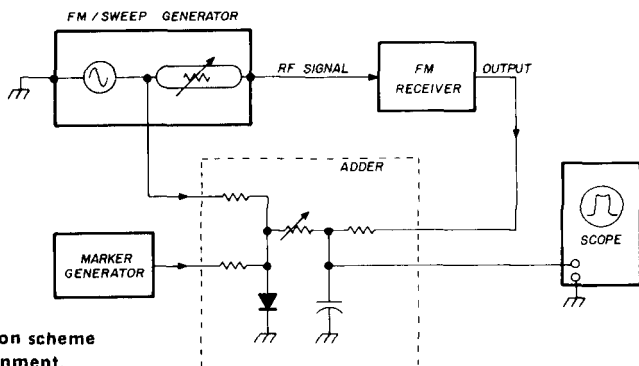


fig. 13. Connection scheme for fm sweep alignment.

known input signal is applied to the input. The signal can be from a multi-kilodollar synthesizer/frequency meter, a close-at-hand transmitter, simple crystal oscillator as shown earlier (provided it is accurate) or from your local repeater. In my Heath HW-202 the transmitter oscillator is used for this purpose. Again, this assumes that some other means was used to verify the transmitter's correctness.

Peak the rf amplifier tuning to either a channel specified by the radio manufacturer or a channel approximately mid-way in the group of channels used. Of course, if the rig is a single-channel affair peak it to that channel. Rf amplifiers will typically have two adjustments. For both it is necessary to keep the input signal level down to a barely

channel bandwidth. In lower grade fm broadcast receivers and narrow-band equipment the need is less acute.

It is important to note, however, that the signal source must be unmodulated. If your source is an a-m signal generator, turn the modulation off. This can be done by turning the modulation control switch to *off* or *external*. Do not depend upon the modulation level or percentage control to sufficiently reduce the level.

As was true in the swept technique, adjust the detector transformer secondary to null when the unmodulated signal, at the i-f of a channel frequency, is present at the input. Coupling to the i-f strip is the same as for the swept technique. Connect a high-impedance dc voltmeter to a point in the receiver

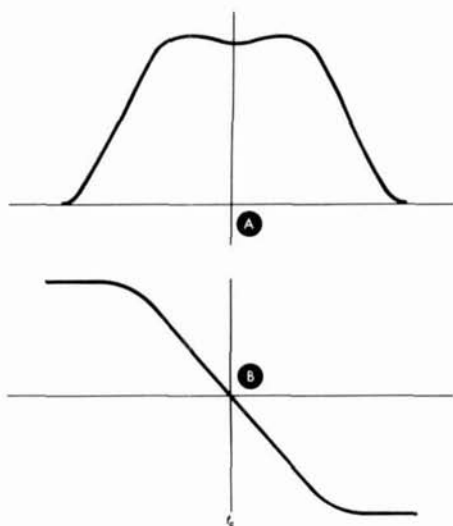


fig. 14. Typical alignment curves from sweep alignment of fm receiver.

which produces a voltage proportional to the strength of the input signal. Point Y in fig. 4 is such a point. In vacuum-tube sets the grid of the limiter does nicely while in transistorized types the emitter resistor of the limiter is good.

Another method uses an rf detector probe at the limiter input although care must be exercised not to detune the output i-f transformer. It is necessary that the input signal level be kept low. In some cases it is a good idea to disable the agc system to prevent interaction with the alignment. No good advice can be given on this point. In some receivers you merely ground the agc line. In others you must apply a fixed bias of one polarity or the other, while in still others it is best to physically interrupt the agc line (some receivers have removable jumpers specifically for this purpose). *Do not* attempt to use your ears as a monitor of the quieting level as it will probably be inaccurate.

In both the swept and non-swept alignment procedures start at the detector and work toward the front-end. Go through the procedure several times looking for a slight improvement each

time. This optimization is needed because there will be a slight interaction between adjustments.

One admonition: *Don't overtighten i-f slugs and trimmer screws.* Many ferrite slugs will become seized if they are tightened against either the top or bottom stops. Additional force will tend to make them break. One sure sign that this has occurred is a "crumbly" feel as you adjust. Stuck slugs can often be freed by application of a slight amount of heat.

I-f transformers which do not tune usually indicate one of two conditions: the transformer is defective and requires repair or replacement, or that coil is actually in the transmitter circuitry (identify *all* parts before making any adjustments). Note that many a good rig has had to make a trip to the repairman because of misguided alignment attempts. Believe me, the service guy can almost always tell a set that has been tinkered with.

quadrature detector alignment

Aligning circuits using the MC1357P or Delco DM-11 ICQD detectors requires a special technique. If a swept generator is available the job is simpler. Connect an ac vtm across the output (in the absence of an ac vtm a rectified dc type or an oscilloscope will be adequate) and adjust the 90° phase coil

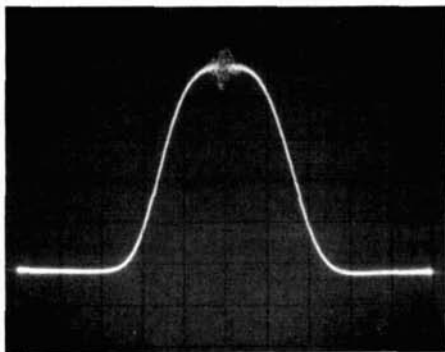


fig. 15. Oscilloscope trace of i-f passband curve with frequency marker.

for maximum output signal level. Connect a dc vtm through an rf detector probe such as the RCA WG-301 to pin 10 of the MC1357 or DM-11 detector (it is worth noting that if you need a MC1357P replacement and can't locate one, drop into the nearest authorized Delco car radio shop and buy a DM-11 or DM-31). Now you can peak the i-f coils for maximum.

When using an unmodulated signal generator you can approximate the pro-

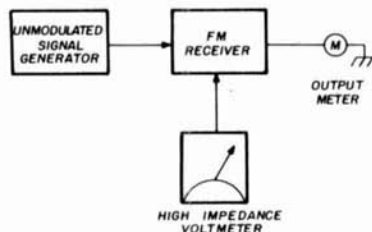


fig. 16. Test equipment arrangement for non-swept alignment of fm receivers.

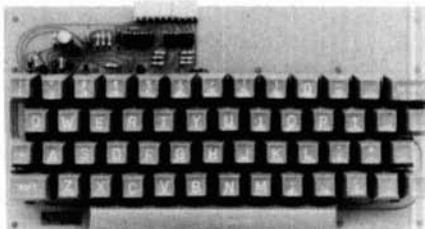
per phase-coil adjustment by nulling the noise level. The phase coil is correctly adjusted when it is tuned to a null located between two relatively high amplitude noise peaks. However, this is only an approximation as the null tends to be rather broad.

summary

As stated earlier these techniques are rather generalized. They will suffice, however, for most jobs without serious performance loss. One parting word of caution: *Do not align anything as a troubleshooting method.* The first and foremost sign of the novice troubleshooter is the galloping "diddle stick." Remember that alignment doesn't change within short spans of time. If your rig suddenly stops working the fault is *not* alignment. Find the fault first. If it is an alignable component, align *only* the replacement part or the repaired original.

ham radio

NEW ★ SWT₂ KEYBOARD and ENCODER KIT



- * 53 Keys
- * One Chip MOS Encoder
- * Upper and Lower Case
- * Standard ASCII Output
- * Two Key Lockout

We are happy to announce a new addition to our keyboard and encoder line. Our new KBD-3 uses a one chip MOS encoder system to give you maximum possible features with a minimum number of parts.

This keyboard produces a standard ASCII coded output that is compatible with TTL, DTL, RTL and MOS logic systems. You have the option of wiring the kit for normal typewriter style output in both upper and lower case letter, or all upper case format. All common machine control commands such as "line feed", "return", "control", etc. are provided on the keyboard. Four uncommitted or extra keys are available for your specific use requirements. Two of these have isolated output lines to the connector for special functions such as "here is".

Keyswitches are standard, full travel style with gold plated contacts for long troublefree service. Requires +5 Volts and -12 Volts.

KBD-3 Keyboard and Encoder Kit \$49.50 ppd

SOUTHWEST TECHNICAL PRODUCTS CORP.

219 W. Rhapsody Dept. HR
San Antonio, Texas 78216



programmable memory

accessory for electronic keyers

Design of an
expandable, programmable
random-access
memory system
for use with
electronic keyers

During the past few years, several circuits have been published for CW keyers, both with and without programmable memories. Most designers, however, seem to either combine memory

capability with a mediocre keyer circuit or design a good keyer with no memory. With the inexpensive TTL ICs and mos memories that are now available, I felt there was room for a better design which incorporated a good iambic keyer with a programmable memory.

Riley¹ had an interesting application of recirculating memories, but the programming seemed awkward, the messages (if more than one) were stored in series, and I felt separate speed controls for the keyer and the memory should be avoided. Gordon² used two mos random-access memories to provide two selectable message stores, but the associated keyer was not acceptable. The other drawback I saw in both these approaches was the inability to re-start the read or write sequence until the current message was completed. The design presented here combines an excellent keyer circuit with two programmable memories.

I chose to use the very popular Accu-Keyer circuit described by Garrett³ as the basic keyer because it features dot

Andrew B. White, WA9LUD, 102 Franklin Street, Urbana, Illinois

and dash memories, iambic operation, automatic character spacing and low cost. The memory accessory, however, could easily be adapted to many other keyer circuits. For the mos memories, I used the readily available National 1101 (or Signetics 2501) static mos RAM. These memories have a three-state output that enables two or more memory outputs to be connected in parallel with no additional circuitry.

places a zero (TTL positive logic) on the CS input of the desired memory. To read the memory, the read line is allowed to float high by switch S3 which enables U7C, gating the data output from the memories to the output keying circuit and sidetone. To write data into a memory, S3 takes the read line to zero, enabling a 500 ns write command pulse triggered by the trailing edge of the clock pulse (see timing diagram, fig. 2).

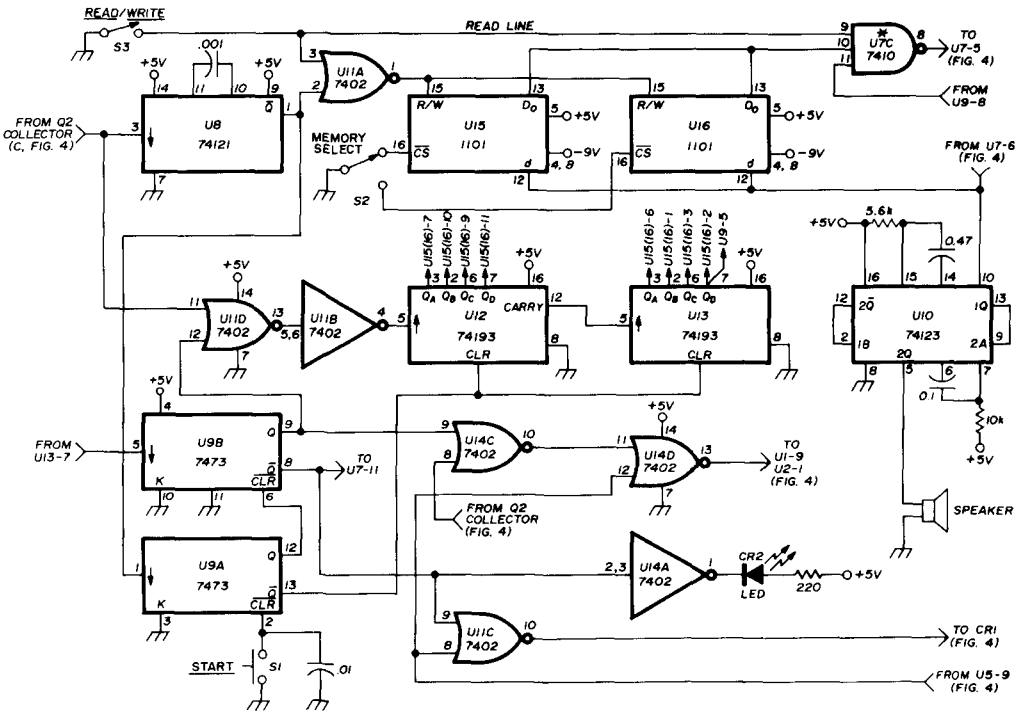


fig. 1. Programmable memory for electronic keyers uses two 256-bit random-access memory ICs, U15 and U16. Timing diagram for this circuit is shown in fig. 2.

memory circuit

Operation of the basic keyer will not be covered here because WB4VVF provided a complete discussion in his original article. Only the operation of the memory circuit itself will be examined. Fig. 1 is a logic diagram of the memory circuit. A memory is selected for either reading or writing by switch S2 which

Both the read and write cycles are initiated by closing S1, a normally-open spst switch, which resets U9A, the start/stop flip-flop U9B, and the counters U12 and U13. When S1 opens, the synchronous four-bit counters count up on the leading edge of the clock pulse from 000 to 255 providing the proper addresses to cycle access to the RAM.

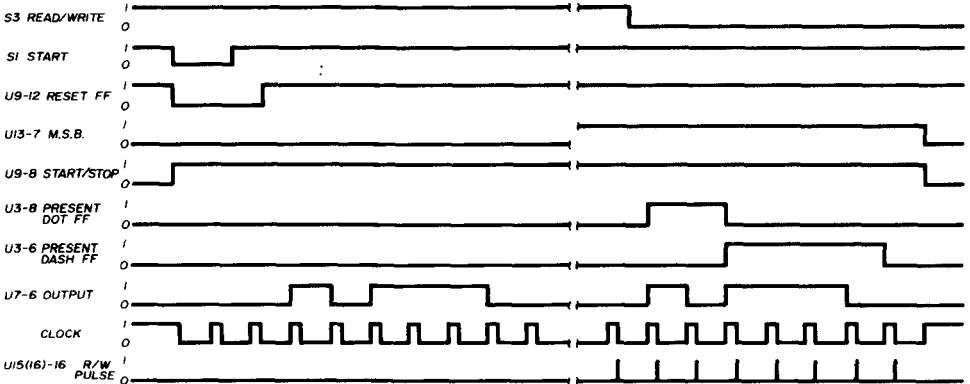


fig. 2. Timing diagram for the programmable CW memory shown in fig. 1.

When the most significant bit of the address goes from 1 to zero, indicating 256 has been attained, U9B toggles, disabling further counting and returning the keyer to normal asynchronous operation.

The start/stop flip-flop, U9B, turns on an LED to signal the user when the keyer is cycling the memory. In addition, a dual monostable, U10, has been included as a sidetone oscillator for programming the memories and use as a code monitor.

Two circuit modifications are necessary to connect the memory accessory to the Accu-Keyer, as shown in fig. 3.

The connection between diode CR1, input gate inputs U1, pin 9, and U2, pin 1, and the missing-character flip-flop, U5, pin 8, has to be broken. Since the oscillator must run free during the read and write cycles, the anode of CR1 is connected to U11, pin 10, which is low during the memory sequence. U5, pin 9, (the complement of U5, pin 8) is connected to U11, pin 8, to provide normal operation when not using the memory.

The gate inputs U1, pin 9, and U2, pin 1, are connected to U14, pin 13, so that during the memory write cycle the dot/dash inputs are sampled only when

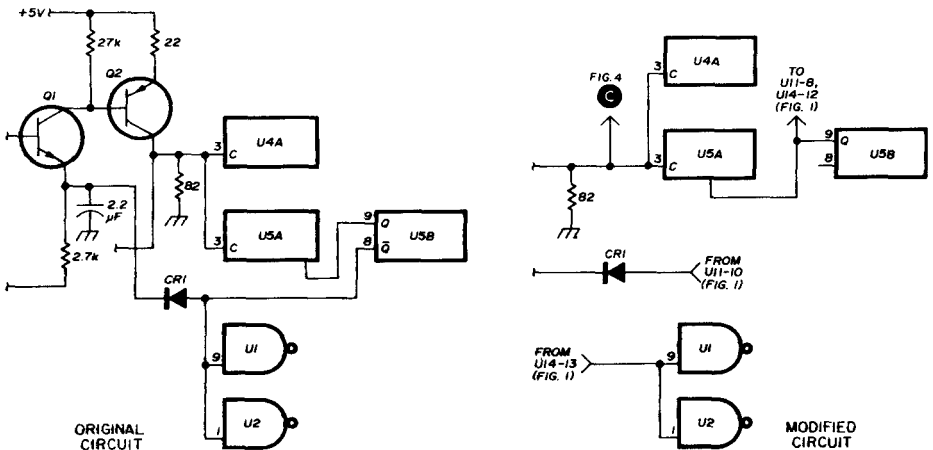


fig. 3. Modifications required to the WB4VVF Accu-Keyer for use with the programmable memory accessory. Complete schematic is shown in fig. 4.

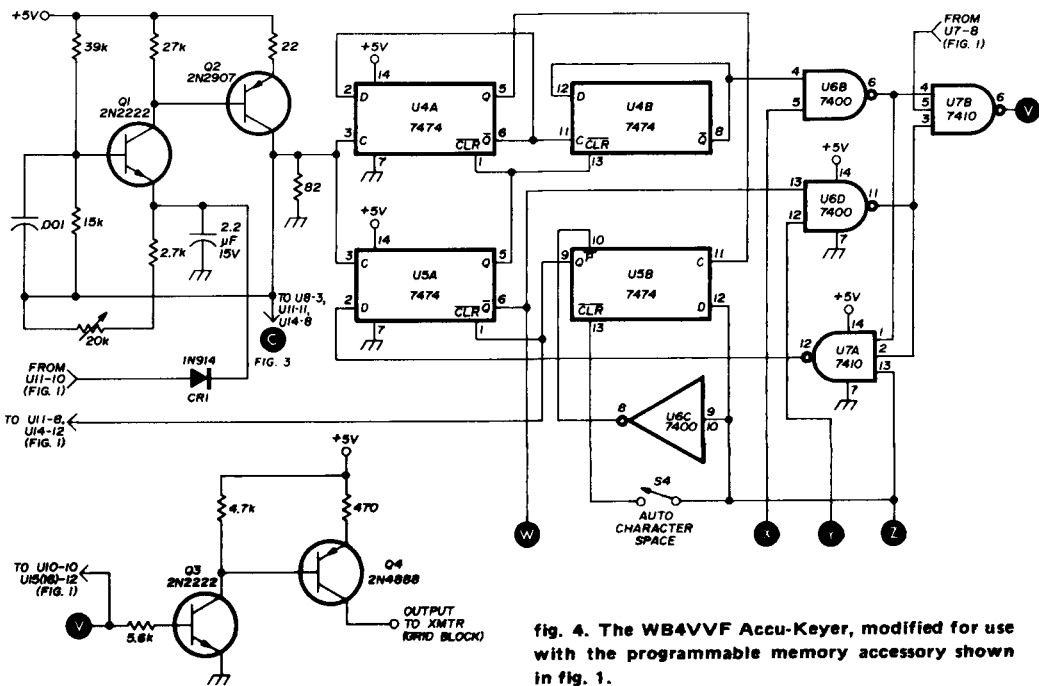
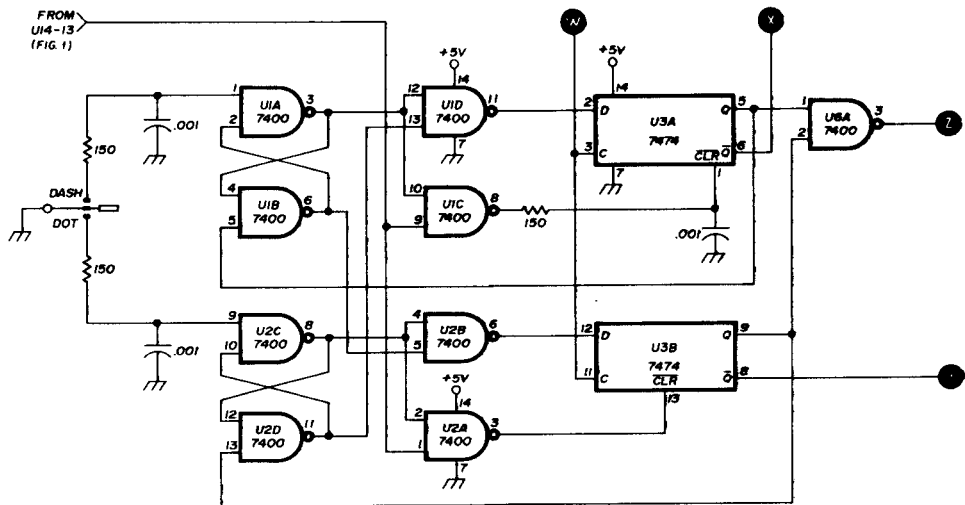


fig. 4. The WB4VVF Accu-Keyer, modified for use with the programmable memory accessory shown in fig. 1.



the clock pulse is high, thus preserving proper dot/dash timing. These inputs are effectively connected to U5, pin 8, otherwise, resulting in normal keyer operation when not using the memory.

The clock in the Accu-Keyer provides the clock pulses for the memory

circuit (taken from the collector of Q2). The previously unused section of U7 is wired to inhibit data transfer out of the memory except during the read cycle. Finally, U7, pin 6, is taken to the memory circuit to key the sidetone and input data to the memories.

construction

I built the memory circuit and keyer on two 3-inch (76mm) square pieces of single-clad Vector board using bread-board-type fabrication because wiring errors are much easier to repair. Any other method of construction would work equally as well so long as the usual rf bypass techniques are used. Fig. 5 shows the power supply I used for both the keyer and the memory circuit.

operation

Operation of this memory accessory is quite simple. The operator selects the desired memory with S2. To write data into the memory, S3 is closed, the start button, S1, is pressed, and, when released any data being sent will also be written into the selected memory. If a mistake is made, simply depress the start button again and start over. Even if the previous cycle is not complete, the counters will be reset to 000.

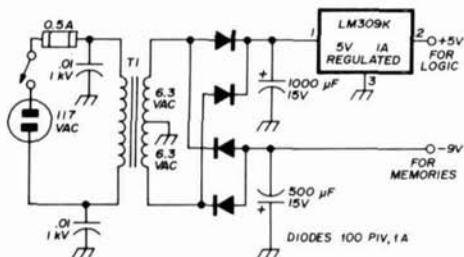


fig. 5. Simple power supply circuit provides regulated +5 volts for the TTL ICs and -9 volts for the random-access memories.

To read the data in storage, open S3 and press the start button, S1. When S1 is released the memory will cycle through the 256 bits. Two separate messages can be stored and selected by S2. Again, the start button may be repressed at any time to restart the message.

Approximately 30 characters can be stored in a 256-bit RAM. This is enough for the typical Sweepstakes exchange:

B DE WA9LUD/9 64 ILL BK

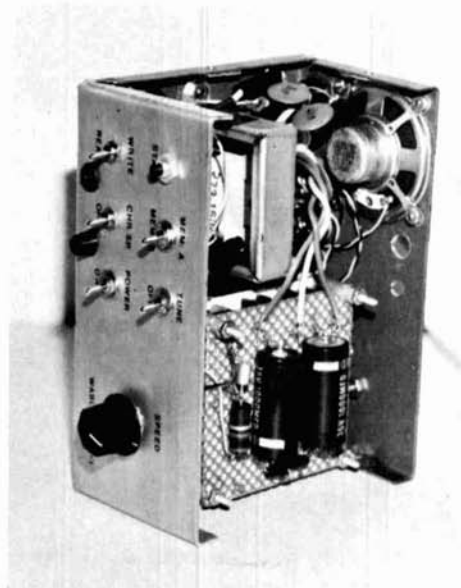
However, the basic circuit can be expanded to a cascade of individual memories for any desired character length.

The entire keyer package cost about \$25 to build, but the memory accessory alone can be built for under \$10. I have been very pleased with the performance of the unit. The memory replaces a clumsy tape recorder device I used to use during CW contests, resulting in a more relaxed and smooth operation. It has been a welcome addition to a crowded operating table.

references

1. Thomas Riley, WA1BYM, "An IC Keyer with Programmable Memory," *QST*, February, 1973, page 26.
2. Michael Gordon, WB9FHC, "Electronic Keyer with Memory," *ham radio*, October, 1973, page 6.
3. James Garrett, WB4VVF, "The WB4VVF Accu-Keyer," *QST*, August, 1973, page 19.

ham radio



Inside view of the memory keyer showing the circuit board stack. Accu-Keyer is on bottom board, memory accessory is on the middle board, and power supply rectifiers and filter capacitors are on top. The +5 volt regulator IC is mounted on heatsink on rear panel.



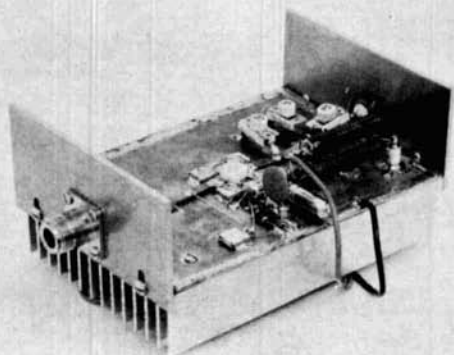
Build Your Own Computer

DOCUMENTA
ALTAIR
COMPUTER
SYSTEM

ALTAIR 8800 COMPUTER

\$439

For complete information package including 24 page catalog, technical data, price list and sample Altair Users Group newspaper send \$2.00 to: Altair Package, MITS, 6328 Linn NE, Albuquerque, New Mexico 87108.



solid-state linear power amplifier for 432 MHz

Construction details
for a solid-state
linear amplifier
that provides
10 watts PEP output
at 432 MHz

Until recently, amateur use of semiconductors on 432 MHz was limited to low-noise preamplifiers, mixers and low-level transmitter stages. Now, with rf power devices developed for the uhf land-mobile service, it is possible to build rf power amplifiers for this band without breaking the bank. The linear amplifier described in this article delivers 10 watts

PEP output with 10 dB or better power gain, operates from a 12-volt power supply, and is comparable in price to vacuum-tube linears operating at similar power levels. One of the goals in designing this amplifier was to develop a circuit that was rugged with respect to load vswr as well as being easy to build and align — the amplifier presented here meets those goals.

When designing an rf power amplifier, the first task is to select a suitable power transistor. The device I selected is the CTC CM10-12. This device, originally developed for the land-mobile service, is both inexpensive and rugged.* Most solid-state linears for vhf and uhf use 28-volt transistors, but 28-volt devices have two important disadvantages: cost (these parts are always more expensive than 12-volt devices) and power supply

*The CTC CM10-12 is \$13.50 in small quantities from Communications Transistor Corporation, 301 Industrial Way, San Carlos, California 94070. The BY1-1 byistor is \$7.50. Since the minimum order is \$50, this amplifier would make an excellent club project.

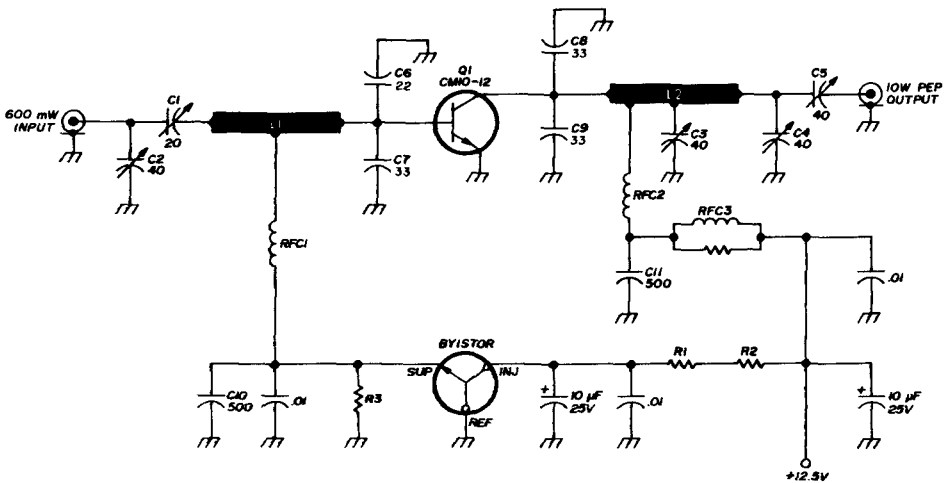
Lance Wilson, WB6QXF, 334 Vista Drive, La Selva, California 95076

availability. Although most amateurs have access to a medium-current 12-volt power supply, 28-volt power presents more of a problem.

Many amateurs find solid-state uhf power amplifiers difficult, if not impossible, to build. Uhf stripline circuits perform exceptionally well, but the Teflon-glass or *duroid* circuit board necessary for their construction is very expensive and difficult to obtain. Furthermore, many amateurs have very little experience with printed-circuit boards. After reviewing this problem, I decided to use lumped constants (mica compression trimmers and conventional inductors).

A main consideration in the design of this amplifier was to make it reproducible.

The circuit, shown in fig. 1, is fairly straightforward. An L-network is used for the input match and a pi-L network for the output. To operate in linear service the CM10-12 must be forward biased. This is accomplished through the use of a CTC *byistor*. The byistor consists of a diode and a silicon resistor in one package which is coupled to the amplifier heatsink. The byistor thermally tracks the power amplifier and assures that problems with thermal runaway are minimized. A previous article describes this device in detail.¹



- C1 2-20 pF mica trimmer (ARCO T51113-1)
- C2,C3 4-40 pF mica trimmer (ARCO T21213-1)
- C6 22 pF Underwood metal-clad mica
- C7,C8 33 pF Underwood metal-clad mica
- C9
- C10,11 500 pF Underwood metal-clad mica
- L1 0.175" (4.5mm) wide copper strip, 1.1" (28mm) long, including bend at input end; RFC1 attached at center
- L2 0.175" (4.5mm) wide copper strip, 1.2" (30.5mm) long, including bend at output end; RFC2 and C3 attached at center

- R1,R2 approximate total series resistance, 37 ohms (10 watts); adjust for correct byistor current (see text)
- R3 adjust for correct idling current (6.8 ohms in parallel with 47 ohms, 1/2 watt, used in amplifier shown in photograph)
- RFC1 no. 20 (0.8mm) wire, 1.5" (38mm) long
- RFC2 2 turns no. 20 (0.8mm), airwound, 0.3" (7.5mm) diameter, 0.3" (7.5mm) long
- RFC3 5 turns no. 20 (0.8mm) wound around 0.5" (12.5mm) Amidon T-50-6 toroid, in parallel with 15 ohm, 1/2 watt resistor

fig. 1. Solid-state 432-MHz linear amplifier. Do not substitute for the Underwood metal-clad mica capacitors; dipped micas or disc ceramics will not work.

construction

The amplifier is built on a 6x4.375 inch (15.2x11.1cm) finned aluminum heatsink (Thermalloy 6157). A smaller heatsink can be used, but I don't recommend it as parts placement becomes cramped and the CM10-12 power tran-

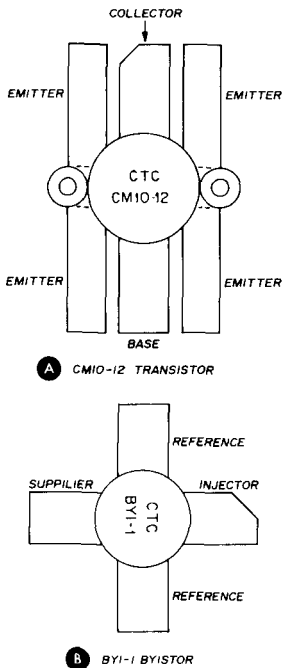


fig. 2. Lead layout for the CTC CM10-12 power transistor and BY1-1 byistor.

sistor will obviously run hotter. With the heatsink described a barely discernable heat rise is noticeable after several hours of operation.

The end pieces are 1/8-inch (3mm) thick aluminum which are attached to the ends of the heatsink with 6-32 screws. The holes for the screws are drilled into the heatsink ends and then tapped.

The first step in building the amplifier is to prepare the printed-circuit board. The circuit board is standard double-clad 1/16 inch (1.5mm) thick fiberglass-epoxy board. The thickness is

not really critical, but if the printed-circuit material is too thin the board may buckle when it is fastened to the heatsink. The CM10-12 power transistor is located at the exact center of the board. A 33/64 inch (0.516" or 13mm) hole is punched or drilled in the center of the board and the transistor is temporarily placed in the hole and used as a template to mark the locations for the two CM10-12 mounting screws. These holes are drilled (or punched) with a 17/64 inch (0.266" or 6.7mm) drill. The extra material is then filed away until the transistor mounting flange fits through the hole with about 0.015 inch (0.4mm) clearance all around (see fig. 3). Don't file away too much of the circuit board or it will be impossible to obtain short emitter leads — a must at uhf.

The 5/16 inch (8mm) hole for the byistor is next drilled 1.25 inch (32mm) from the center of the CM10-12. For best thermal tracking the byistor should be as close to the power transistor as is practical.

A good ground is a must in uhf power amplifiers and most problems with unstable amplifiers can be traced back to poor grounding. In this amplifier cop-

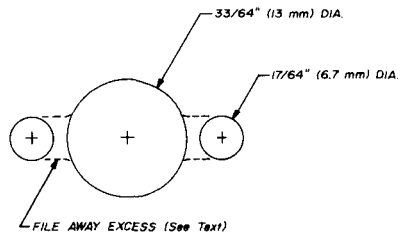


fig. 3. The CM10-12 transistor mounting hole is placed in the center of the circuit board (fig. 4).

per foil is soldered from the top to bottom ground planes around the entire outside edge of the board as shown in fig. 4. Similarly, short pieces of foil are soldered at the four edges of the CM10-12 mounting hole. Make sure

these fit snugly or the transistor may not fit. These copper strips are about 0.125 inch (32mm) wide.

The board is then placed on the heat-sink and secured with four 4-40 machine screws which are threaded into corresponding holes drilled and tapped into

capacitor leads overlap one another (see fig. 5). This will provide the points for the base and collector connections.

The leads of the transistor are then trimmed as shown in the photograph. Put Silicone heatsink compound on the CM10-12 mounting flange and fasten

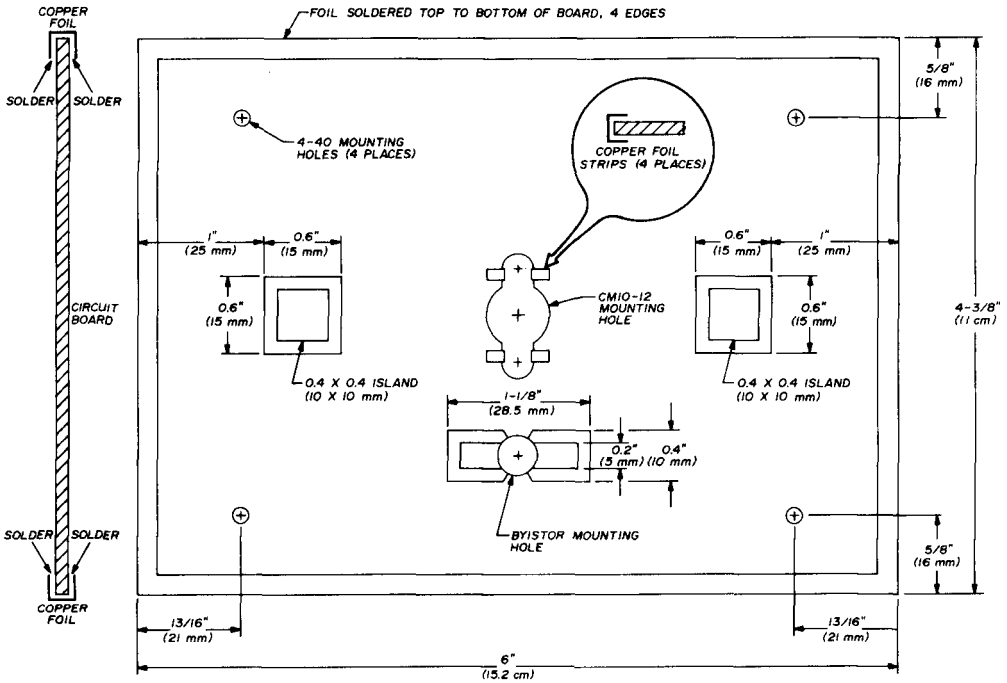


fig. 4. Layout of the circuit board used for the 432-MHz linear amplifier. Good grounding is provided by copper foil around outside edge of the board. Input and output islands and byistor circuit pads are cut out with an Xacto knife.

the heatsink. Temporarily remove the board and, with a milling bit or large diameter drill, prepare a space for the byistor mounting stud on the finned side of the heatsink. Be careful not to drill all the way through the heatsink.

The circuit board may now be secured to the heatsink with the 4-40 screws. Install the four Underwood capacitors* on the board as close as possible to the CM10-12 mounting holes. Solder the metal cases of the capacitors to the circuit board and let the

the transistor to the heatsink. (*Do not* solder the transistor into circuit before securely fastening it to the heatsink with the two mounting screws – doing so may fracture the ceramic transistor case.) When the transistor leads have been soldered in place, small islands are cut out with an Xacto knife for the byistor supplier and injector and the transistor base and collector lines, L1

*Do not substitute for the Underwood metal-clad mica capacitors; dipped mica or disc ceramic capacitors will not work.

and L2. The remaining components are then installed as shown in the photographs.

Small turret terminals are used for the byistor power resistor connections and the 12-volt supply voltage, V_{CC} . It is suggested that the layout shown be fol-

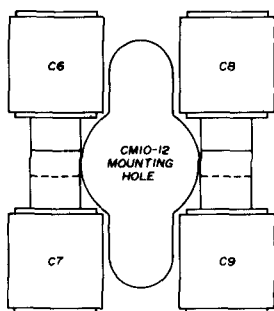


fig. 5. Installation of the Underwood mica capacitors, C6, C7, C8 and C9. Transistor base and collector connections are made at the overlap points.

lowed if you have not had experience with uhf solid-state amplifiers.

tuneup

Do not operate the amplifier without resistor R3 connected; that will damage the power transistor.

Temporarily disconnect the collector dc feed choke, RFC2, gradually apply +12 volts to the byistor and make sure injector current is 300 and 350 mA. If

rent drain. A milliammeter in series with the 12-volt supply line will read the byistor current plus the quiescent current of the power amplifier:

$$\text{Indicated current} = \text{byistor current} + \text{CM10-12 idling current}$$

If the byistor current is 300 mA, for example, and the total indicated current is 350 mA, the idling current of the CM10-12 is 50 mA. Increase resistor R3 in one-half ohm steps until an idling current of 50 to 60 mA is reached. It may be necessary to *parallel* two resistors to obtain the correct idling current.

Basic tuneup of the amplifier can be done with a uhf vswr bridge, power meter and dummy load as shown in fig. 6. However, an accurate power meter and non-reactive 50-ohm load are required for proper circuit adjustment.

Apply V_{CC} and check to see that the power meter reads zero with no drive applied. This will indicate if the amplifier is oscillating. (No oscillation was detected in any of the four units I built.) Apply about 200 mW of drive and tune capacitors C3, C4 and C5 for maximum output. Tune C1 and C2 for minimum input vswr. Now increase drive to 600 mW and repeat the above process. The power meter should read approximately 10 watts.

If two-tone measurements are to be made and you're using an average-

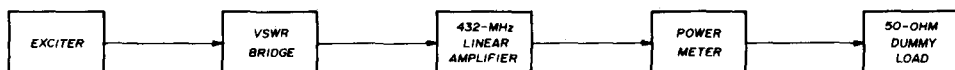


fig. 6. Equipment setup required for tuning up the 432-MHz amplifier. For correct adjustment the power meter must be accurate and the 50-ohm must be non-reactive.

this current level is not achieved, the values of resistors R1 and R2 must be adjusted until it is. Remove V_{CC} and reconnect the collector choke, RFC2.

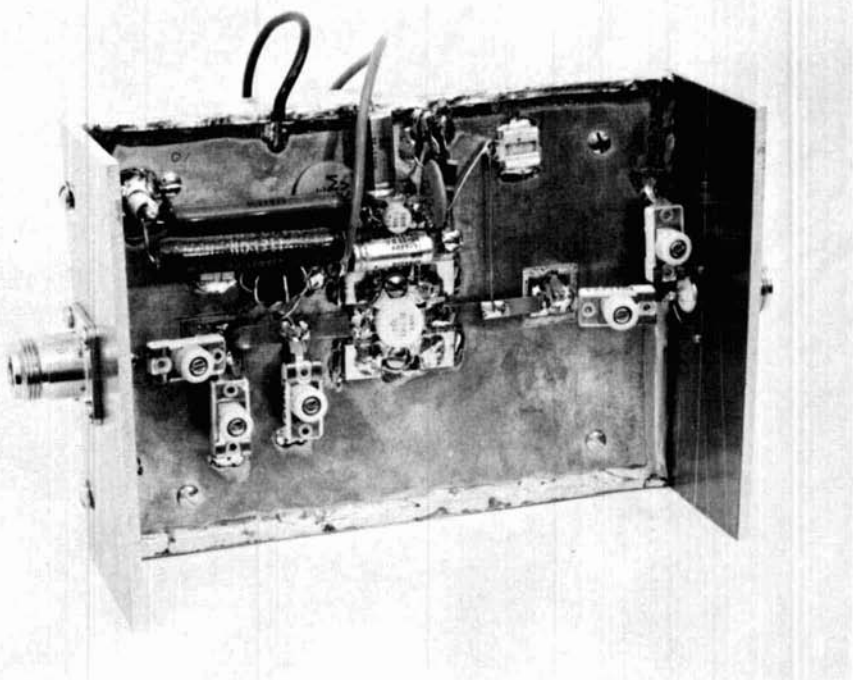
Now install about 1 ohm at resistor R3, apply V_{CC} and check the total cur-

reading meter such as a Bird model 43, remember that the power meter indication will be one-half the actual rf output. For example, if the Bird wattmeter reads 5 watts, actual PEP output is 10 watts.

operation

A well-regulated 12-volt supply is necessary for linear operation. Since current drain is less than 2.0 amps, a simple series regulator will work fine. Most current handbooks describe such circuits.

600 mA will put you in the safe area (remember that the meter will read 300 mA high because of the byistor current). Make sure the amplifier works into a good load. Although the CM10-12 device will survive an infinite vswr, sustained operation into such



Solid-state 432-MHz power amplifier built by WB6QXF. In this photograph output is at left, input on right. Large wirewound resistors are in the byistor circuit.

Since voice characteristics vary from one operator to another, if possible an oscilloscope should be used to check for flattopping. If a scope isn't available, talking collector current up to 500 to

loads will damage it.

Every effort was made to make the construction of this amplifier as easy as possible. Inexpensive components were used throughout and the results have been very gratifying. The total cost of the amplifier is less than that of a comparable vacuum-tube unit and it is a lot less trouble.

table 1. Performance of the 10-watt, 432-MHz solid-state linear power amplifier. Second harmonic is more than 35 dB down.

single tone	two tone
$V_{CC} = +12.5 \text{ Vdc}$	$V_{CC} = +12.5 \text{ Vdc}$
$P_{in} = 15 \text{ Wdc}$	$P_{in} = 600 \text{ mW PEP}$
$P_o = 10 \text{ W}$	$P_{out} = 10 \text{ W PEP}$
$I_c = 1.2 \text{ A}$	$I_c = 750 \text{ mA}$
	$\text{IMD} = -29 \text{ dB at } 10 \text{ W PEP}$

reference

1. Robert Stein, W6NBI, "Solid-State Transmitting Converter for 144-MHz SSB," *ham radio*, February, 1974, page 6.

ham radio

adjustable voltage-regulator ICs

Circuit applications

for the new

Fairchild 78MG and 79MG

adjustable positive

and negative

voltage-regulator ICs

The 7800 series of fixed, three-terminal IC voltage regulators has greatly simplified the design of well regulated power supplies.¹ The only drawback of this series of ICs is that variable output voltages cannot be obtained without sacrificing performance or circuit simplicity. Fairchild Semiconductor has developed two new devices which fill the need for a low cost, adjustable voltage regulator: The 78MG positive regulator and the 79MG negative regulator.

Both of these IC regulators are rated for 500 mA output current, are protected against short-circuits and thermal overloads, and feature infinitely variable

output voltages between V_{ref} and V_{in} (minus a few volts). Brief specifications are listed in table 1.

positive voltage regulator

A basic, positive adjustable regulator using the 78MG IC is shown in fig. 1. The internal reference voltage for the 78MG is 5.0 volts, so this sets the lowest possible output voltage with this device. As is true with the 7800 series voltage-regulator ICs, a 0.33 μ F capacitor is required from the input of the device to ground if the regulator is located more than a few inches from the power supply filter capacitor. A small capacitor from the output to ground will improve transient response.

The output voltage of this circuit is predicted by

$$V_{out} = V_{ref} \left(\frac{R1 + R2}{R2} \right)$$

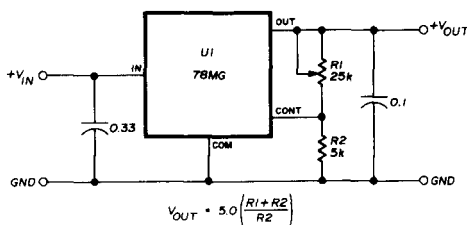


fig. 1. Basic, adjustable positive voltage regulator using the Fairchild 78MG. Unregulated input voltage must be 2 volts greater than desired maximum output.

Douglas Schmiesskors, WB9KEY, 1310 N. Valley Lake Drive, Apt. 451, Schaumburg, Illinois

where $V_{ref} = 5.0$ volts. If 1 mA is used as the control current, then $R2 = 5k$ ohms and $V_{out} = 0.001 (R1 + R2)$. With the values shown in fig. 1 and $V_{in} > 32$ volts, V_{out} is adjustable from +5 to +30 volts.

The 78MG may be used in higher current applications by using a series pass transistor, Q2, as shown in fig. 2.

table 1. Electrical parameters of the Fairchild 78MG and 79MG adjustable positive and negative voltage regulators.

78 MG positive regulator

Input voltage, V_{in}	+40 volts max
Output voltage, V_{out}	+5 to +30 volts
Voltage reference, V_{ref}	+5.0 volts
Reference current, I_{ref}	1.0 μA
Dropout voltage	2 volts
Quiescent current	2.5 mA
Line regulation	1%
Load regulation	2%
Dissipation (internally limited)	≈ 6 watts
Thermal shutdown temperature	$\approx 170^\circ C$
Thermal resistance, junction-case	8 $^\circ C/watt$
Thermal resistance, junction-ambient	70 $^\circ C/watt$

79MG negative regulator

Input voltage, V_{in}	-40 volts max
Output voltage, V_{out}	-2 to -30 volts
Voltage reference, V_{ref}	-2.23 volts
Reference current, I_{ref}	0.3 μA
Dropout voltage	2 volts
Quiescent current	0.5 mA
Line regulation	1%
Load regulation	2%
Dissipation (internally limited)	≈ 6 watts
Thermal shutdown temperature	$\approx 175^\circ C$
Thermal resistance, junction-case	8 $^\circ C/watt$
Thermal resistance, junction-ambient	70 $^\circ C/watt$

The short-circuit sensing resistor, R_{sc} , is equal to V_{be}/I_{sc} , or about 0.6 ohm for 1.5 amp output current. Transistor Q1 is another 2N6124 or equivalent. The sensing resistor, R_{sc} , turns Q1 on at high output current conditions and since $V_{ce(sat)}$ of Q1 is less than the voltage drop across R_{sc} plus the base-emitter voltage of Q2, the current through Q2 will decrease, protecting the transistor.

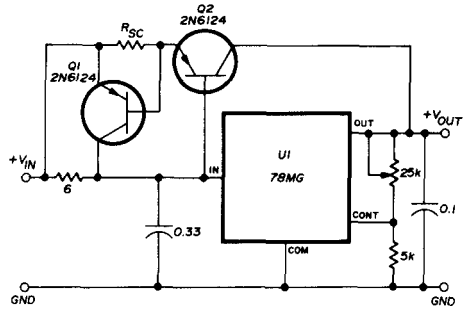


fig. 2. High-current, short-circuit protected adjustable positive voltage-regulator circuit using the Fairchild 78MG.

negative voltage regulator

A basic negative adjustable regulator is shown in fig. 3. The reference voltage for the 79MG is 2.23 volts and, as in the 78MG, this reference determines the minimum possible output voltage available from the device. Again, 1 mA should be selected for the control current; therefore, R2 is 2.2k ohms and $V_{out} = 0.001 (R1 + R2)$. R1 may be a 25k ohm pot as was used in the circuit of fig. 1.

A dual tracking regulator with 500 mA output capability is shown in fig. 4. This circuit features dual 10 volt outputs with the use of only two ICs and seven external components.

packaging

Obviously, a four-terminal package is now required due to the addition of the control pin. Fig. 5 shows the basic

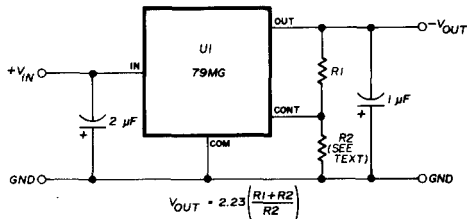


fig. 3. Basic, adjustable negative voltage regulator using the Fairchild 79MG. Unregulated input voltage must be 2 volts greater than desired maximum output.

configuration and connection diagram of both regulators, while **fig. 6** shows mounting techniques for two of the package options which are available. Package size and pin spacing are similar to the familiar mini-DIP package. For low power dissipation applications, the cooling wings may be bent upwards for natural convection cooling, or a heat-sink may be added for higher power applications. Refer to **table 1** for thermal resistance and maximum junction temperature values for the package.

conclusion

These new adjustable voltage regulators fill the need for easy to use, high

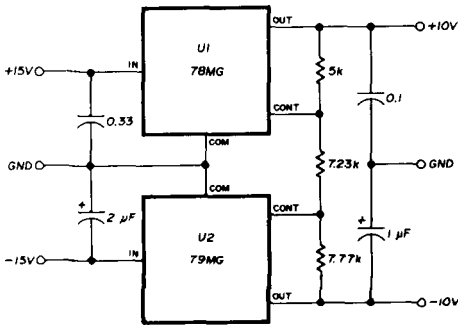


fig. 4. Dual tracking regulator for up to 500 mA output at ± 10 volts.

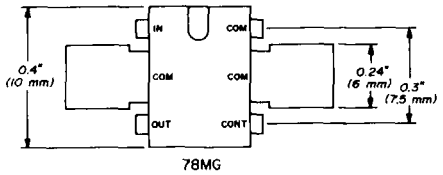
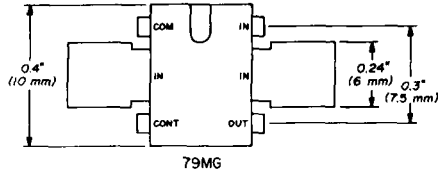


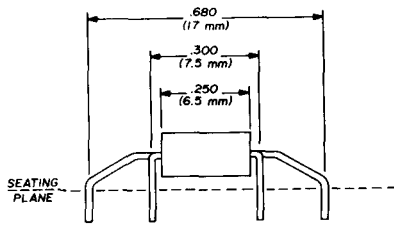
fig. 5. Connection diagrams for the 78MG and 79MG adjustable voltage-regulator ICs.

performance, minimum component count, variable-voltage regulators. Both electrically and thermally, the 78MG and the 79MG perform well in all medium-current applications and as drivers for higher current regulators. The 78MG and the 79MG and their related data sheets may be obtained from franchised Fairchild distributors.

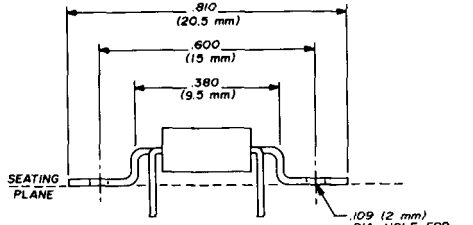
reference

1. James Trulove, WB5EM1, "Three-Terminal Voltage-Regulator ICs," *ham radio*, December, 1973, page 26.

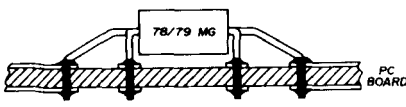
ham radio



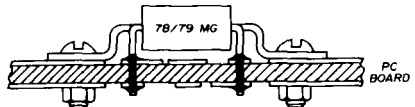
U PACKAGE
LEAD BEND 1



V PACKAGE
LEAD BEND 2



MOUNTING TECHNIQUE U PACKAGE



MOUNTING TECHNIQUE V PACKAGE

fig. 6. Dimensions and mounting techniques for the two package options which are available for the 78MG and 79MG adjustable voltage regulators.

calibrated electronic keyer time base

Description of a
novel electronic
time base
that provides
direct readout
of keyer speed

It is desirable to be able to set the speed of an electronic keyer before you start sending. This is difficult if the keyer has a single uncalibrated knob and the variable resistor it controls is not linear and gives a large change in speed for a small rotation. Three solutions to this minor problem will be discussed in this article: speed selection with toggle switches or a thumbwheel switch, a digital counter, and a simple analog frequency meter which will display keyer speed on a meter. The last two systems require the time-base oscillator to run continuously. However, by running the oscillator at a high frequency and dividing down, the

normal disadvantages of a continuously running oscillator can be avoided.

switch selection

It is well known that the time delay of an RC circuit is proportional to the RC product. The frequency of an RC oscillator, therefore, is proportional to $1/RC$, or G/C where G is the conductance ($1/R$) of the resistor. When resistors are connected in parallel the conductances add. Resistors can easily be switched in parallel with toggle switches or thumbwheel switches, and when this is done the frequencies associated with the individual resistors add directly.

In the keyer time base shown in fig. 1, a 560k resistor (R_5) is permanently wired in to give a speed of 5 wpm. Another 560k, 270k or 150k resistor can be switched in to add 5, 10 or 20 wpm to the speed. With three switches any speed from 5 to 40 wpm can be selected in steps of 5 wpm. The 1000-ohm vernier adjustment pot, R_1 , can be mounted on the front panel if continuous speed adjustment is desired. This pot can also be screwdriver adjusted (or even omitted if the timing capacitor is carefully selected).

Fig. 2 shows how a single thumbwheel switch can be used to provide keyer speeds of 5 through 45 wpm. Fig. 3 shows how a two-section thumbwheel

George Jones, W1PLJ, 12 Traill Street, Cambridge, Massachusetts 02138

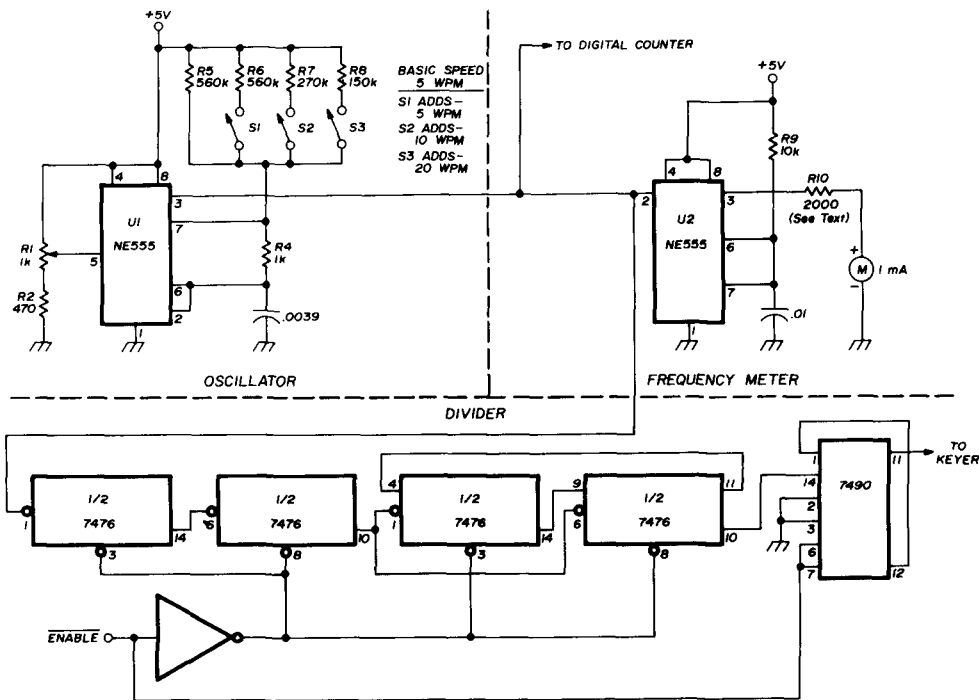


fig. 1. Electronic keyer time base with switch selection of speed. Analog frequency meter indicates keyer speed directly.

switch can be wired for speeds of 1 through 99 wpm in 1 wpm steps. The principle of paralleling resistors is very simple and can be applied to any keyer whose speed is determined by a single resistor and capacitor.

digital speed readout

A formula in the ARRL *Radio Amateur's Handbook* states that the speed of an electronic keyer is 1.2 times the clock frequency in Hz. In the time base shown in fig. 1 the frequency of the basic NE555 oscillator is 100 times the keyer speed. The keyer clock is obtained by dividing the oscillator frequency by 120. For a 24 wpm keyer speed, for example, the oscillator runs at 2400 Hz. This can easily be read on a digital counter. If the counter is set to its 100 Hz range (dropping the tens and units digits), the speed can be read

directly. The time-base divider would supply a clock frequency of 20 Hz, the correct clock frequency for 24 wpm keying.

Normally an electronic key with a continuously running oscillator does not have a good "feel" because you have to wait up to one-half the length of a dot for the keyer to start after pressing the paddle. With the time base shown in fig. 1, however, you only have to wait 1/240 the length of a dot, which is hardly noticeable (only 2 milliseconds

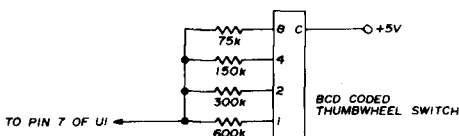
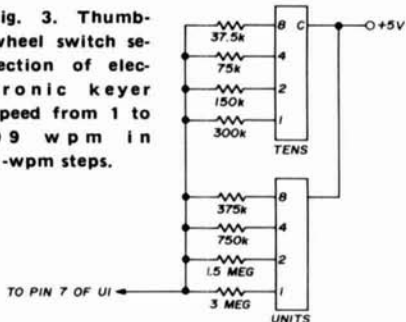


fig. 2. Using a thumbwheel switch to set electronic keyer speed. This arrangement provides speeds of 5 to 45 wpm in 5-wpm steps.

at 5 wpm). This is because when the keyer is not enabled the dividers are poised with all outputs high, ready to give a negative transition as soon as the next oscillator pulse comes along after the keyer is enabled. This system has all the advantages of a continuously running oscillator with none of the disadvantages.

fig. 3. Thumb-wheel switch selection of electronic keyer speed from 1 to 99 wpm in 1-wpm steps.



The signal marked "to keyer" should go to a JK flip-flop such as the 7473 or 7476 which responds to negative transitions. The input to the inverter should be high when not sending and low when sending or self-completing a character.

keyer speed meter

It's doubtful that anyone would build a digital counter especially for his electronic keyer, and switching another counter to the keyer is not as convenient as simply looking at a panel meter which indicates keyer speed. The simple analog frequency meter shown in fig. 1 uses few components and has all the accuracy that is needed. The meter is a 0-1 milliammeter with a 0-5 scale such as the Lafayette 99F26270. Resistor R10 should be trimmed to give a full-scale reading at 50 wpm using a digital counter to set the speed to 50 wpm (oscillator at 5000 Hz). The meter in my keyer, calibrated at 50 wpm, agrees with my digital counter over the entire scale.

ham radio

Regency HR-2B gives a lot to talk over



American Made Quality at Import Price

Full 12 Channel, 15 Watts with HI/LO power switch

Here is everything you need, at a price you like, for excellent 2 meter FM performance. The 12 transmit channels have individual trimmer capacitors for optimum workability in point-to-point repeater applications. Operate on 15 watts (minimum) or switch to 1 watt. 0.35 uv sensitivity and 3 watts of audio output make for pleasant, reliable listening. And the compact package is matched by its price.

\$229⁰⁰

Amateur Net

Regency ELECTRONICS, INC.

7707 Records Street
Indianapolis, Indiana 46226

An FM Model For Every Purpose . . .
Every Purse



HR-6 12 Channel-25 Watt 6 Meter FM Transceiver
HR-220 12 Channels-10 Watts 220 MHz FM Transceiver
ACT-10 H/L/U 3 Band-10 Channel FM Scanner Receiver

dc latch circuit

Modern dc latch
for transmitter
PTT control
uses cmos circuits
for low current drain

A dc latch circuit or flip-flop is a handy circuit to have around if you operate PTT but don't want to hold down the microphone switch. One circuit described by W2EEY¹ used a form of latch for PTT-PTL (push-to-talk, push-to-listen) control of a radio system.

Fig. 1 shows a fairly typical latch circuit of the 1960s which used four bipolar transistors and one unijunction to drive a relay circuit. Applying a +12 volt pulse to diode CR1 caused the circuit to be *set*. Applying a +12 volt pulse to diode CR2 *resets* the circuit. However, during the set cycle the 180-ohm resistor in Q2's emitter circuit dissipates almost 800 mW of power. Not counting the relay, this circuit requires almost 100 mA (1.2 watt) to function — with modern cmos circuits this excessive power drain can be reduced by a factor of 200.

updated latch

The latch circuit shown in fig. 2 is made for today. Disregarding the transistors Q3, Q4 and Q5 and the two relays for a moment, when the push-button switch, S1, is depressed, the

circuit draws slightly more than 500 microamps. When switch S1 is not activated current drain is in the region of 100 μ A. This very low power requirement is one of the advantages of using modern cmos ICs. This is not to say that cmos doesn't have its problems. It does: handling, static discharge and drive ability, but for ultra low power consumption cmos is the answer.

In the circuit of fig. 2 integrated circuit U2A is a dual type-D cmos flip-flop. When the incoming clock signal makes a transition from zero to 1, the signal on the data input (D) is gated through to the Q output. When switch S1 is depressed, the input to the cmos inverter, U1A, goes low and its output goes high. The RC network consisting of the 100k resistor and 0.01 μ F capacitor add roll-off to the leading edge of the zero to 1 transition, eliminating any contact bounce caused by S1. It has been found by experimentation that the RC time constant should approximate (or be slightly longer) than the contact bounce of your particular switch; more about this later.

During the zero to 1 transition, if the Q output of U2A is high, \bar{Q} by definition is low. Since this low is also present on the data input as the clock makes the transition from zero to 1, Q goes to zero and \bar{Q} goes to logic 1. At the next zero to 1 clock transition the output states will change.

When the Q output of U2A is low, it is inverted in U1B, turning on transistor Q2 and enabling relay K1. The \bar{Q} output, which is high, is inverted in U1C, turning off Q1 and relay K2. The 4700-ohm resistors in series with the inverter outputs are determined by the

Bill Lambing, WØLPO, 1480 25th Street, Marion, Iowa 52302

transistor collector loads. Do not try to use a higher value or the transistor will not turn on. A lower value will most likely burn out the cmos inverter. Note that the series resistor R2 is 10k because Q3's collector load is greater than the loads seen by Q1 or Q2.

The main function of transistors Q3, Q4 and Q5 is as a power switch. When transistor Q3 is turned by a logic 1 at the \bar{Q} output of U2A, it allows +24 volts (or what is on the Q5 emitter) to be seen at Q5's collector. Several hun-

is driven directly by a complementary bipolar or IC output device; it can only be used where an output transformer is used (no dc component). Otherwise connect the Q3's collector across the volume control for an audio signal without a dc component.

cmos levels

The graph of fig. 3 shows a large intermediate region in the operating characteristics of cmos logic that expands as the supply voltage, V_{DD} , is

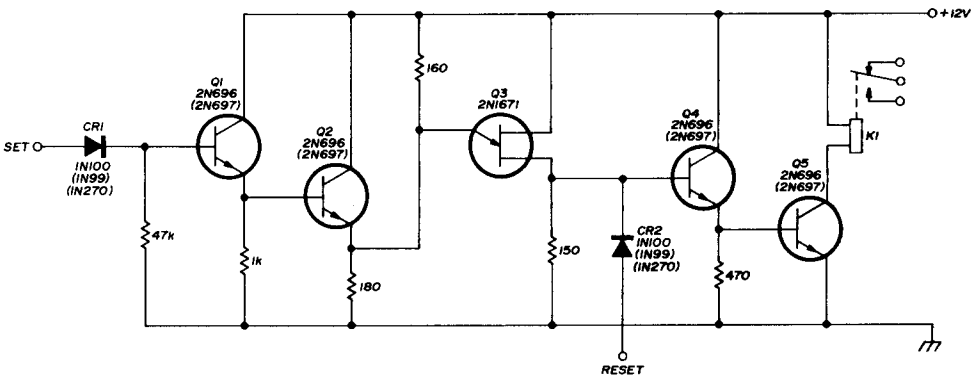


fig. 1. Dc latch circuit using bipolar transistors requires up to 1.2 watt of power. In this circuit a +12 volt pulse at set input latches relay K1; +12 volt pulse at reset input resets K1.

dred milliamperes of current can be switched in this way using a 2N2222A. More current can be switched by using a Darlington connection at Q5.

When working with this circuit just remember that a logic zero at the base of Q3 turns on transistors Q4 and Q5. A logic 1 turns on Q3, pulling the base of Q4 to ground, which shuts off power switch Q5. If you don't mind relay noise, you can use a relay. However, if you like silent operation and no wasted relay power, use the solid-state arrangement.

If you consider transistor Q3 by itself (forgetting Q4, Q5 and the three 10k resistors for a moment), you can tie the collector of Q3 to your speaker output for muting. This arrangement can't be used, however, if your speaker

increased. This is where cmos really shines — noise immunity. The maximum acceptable input level for a cmos device in a low-level input state, V_{IL} , is 30 per cent of V_{DD} , or 4.5 volts when $V_{DD} = 15$ volts. This means that a logic zero can be from 0.01 to 4.5 volts.

At the other end of the scale, the minimum acceptable input level for a cmos device in a high-level input state, V_{IH} , is 70 per cent of V_{DD} or 10.5 volts when $V_{DD} = 15$ volts. This means that a logic 1 can be 10.5 to 14.99 volts. The intermediate region (or noise margin) is from 30 to 70 per cent of V_{DD} .

Referring back to fig. 2, to effectively combat contact bounce the RC time constant at one time constant (63.2%) should approximate or be slightly longer than the switch's contact

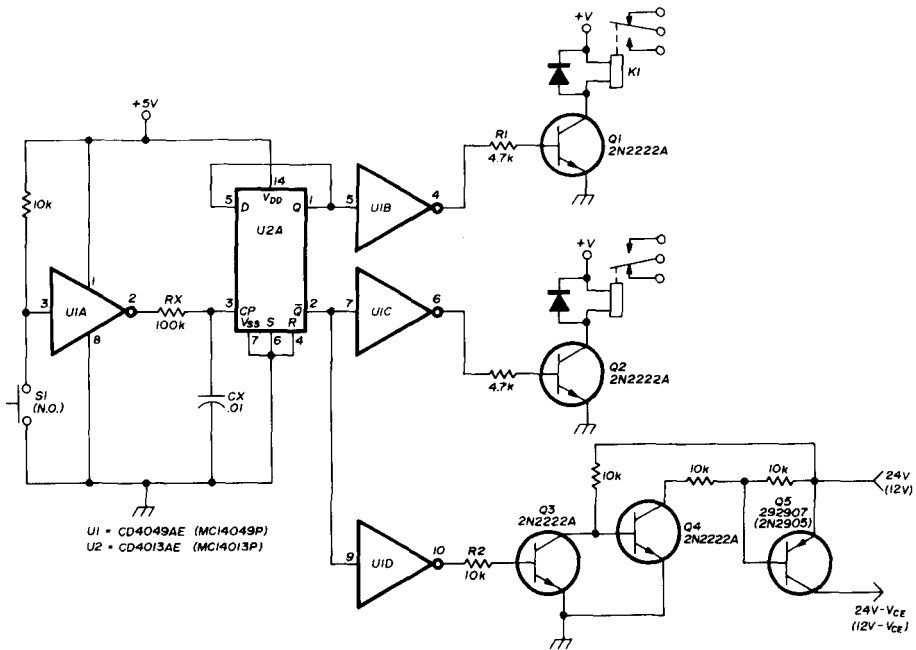


fig. 2. Modern dc latch uses cmos ICs for minimum current drain. Either relay switching (Q1, K1 or Q2, K2) or solid-state switching (Q3, Q4 and Q5) may be used.

bounce, and should approximate 70 per cent of the supply voltage, V_{DD} .

When using cmos devices be sure you look at the manufacturers' specifications.² If you are not using an input, tie it to ground or to V_{DD} whichever is appropriate. Do not use cmos NAND or NOR gates to drive transistors — invert-

ing or non-inverting buffers are designed to do this job. Be careful when handling cmos devices as the static burnout problem is very severe. In addition, do not use plastic bags or polyethylene snow for packaging cmos devices — this stuff has zapped more than one device.

Reference 3 has much more information on the use of cmos devices which should enable experimentally inclined amateurs to learn much more about these very useful devices. Just obey the rules and you can gain as much as a 1000:1 reduction in circuit current drain.

references

1. John Schultz, W2EEY, "Solid-State Transmitter Switching," *ham radio*, June, 1968, page 44.
2. *COS/MOS Digital Integrated Circuits*, RCA Solid-State Data Book SSD-203B, RCA Solid State, Somerville, New Jersey 08876.
3. M. Stiglianese, "Interface CMOS Logic with Switches," *Electronic Design*, August 16, 1974, page 80.

ham radio

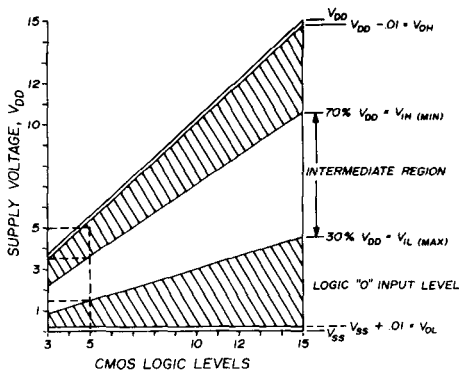


fig. 3. Graph of cmos logic levels shows how intermediate region with high noise immunity expands as the supply voltage is increased. Dashed lines show operation with +5 volt supply (see text).



CRYSTAL FILTERS and DISCRIMINATORS



by
K.V.G.

XF9-NB

We are pleased to announce the latest addition to the KVG high performance 9 MHz crystal filter line. The XF9-NB is a 500 Hz band width filter designed for CW reception and narrow band digital data circuits. Its characteristics almost eliminate the ringing effect present in less sophisticated narrow band filters. The XF9-NB, like all other KVG 9 MHz filters, has internal input and output transformers to facilitate matching its natural impedance to adjacent circuit stages.

Write for detailed specifications.
Export inquiries invited.

Price **\$63.95**
Postage 50¢

ANTENNAS

144/148 MHz



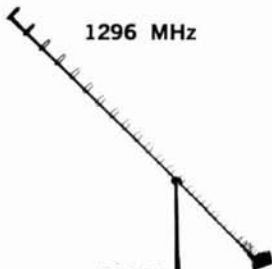
D8/2M - VERT.
FOR LONGE RANGE
REPEATER ACCESS
GAIN 12.6dB REF DIPOLE
FEED 50Ω COAXIAL
\$48.70

420-450 MHz



70/MBM46
GAIN 17.3dB REF DIPOLE
GAIN VARIATION ACROSS
BAND LESS THAN 0.25dB
FEED 50Ω COAXIAL
\$51.75

1296 MHz



1296-LY
1296 MHz LOOP-YAGI
GAIN +20dB
FEED 50Ω COAXIAL
\$51.75

PRE-SELECTOR FILTERS

We are pleased to introduce **UHF pre-selector band pass filters** for the 435 MHz and 1296 MHz bands. The 8% band width, 3 pole interdigital design eliminates the interference problems caused by strong TV and FM broadcast signals.

MODEL
FREQ. RANGE
RIPPLE TYP.
I. L. TYP.
CONNECTORS
IN/OUT IMPEDANCE
Postage \$1.00

JMF432
420-450 MHz
0.1dB PEAK
0.15dB
BNC
50 OHMS
\$34.95

JMF1296
1250-1340 MHz
0.1dB PEAK
0.2dB
TNC
50 OHMS
\$32.95

Write for detailed specifications.
Antennas FOB Concord, Mass.

**SPECTRUM
INTERNATIONAL**
BOX 1084 CONCORD
MASSACHUSETTS 01742
U. S. A.

fet-controlled charger

for small nicad batteries

A novel use
of the fet
produces this simple
constant-current
nicad charger

Rechargeable nickel-cadmium batteries have become very popular over the last few years, not only for hand-held fm transceivers, but also for powering test equipment. Several ideas for inexpensive chargers have been tried, but maintaining a constant rate of charge has been a problem.¹

The Regency HRT-2 uses the Regency MA-50, Eveready N64, Gould

CD64, or the Alexander R64 rechargeable nicad battery, which is representative of the batteries used in most hand-held units. Regency recommends a charge rate of 50 mA and a trickle or "float" rate of 15 mA. It is detrimental to the nicad if the voltage across the battery rises too high. This particular battery is fully charged at 14.4 volts, so a 15-volt zener diode was chosen to provide over-voltage protection.

constant current charger

Junction field-effect transistors can be used as constant-current sources simply by shorting the gate to the source. The current which results is the I_{dss} rating given in the data sheets. Type 2N3819 fets were used in the circuit in fig. 1 simply because there was an abundance of them on hand. Practically any n-channel junction fet will work, but only devices that have an I_{dss} of 8 to 15 mA should be used. There are special power fets available, but most of the inexpensive plastic devices will strain to dissipate a quarter of a watt at room temperature — so don't crowd them. The six fets used were actually graded by connecting them as shown in fig. 2 and grouped to supply the 15 mA or 50 mA as selected by the switch.

G. Kent Shubert, WA0JYK, 1308 Leaview Drive, Olathe, Kansas 66061

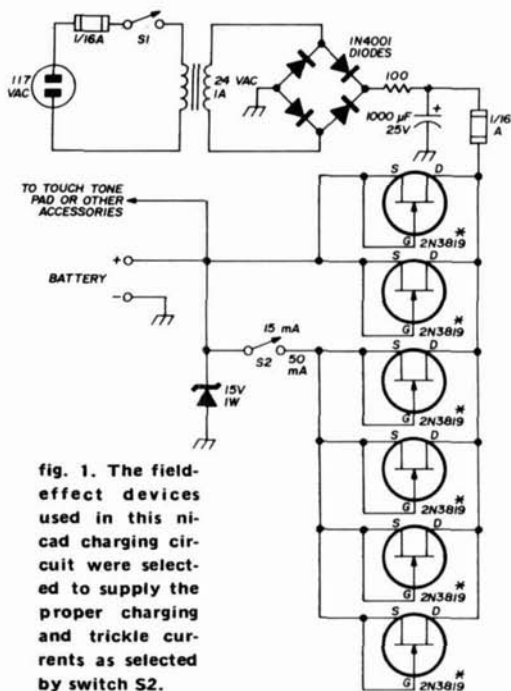


fig. 1. The field-effect devices used in this nicad charging circuit were selected to supply the proper charging and trickle currents as selected by switch S2.

The photograph shows a few other frills that were added to the basic charger to make life on two meters a little more enjoyable. The hand-held portable becomes a low-power base station when placed in the charger. The HRT-2 has both antenna and battery terminals in the base, so placing the unit on the charger connects the external antenna and places the battery on charge. The external microphone and PTT keying is connected to the top of the HRT-2 to enable the hand microphone and the Touch-Tone encoder to function. The ac power is switched by a microswitch mounted so the weight of the transceiver turns it on. The unit is

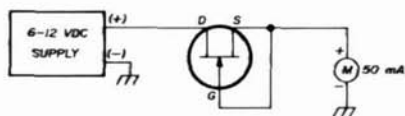


fig. 2. Setup for testing fet's for the drain-source current, I_{DSS} , measured with the gate shorted to the source.

held firmly to the charger with a black elastic garter, a difficult item to locate nowadays.

As an added bonus, the unit can be used far from ac power lines just for the Touch-Tone encoder function. It is necessary to use an external antenna, but at least the charger serves as an adapter from the mini-phone plug to the more popular UHF or BNC connectors.

The hookup of the Touch-Tone pad is standard with fm operators so no details are included here. The 1/16th amp fuse is not necessary but is added life insurance against a semiconductor failure.

reference

1. R. D. Shriner, WA0UZO, "Charging Nickel-Cadmium Walkie-Talkie Batteries," QST, August, 1973, page 44.

ham radio



The Regency HRT-2 sits atop the charger overlooking the ever popular Touch-Tone pad.

Dentron introduce



s the Sky Openers.

Whether it's opening up new bands to you or giving you a better grip on the bands you work, look to DenTron for new and better ways of getting out like you never could before.

A. New! The DenTron TopBander™ 160 meter transverter.

If you're working 80 now, put yourself on 160, too, with DenTron's remarkable new TopBander.™ Just 5 watts drive between 3.8 and 4.0 MHz gives you 100 watts DC input of clean SSB on 160. Two connections do it, the TopBander™ is already matched to your 50 ohm antenna. And the 110/220 volt 50/60 Hz supply is built in. Plus there's a special TopBander™ for 2 MHz MARS. Just \$199.50 postpaid in the U.S.A.

B. New! The DenTron SkyMatcher™ antenna tuners.

DenTron has two SkyMatchers,™ the model 160AT for (of all things) 160 meters, and the model 80-10 for (you'll never guess) 80 through 10. Both models are designed to handle the full legal limit, matching your 52 ohm transceiver to whatever hunk of wire you have to use. Got an antenna for the wrong band? A longwire between two trees? A sneaky stick sticking out of your apartment? You can tune to it with SkyMatcher.™ Just \$59.50, either model, postpaid in the U.S.A.

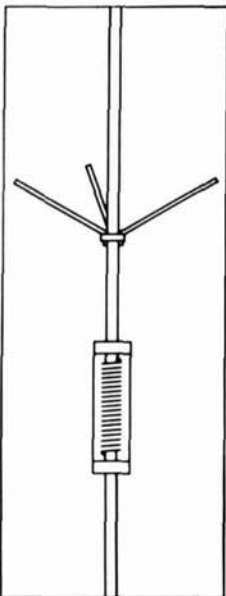
C. New! The DenTron SuperTuner™ antenna tuner. And a Super Supertuner.

Want to match everything between 160 and 10 through balanced line, coax line, random line or whatever you have, pump out the full legal limit and look and sound good doing it? Sounds like a job for SuperTuner™! Just \$119.50 postpaid in the U.S.A.

Our new Super Supertuner™ (not shown) handles a full 3 KW PEP. In case you-know-who okays you-know-what. Or just in case you like letting your equipment loaf along at a fraction of what it can handle. The Super Supertuner™ is just \$229.50 postpaid in the U.S.A.

New! The DenTron SkyClaw™ 40/80/160 tunable monoband vertical antenna.

Which would you rather be, jack-of-all-bands or master of one? SkyClaw™ gives you no-compromise performance on 160 (50kHz bandwidth), 80 (200kHz bandwidth) or 40 (the whole band). It's self-supporting. Weatherproof. Easy to put up alone. Able to take 100 mph winds. And capable of the full legal limit. Tuning it to your band is easy and reliable. And it's almost embarrassingly easy to own. Just \$79.50 postpaid in the U.S.A.



DenTron

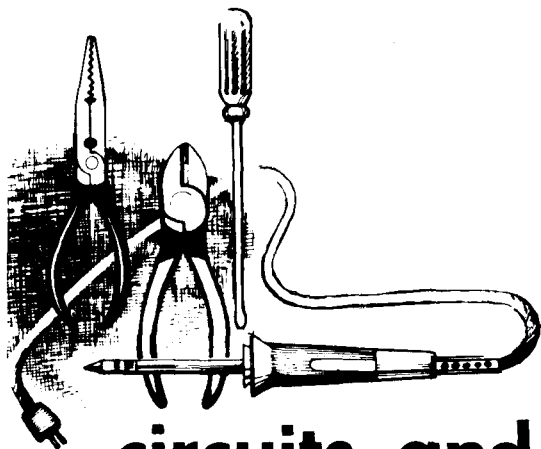
Radio Co., Inc.

2100 Enterprise Parkway

Twinsburg, Ohio 44087

(216) 425-8073





circuits and techniques

ed noll, W3FQJ

QRP fet transmitter

The Siliconix 2N3970 switching fet performs well in low-powered transmitter circuits such as crystal oscillators, modulators, rf amplifiers and frequency multipliers. Circuit simplicity is an fet

advantage and many circuits are identical to vacuum-tube arrangements except that no filament power is required. The two-stage crystal oscillator and amplifier, **fig. 1**, requires approximately 500 mW dc input to the final and can be operated from two 12-volt lantern batteries in series. At W3FQJ it operates from the solar power supply detailed in the November, 1974, issue of *ham radio*.¹ A 12-volt motorcycle battery has also been added to the installation, providing 24-volt capability.

The oscillator is a Pierce-type and requires no resonant output circuit. The signal is capacitively coupled to the gate of the amplifier with an rf choke serving as a means of applying the drain supply voltage. A 1-mA meter can be connected across the low-value gate-circuit resistor to provide an indication of gate current and, therefore, the strength of the oscillator signal arriving at the gate. The meter can be connected and disconnected without any influence on the operation of the transmitter because the value of R4 is very low in comparison to the value of the gate resistor, R3. The

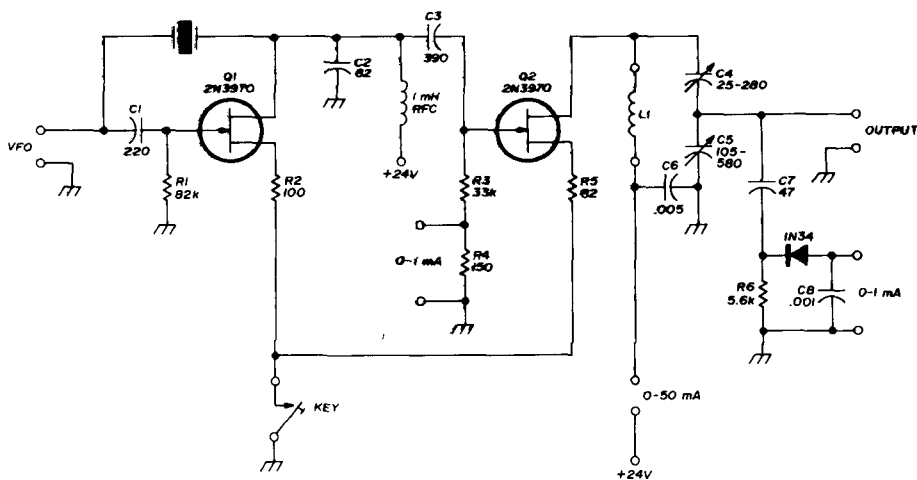


fig. 1. Two-stage fet QRP transmitter uses crystal oscillator stage, Q1, and power amplifier, Q2. Dc power input is about 500 mW. A vfo may be used if desired. For 80 meters L1 is 50 close-spaced turns no. 24 on 13/16" (20mm) toroid core.

low-value capacitor C2 aids crystal starting when operating at low frequencies. Parts values and information are given for operation on the 80-meter band.

The resonant circuit of the rf amplifier consists of a toroid coil and two series-connected trimmer capacitors. These capacitors are used both for tuning and for obtaining an impedance

meter is a relative measure of the level of the rf output voltage. This meter can also be connected and disconnected without affecting the output power level.

The simple two-stage QRP transmitter is mounted on a Vector board, fig. 2. This is micro-vector board type 84P44-062; the 0.042-inch (1-mm) hole

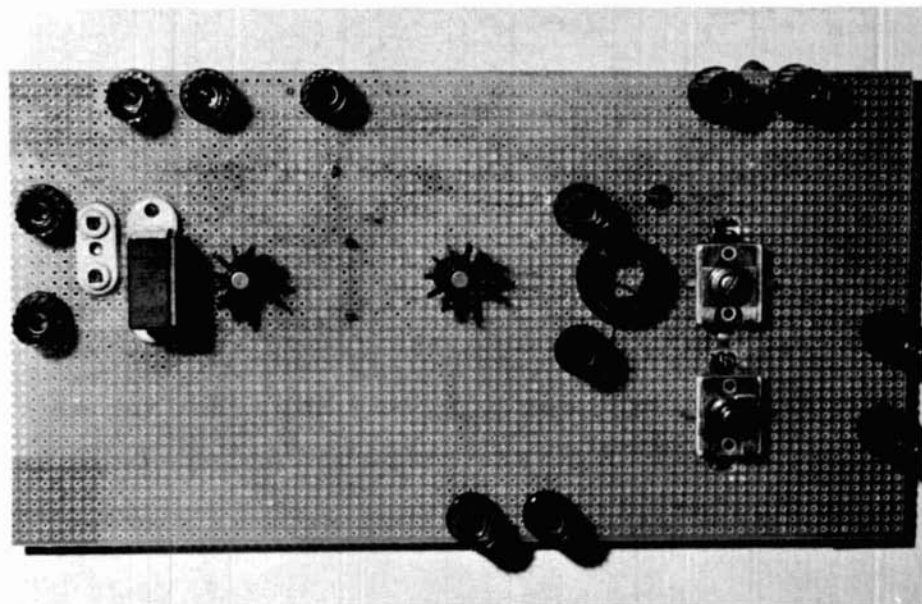


fig. 2. Two stage fet QRP transmitter is built on piece of Vector perfbord as shown here.

match to a low-impedance load. Capacitor C4 influences primarily the resonant tuning; capacitor C5 is for the impedance match. The amplifier drain current can be measured with a 50-mA meter or an appropriate vom current scale. The product of drain current and supply voltage represents the dc input power to the amplifier. As in vacuum-tube practice, when the resonant circuit is tuned through the resonant point, there is a dip in drain current.

A 1N34 diode and resistor-capacitor filter are used as an rf output indicator. The dc current indicated on the 1-mA

size and 0.1 inch (2.5mm) spacing are ideal for mounting transistor and IC sockets. The Vector T42-1 micro-clips can be inserted conveniently into the holes to provide terminals. This method of construction will be used throughout the *Expro* projects. Binding posts are convenient for making tests and interconnections. Stick-on protector pads (available at hardware stores) provide support and permit the bulk of the wiring to be done underneath the Vector board.

The toroid core is the 13/16-inch (20-mm) type. The winding consists of

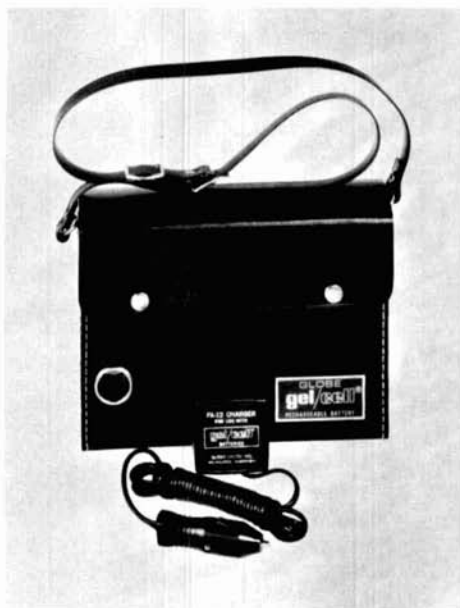
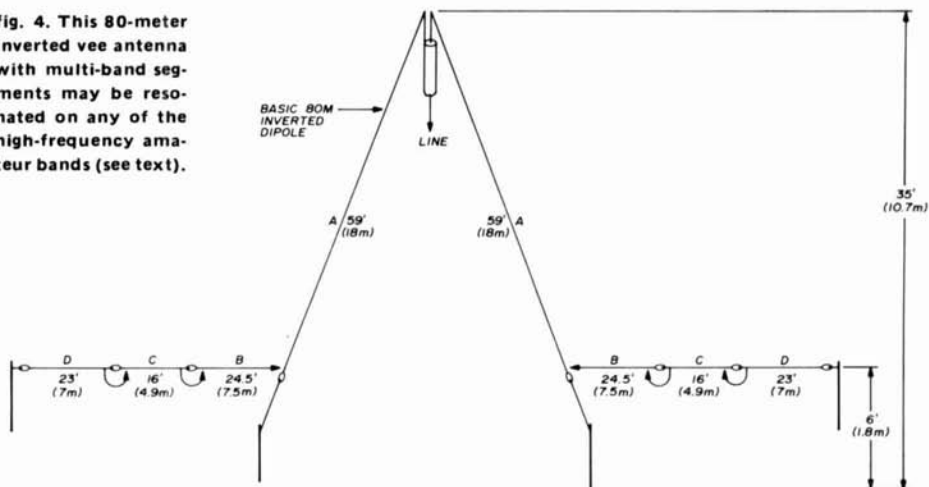


fig. 3. For portable use you may want to use a rechargeable Gel/Cel battery made by Globe Battery, Milwaukee, Wisconsin.

50 close-spaced turns of number-24 enameled copper wire. There are two binding posts positioned on each side of the toroid. Later you may wish to operate on other bands and they provide an easy means of changing coils for multi-band operation. The two trimmer capac-

fig. 4. This 80-meter inverted vee antenna with multi-band segments may be resonated on any of the high-frequency amateur bands (see text).



itors are mounted near the coil so they can be easily adjusted while observing the readings on the output indicator.

You may wish to drive the two-stage transmitter with a variable-frequency oscillator connected to the vfo input binding posts, fig. 1. For this mode of operation you need only remove the crystal from its socket.

tuneup

To check out the transmitter, first insert the crystal and the two fet's. Arrange the supply voltage so as to apply power, initially, to the oscillator only. Connect the 1-mA meter across the gate resistor R4.

Turn on the oscillator stage. Note that there is an indication on the meter. This indicates that the oscillator is operating and there is adequate drive to the amplifier, enough to draw gate current. Meter reading is low and approximately 0.1 mA. Note that if the crystal is removed from its socket, the current reading falls to zero. Also, if the amplifier fet is removed from its socket the meter reading falls to zero.

Insert the 50 mA meter in the supply line to the drain of the amplifier. Adjust capacitor C5 for near maximum setting. Apply power to both stages. Now tune capacitor C4 through its range. Note the

dip in the drain current as the output circuit is tuned through resonance.

Transfer the 1-mA meter to the indicator circuit (across capacitor C8), connect a 68-ohm resistor across the amplifier output, and turn on the transmitter. Adjust capacitor C4 for maximum meter reading. Now adjust capacitor C5 for best output. Jockey back and forth between C4 and C5 until maximum output is obtained.

Jot down the output meter readings and the drain current reading, and calculate the dc power input to the amplifier

$$P_{IN} = V_{DD} I_D$$

Typical dc input power is 480 milliwatts (24 V x 20 mA).

Now connect an oscilloscope across the output. Note the good quality of the generated 80-meter sinewave. Key the transmitter, noting the influence on the oscilloscope pattern and the drain and output current meter readings. Tune the transmitter in on your receiver. Check out the keying quality of the CW signal.

Remove the 68-ohm resistor which is across the output, disconnect the oscilloscope, and connect your 80-meter dipole antenna across the output. Retune

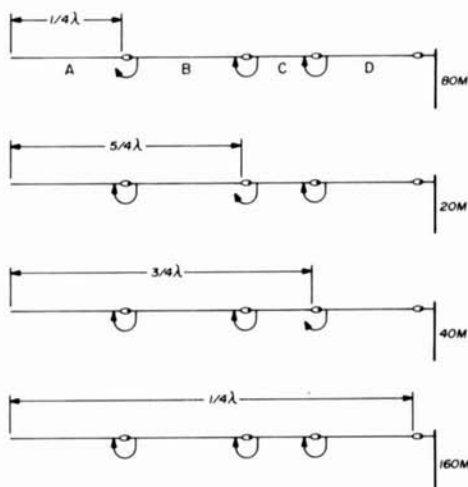


fig. 5. How to use the basic antenna system of fig. 4 on four bands by using jumpers.

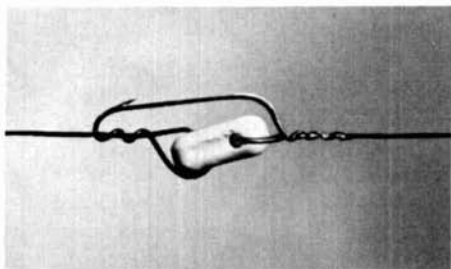


fig. 6. Installing a simple jumper wire across the antenna insulator to adjust resonance.

the transmitter. If your antenna system matches properly there should be very little change in drain current or the output meter reading. If your antenna is not resonant to exactly the crystal frequency the meter readings might not be the same. You are now ready to operate your fet QRP transmitter. Initial W3FQJ contacts with this little rig were with W2UEZ and W2UUV/1.

The rig can also be operated portable using the Globe Gel/Cel 4.5AH 12-volt battery. This convenient battery can be supplied with its own charger or it can be charged from a small solar energy converter, fig. 3.

single antenna — four bands

In my solid-state and QRP experiments I needed a single good performing, one-transmission-line test antenna for the 20-, 40-, 80- and 160-meter bands. In addition, it should be possible to resonate the antenna to any frequency in any band. For good performance there should be a current loop at the top of the antenna for each band. For convenience it is helpful to make all resonant frequency and band changes from the ground level and without letting a mast down or putting it back up. A bit of walking to make changes was welcome rather than frowned upon.

The Inverted-Vee antenna was selected because current maxima could be positioned at the apex for each band by proper selection of leg length. At the

same time all changes in resonant leg length could be made from ground level. This is accomplished by making each leg length some odd multiple of an electrical quarter wavelength, reflecting a low impedance to the feedpoint at the

jumper open or closed plan for four-band operation. All of this can be done conveniently from ground level. The photograph of **fig. 6** shows how a jumper is closed across a standard ceramic insulator.

table 1. Free-space dimensions (f in MHz).

1/2 wavelength	492/f (feet)	150/f (meters)
3/2 wavelength	1496/f (feet)	450/f (meters)
5/2 wavelength	2460/f (feet)	750/f (meters)
7/2 wavelength	3444/f (feet)	1050/f (meters)

apex. The final antenna operated as an inverted dipole on 80 and 160; a $3/2\lambda$ Inverted-Vee on 40; and $5/2\lambda$ on 20.

A general plan of the antenna is shown in **fig. 4**. The 80-meter segment is a conventional inverted dipole with its apex about 35 feet (11m) up at W3FQJ, with wire ends reaching down to 4 to 5 feet (1 to 1.5m) above ground level. From these accessible ends the legs of the antenna span out horizontally at the same level.

Segment B, approximately 25-feet (7.6m) long, when added to segment A with a jumper in each leg sets up the $5/2\lambda$ antenna on 20 meters. Additional 15-foot (4.5m) segments jumpered onto leg ends establishes a $3/2\lambda$ on 40. Finally, about 25 additional feet (7.6m) provide a half-wavelength antenna on

Free-space dimensions for a sequence of odd quarter-wavelength segments is shown in **table 1**. These free-space lengths must be shortened to obtain an electrical resonance with a wire antenna. The following formulas are normally used to find the length of a quarter-wavelength dipole leg:

$$\text{leg length (feet)} = \frac{234}{f_{\text{MHz}}}$$

$$\text{leg length (meters)} = \frac{71.3}{f_{\text{MHz}}}$$

This works for most amateur bands. However, when building a 160-meter antenna recently I found the leg length was more closely given by $228/f_{\text{MHz}}$ (feet) or $69.5/f_{\text{MHz}}$ (meters), possibly showing the close-to-ground influence.

table 2. Design equations and resonant points for inverted-vee antenna shown in fig. 4.

band	antenna	equations		measured resonance
160 M	1/4 wavelength	228/MHz (feet)	69.5/MHz (meters)	1850 kHz
80 M	1/4 wavelength	234/MHz (feet)	71.3/MHz (meters)	3930 kHz
40 M	3/4 wavelength	725/MHz (feet)	221/MHz (meters)	7290 kHz
20 M	5/4 wavelength	1210/MHz (feet)	369/MHz (meters)	14340 kHz

160 meters. The legs do not necessarily have to run straight away. When necessary they can be tilted away from the plane of the Inverted-Vee by as much as 40 to 60° to permit accommodation to the mounting site.

The arrangement of each leg of this antenna is shown in **fig. 5**, showing the

By experiment I have found that the leg-length equations for $3/4$ wavelength are $752/f_{\text{MHz}}$ (feet) and $221/f_{\text{MHz}}$ (meters); for $5/4$ wavelength the equations are $1210/f_{\text{MHz}}$ (feet) and $369/f_{\text{MHz}}$ (meters). These equations should get you into each of the desired bands. However, some length ad-

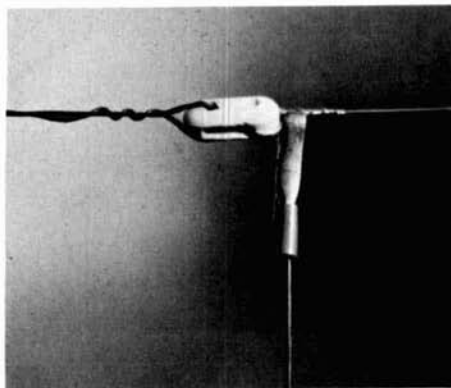


fig. 7. Resonating to a spot frequency in any band may be accomplished with short clip-on sections.

adjustments will undoubtedly be necessary for resonance at your preferred frequency as variables inevitably creep into any antenna installation.

Resonating to a spot frequency within any one band can be handled with clip-on sections, fig. 7. In using the idea of the clip-on section, dimension the antenna segments to the high end of each band. For example, the 80-meter inverted dipole is resonated near 3.95 MHz. Two clip-on sections of proper length can then be used to resonate the dipole to any lower frequency in the same band. For the case in point clip-on lengths of 4 feet (1.2 meter) tune the antenna to resonance at 3.6 MHz.

The dimensions given in fig. 4 are the final practical values. Data for them are given in table 2. Of course, you may wish to cut the antenna segments for resonance at the center of the phone segment of each of the bands. If you decide to do this, a single pair of clip-ons for each band can then be used to lower antenna resonance into the CW band.

reference

1. Ed Noll, W3FQJ, "Solar Power," *ham radio*, November, 1974, page 52.

ham radio

FREE DATA SHEETS WITH EVERY ITEM 749 IC WITH EVERY \$10 ORDER*

- REDUCE YOUR PROJECT COSTS
- MONEY-BACK GUARANTEE
- 24-HOUR SHIPMENT
- ALL TESTED AND GUARANTEED

TRANSISTORS (NPN):

2N3563 TYPE RF Amp & Osc to 1 GHz (pl.2N918)	6/\$1.00
2N3565 TYPE Gen. Purpose High Gain (TO-92/106)	6/\$1.00
2N3567 TYPE High-Current Amplifier/Sw 500 mA	4/\$1.00
2N3866 TYPE RF Power Amp 1.5 W @ 450 MHz	\$1.50
2N3903 TYPE GP Amp & Sw to 100 mA and 30 MHz	6/\$1.00
2N3919 TYPE RF Power Amp 10-25 W @ 3-30 MHz	\$3.00
2N4274 TYPE Ultra-High Speed Switch 12 ns	4/\$1.00
MPS6515 TYPE High-Gain Amplifier hFE 250	3/\$1.00
Assort. NPN GP TYPES, e.g. 2N3694, 2N3903, etc. (15)	\$2.00
2N3638 TYPE (PNP) GP Amp & Sw to 300 mA	4/\$1.00
2N4249 TYPE (PNP) Low-Noise Amp 1µA to 50mA	4/\$1.00

FET's:

N-CHANNEL (LOW-NOISE)

2N4091 TYPE RF Amp & Switch (TO-18/106)	3/\$1.00
2N4416 TYPE RF Amplifier to 450 MHz (TO-72)	2/\$1.00
2N5163 TYPE Gen. Purpose Amp & Sw (TO-106)	3/\$1.00
2N5486 TYPE RF Amp to 450 MHz (plastic 2N4416)	3/\$1.00
E100 TYPE Low-Cost Audio Amplifier	4/\$1.00
ITE4868 TYPE Ultra-Low Noise Audio Amp	2/\$1.00
TIS74 TYPE High-Speed Switch 405Ω	3/\$1.00
Assort. RF & GP FET's, e.g. 2N5163, MPF102, etc. (8)	\$2.00

P-CHANNEL:

2N1360 TYPE Gen. Purpose Amp & Sw (TO-106)	3/\$1.00
E175 TYPE High-speed Switch 125Ω (TO-106)	3/\$1.00

SUMMER SPECIALS:

1N4154 DIODE 30 V/10mA-1N914 exc. 30 V	20/\$1.00
2N3904 NPN TRANSISTOR GP Amp & Switch	5/\$1.00
2556 DUAL 555 TIMER 1 µsec to 1 hour (DIP)	\$1.00
2N2222 NPN TRANSISTOR GP Amp & Switch	5/\$1.00
2N2907 PNP TRANSISTOR GP Amp & Switch	5/\$1.00
2N3553 RF Power Amp 5 W @ 150 MHz, 1 W @ 50 MHz	\$2.00

BUILD IN ONE HOUR!

8-DIGIT MEMORY CALCULATOR KIT-Pocket size, 5 function (+ - x ÷ %), addressable memory with individual recall plus constant and floating decimal. Timed display turnoff (saves batteries). Easy to assemble. Everything you need—ICs, keyboard, LED array, handsome case, etc.; just add solder and batteries. \$19.95

LINEAR IC's:

308 Micro-Power Op Amp (TO-5/MINI-DIP)	\$1.00
309 K Voltage Regulator 5 V @ 1 A (TO-3)	\$1.50
324 Quad 741 Op Amp, Compensated (DIP)	\$1.75
380 2.5 Watt Audio Amplifier 34 dB (DIP)	\$1.29
555X Timer 1 µs:1 hr. Dif. pinout from 555 (DIP)	\$.85
709 Popular Op Amp (DIP/TO-5)	\$.29
723 Voltage Regulator 3-30 V @ 1-250mA (DIP/TO-5)	\$.58
739 Dual Low-Noise Audio Preamp/Op Amp (DIP)	\$1.00
1458 Dual 741 Op Amp (MINI-DIP)	\$.65
741 Freq. Comp. OP AMP (DIP/TO-5/MINI-DIP)	3/\$1.00

DIODES:

ZENERS—400mW, Specify Voltage 3.3, 3.9, 4.3, 5.1, 6.8, 8.2, 9.1, 10, 12, 15, 18, 22, 24, 27 or 33V (±10%)	4/\$1.00
1N3600 TYPE Hi-Speed Sw 75 V/200 mA	6/\$1.00
1N3893 TYPE RECTIFIER Stud Mount 400 V/12 A	2/\$1.00
1N914 or 1N4148 TYPE Gen. Purp. 100V/10mA	10/\$1.00
D5 VARACTOR 5-50 W Output @ 30-250 MHz, 7-70 pF	\$5.00
F7 VARACTOR 1-3 W Output @ 100-500 MHz, 5-30 pF	\$1.00

*MAIL NOW! FREE DATA SHEETS supplied with every item from this ad. FREE ON REQUEST—749 Dual Op Amp (\$1.00 value) with every order of \$10 or more, postmarked prior to 9/30/75.

ORDER TODAY—All items subject to prior sale and prices subject to change without notice. All items are new surplus parts — 100% functionally tested.

WRITE FOR FREE CATALOG offering hundreds of semiconductors not listed here. Send 10¢ stamp.

TERMS: All orders must be prepaid. We pay postage. \$1.00 handling charge on orders under \$10. Calif. residents add 6% sales tax. Foreign orders — add postage. COD orders — add \$1.00 service charge.

ADVA ELECTRONICS

BOX 4181 AO, WOODSIDE, CA 94062
Tel. (415) 851-0455

simple audio-frequency keyer for RTTY

This easily-duplicated
afsk unit
produces a stable,
smoothly-switched,
sine-wave output
from a minimum
of components

With a minimum of parts and a bit of electronic serendipity, I designed and constructed the audio-frequency-shift-keyer described herein. I received excellent and gratifying reports as well as queries on its circuitry from experts on the air and friends who have used my "spare" on both afsk a-m on two meters and fsk via ssb-afsk on the low bands. Most don't believe me when I tell them that it uses only one transistor and no filter or other complication. The device, however, doesn't know that, so it continues to function and to enjoy the flat-tery of its more complicated counter-

parts. Consult the circuit diagram (fig. 1) and you'll see immediately that it is a gutless thing, with only a few parts.* I almost forgot to mention that it also puts out a pure sine wave!

circuit description

The power supply is derived from the loop current (typically 60 mA), and when the loop current disappears during spacing, the electrolytic supplies the 4 mA required by the oscillator. Since the device is insensitive to voltage changes, the small drop in supply voltage is not detectable.

As will be developed in the data tables to follow, power supply voltage changes from 15 to 30 volts have less than 6 Hz effect on the frequency and only a 5 per cent effect on the audio frequency output voltage. The oscillator is a Hartley type, using a resistance loaded inductor with a Q of ten. The "grid-leak" has no capacitor across it. These points, in addition to the current regulating nature of the jfet, are what allows transient-free frequency-shift keying.

The opto-electric coupler keys a diode-switched capacitor to change from mark to space frequencies. The coupler is required for isolation and to obtain the very high impedance needed for good switching.

*A printed-circuit board and the components for the afsk can be obtained from Varco Devices, Drawer 8, Stirling, New Jersey 07980.

W.H. King, W2LTJ, 5 Midwood Drive, Florham Park, New Jersey 07932

Note that you could get away with one logic diode in lieu of the diode bridge if you connect the RTTY loop up with the proper polarity. The bridge arrangement is better, as anybody can wire it up and get the correct polarity

the 2975-Hz space frequency by unwinding turns from the toroid.

You can tune the unit on the RTTY loop, or you can use an equivalent source of power of 18 volts, current limited with a resistor to 60 mA. What-

table 1. Audio frequency and rms voltage at top of toroid as a function of supply voltage. Above 15 volts both frequency and audio output are independent of supply voltage.

power supply volts	850 Hz shift tones				170 Hz shift tones			
	marking freq Hz	spacing audio volts	marking freq Hz	spacing audio volts	marking freq Hz	spacing audio volts	marking freq Hz	spacing audio volts
10.0	2100	13.3	2900	13.5	2096	13.3	2264	13.3
15.0	2125	18.5	2966	18.7	2121	18.7	2294	18.5
20.0	2134	19.7	2983	20.5	2128	20.1	2302	20.1
25.0	2133	20.1	2986	20.3	2128	20.3	2303	20.0
30.0	2131	19.6	2987	19.6	2130	20.1	2304	19.3

on the circuit, thus providing protection at the same time!

It is no surprise that the 88-mH toroid and the capacitors aren't "on the button" items; thus, you will have to tune the circuit to the appropriate frequencies by trial and error. For 850-Hz shift keying between 2125-Hz mark and 2975-Hz space, the values for C1 and C2 are 0.0317 μ F and 0.0330 μ F, respectively. For 170-Hz shift the values are 0.0555 μ F and 0.0092 μ F. Please note that the toroid in this case had an inductance of 86.7 mH. You could never be so lucky as to get an identical one, but you can come close if you start with a capacitor of about 0.033 μ F and tune to

ever you use, I suggest that you connect a temporary short across the LED in the MOC1002 (pins 1 and 2). This will put the unit in the spacing condition and you can now tune C1. Next, remove the short and tune C2 to the mark frequency. Since there may be a little interaction, recheck it, and when you are satisfied solder the capacitors in place. If you desire both shifts, you can add a dpdt switch and the two additional capacitors.

The only other adjustment depends upon your audio output requirements. Each turn of output secondary you wind on the toroid gives about 20 mV of audio output for your microphone

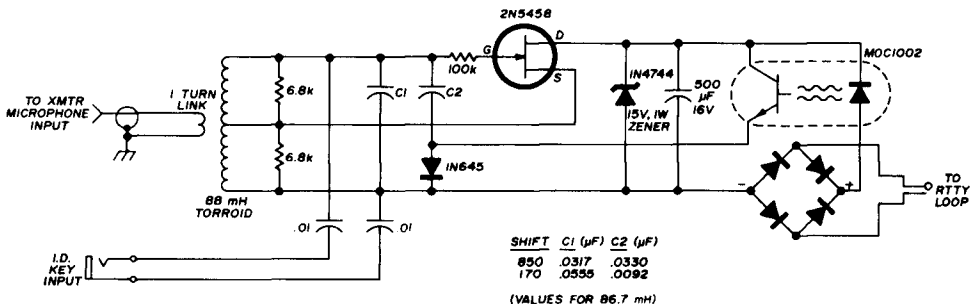


fig. 1. Schematic diagram of the afsk Keyer. Values for C1 and C2 are approximate; oscillator must be tuned to frequency by removal of turns from the 88 mH toroid.



**There's
nothing
like it !**

RADIO AMATEUR callbook

*Respected worldwide as
the only complete authority
for radio amateur
QSL and QTH information.*

The new 1975 U. S. Callbook has nearly 300,000 W & K listings. It lists calls, license classes, names and addresses plus the many valuable back-up charts and references you come to expect from the Callbook.

Specialize in DX? Then you're looking for the new, larger than ever 1975 Foreign Callbook with almost 235,000 calls, names and addresses of amateurs outside of the USA.

**United States
Callbook**
All W & K Listings
\$12.95
with
3 Service Editions
\$18.95

**Foreign Radio
Amateur Callbook**
DX Listings
\$11.95
with
3 Service Editions
\$17.95

Order from your favorite electronics dealer or direct from the publisher. All direct orders add 75¢ shipping and handling per Callbook.

**WRITE FOR
FREE
BROCHURE** RADIO AMATEUR
callbook INC.
Dept. E 925 Sherwood Drive
Lake Bluff, Ill. 60044

table 2. Audio frequency as a function of shift, loop current and supply voltage.

power supply volts	spacing zero mA		marking 50 mA		marking 70 mA	
	850	170	850	170	850	170
5.0	2784	2209	2503	2053	2050	2047
7.5	2891	2260	2093	2090	2094	2090
10.0	2934	2280	2112	2107	2111	2109
12.5	2957	2291	2130	2118	2120	2117
15.0	2967	2296	2140	2122	2125	2122
17.5	2974	2298	2140	2124	2127	2124
20.0	2975	2299	2139	2124	2128	2125
22.5	2976	2300	2138	2125	2128	2124
25.0	2977	2300	2136	2125	2128	2125
27.5	2978	2300	2135	2125	2127	2125
30.0	2978	2300	2133	2125	2128	2126
ideal	2975	2295	2125	2125	2125	2125

Note: Frequencies at 60 mA are within a few Hz of those shown at 70 mA.

input. In my case one turn was enough, so you can be accordingly cautious.

performance

I don't intend to defend my design with great amounts of data which may prove difficult for you to verify. But let me say this: on 170-Hz shift you can't find any defect or transient problem as determined by scope, ear, or RTTY expert; on 850-Hz shift there is a bit.

Recently, I borrowed a Western Electric Telegraph Transmission Measuring Set (model 164C2) and used it to check the above conclusions. I played a test tape into the TD to key the loop and thus the afsk. The tones were simultaneously demodulated with a terminal unit which keyed a second loop containing the distortion meter and a printer. The 170-Hz shift was — as advertised — perfect, and the 850-Hz shift mode showed about one percent distortion that could be blamed on the afsk.

The data in tables 1 and 2 quantify my statements about the frequency stability and constant-amplitude audio output of the circuit. In order to make these tests, the circuit was altered by applying static voltages, then measuring the resulting frequencies and voltages.

ham radio

Morse and RTTY from one keyboard?



Meet the two and only.

The HAL DKB-2010 Dual Mode keyboard is one of the most sophisticated products ever offered to the radio amateur. It's an all solid state keyboard that allows you to send either RTTY or CW — with more ease, more versatility than anything you've ever seen before.

In the RTTY mode, you can transmit at standard data rates of 60, 66, 75 or 100 WPM, as well as an optional 132 WPM, 100 baud. In addition to the complete alphanumeric keys, you get 17 punctuation marks, 3 carriage control keys, 2 shift keys, a break key, 2 three-character function keys, a "DE-call letters" key and a "Quick brown fox . . ." test key.

In the CW mode, you can send at speeds anywhere between 8 WPM and 60 WPM. You can also adjust dot-to-space weight ratios to your liking. For CW, you have all alphanumeric keys, plus 11 punctuation marks, 5 standard double-character keys, 2 shift keys, a break-for-tuning key, error key, "DE-call letters" key, plus

2 three-character function keys. Output interfacing is compatible with cathode keying or grid-block keying. A side tone oscillator and built-in speaker allow you to monitor your signal — with adjustable volume and pitch controls.

The DKB-2010 also has a three-character memory buffer which operates in either the RTTY or CW mode, allowing you to burst type ahead without losing characters. A 64-character memory buffer is also available as an option. Key function logic in either mode is governed by LSI/MOS circuitry. All key switches are computer grade.

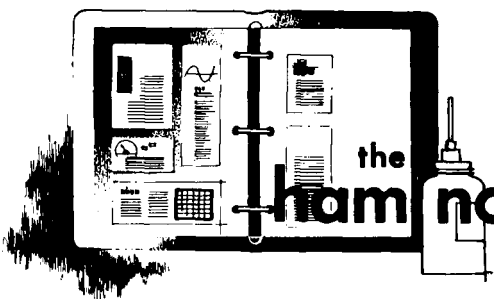
The DKB-2010 is available assembled or in kit form. Should you choose the kit, you'll find construction easy — the unit consists of three assemblies: power supply board, logic PC board, keyswitch PC board, and pre-assembled wiring harness.

Any way you look at it — as an easy-to-build kit, a complete assembly, as a CW keyboard, or an RTTY keyboard, the HAL

DKB-2010 is a real breakthrough for every amateur. It adds a whole new dimension to the exciting world of amateur radio. Once you've used the DKB-2010, you'll wonder how you ever got along without it!

Prices: \$425 Assembled;
\$325 Kit

	HAL Communications Corp. Box 365, Urbana, Illinois 61801 Telephone: (217) 367-7373
<input type="checkbox"/>	Enclosed is \$ _____ (Assembled) \$ _____ (Kit)
	Call letters _____
<input type="checkbox"/>	Charge Master Charge # _____
<input type="checkbox"/>	Charge BankAmericard # _____
	M/C Interbank # _____
	Card Exp. date _____
<input type="checkbox"/>	Please send me the HAL catalog.
Name _____	
Address _____	
City/State/Zip _____	
All prices include U.S.A. shipping. Add \$10 for air shipment. Illinois res. add 5% sales tax.	



the ham notebook

TTL crystal oscillators

Since building a frequency counter, I've been intrigued by TTL crystal oscillators because of their simplicity. Previously I had not been able to obtain reliable performance at frequencies above a few MHz, but I recently ran across a circuit that purrs like a kitten at 14.833 MHz, the highest frequency crystal in my junk box. While checking out this circuit, the possibility of frequency modulating a TTL oscillator

came to mind. The circuit is shown in fig. 1.

The varicap I used was one of Radio Shack's specials, since that was what was in the junk box. With no audio, the bias was varied to obtain voltage/deviation curves with two available crystals, an FT243 at 8.1 MHz and an HC6/U at about 7.2 MHz. The two curves are shown in fig. 2. A bias of 4 volts was chosen.

Since I hadn't been bitten by the 2-meter fm bug at the time I first built this circuit, there was nothing in the house to monitor the output except a six-band general-coverage receiver which covered the 2-meter band along with harmonics and other frequencies. The 18th harmonic of the oscillator was strong and the audio quality seemed to be surprisingly good. I had KØPHF's Heath Twoer on the bench, and with one connection change (and a different crystal) the output of the oscillator was plugged into the Twoer's crystal socket. It drove the Twoer nicely, and to keep it in the sphere of amateur radio, a contact was made through the local 34/94 repeater.

The Twoer first stage, a tripler, seemed to flourish on the harmonic content of the TTL oscillator. Succeeding stages should do a fair job of curtailing final harmonic output. However, this must be carefully checked before any long-term 2-meter operation as additional filtering may be required.

George Chynoweth, WØJVA

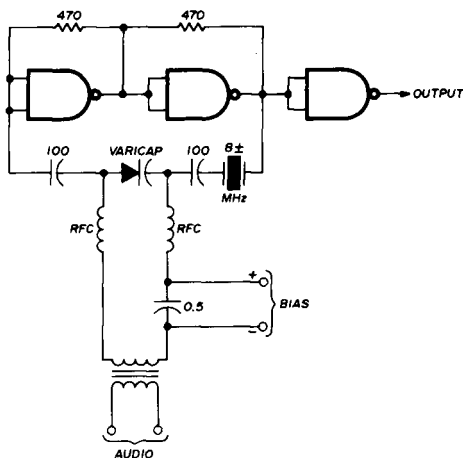
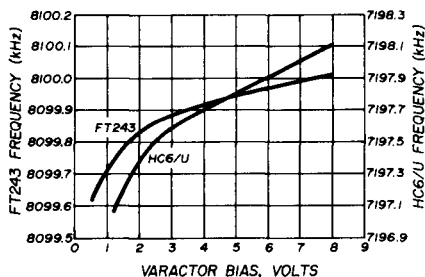


fig. 1. Frequency-modulated crystal oscillator uses TTL gates and varicap diode. Performance curves are shown in fig. 2.

fig. 2. Deviation of frequency-modulated TTL oscillator shown in fig. 1.



filter alignment

Moore covers a lot of territory in his recent article¹, but he couldn't include everything. However, one point does need to be expanded: using the spectrum analyzer and noise generator for matching and aligning filters. I have been using this method for several years.

I first used the noise generator in my Omega-T antenna bridge in lieu of a good sweep generator that would cover the i-f frequencies. A Heath SB620 Scanalyzer was connected behind or ahead of the filters under test. Unfortunately, the SB620 covers only the i-f it is built for. I was interested in an i-f of 5645 kHz and the SB620 was equipped with those coils (various frequency coils are supplied in the SB620 kit).

The object of all this was to properly match and align a Drake R4B receiver after installing an 8-pole, 3.7 kHz filter in place of the original, rather wide, 4-pole, 8 kHz filter. More recently the 8 kHz filter was removed from an R4C and replaced with a 5 kHz filter.

To align the filter I coupled the noise bridge into the antenna terminal of the receiver, and the AVC was turned off. The SB620 is coupled very loosely to the grid of the first tube after the filter which is being adjusted. Observe the lower cor-

ners of the bandpass curve. You will probably see something like fig. 3, curve A. But what you want, and can get by adjusting the coupling components, is curve B.

What you may not suspect is that the SB620 can be placed ahead of the filter to display the "suck-out" of the filter (its low-impedance swamping of the incoming noise). This curve, fig. 4, is just about the reciprocal of fig. 3. The area between the solid and broken lines is what you have gained by proper matching and isolation.

The curve in fig. 4 also illustrates what happens when the SB620 is con-



fig. 3. Display of filter response with noise generator input and SB620 installed after the filter. Curve B can be obtained with careful matching and tuning.

nected as a pan adapter in front of a good filter which has a fairly low impedance. This results in off-frequency signals appearing stronger than those within the passband of the filter. This is rather disconcerting when you wish to check the frequency to which you are tuned: it will look like a clear spot and a good place for a CQ when, in fact, there may be signals there.

Arthur E. Lux, W7UC

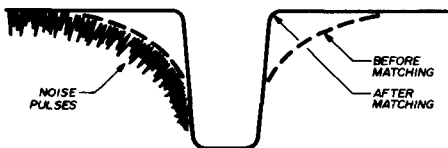
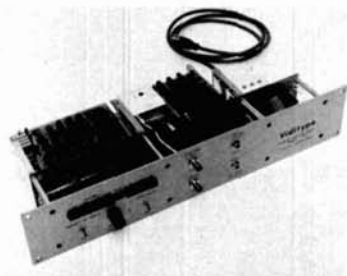


fig. 4. Display of filter "suck-out" with SB620 installed in front of the filter. This curve is nearly a reciprocal of that shown in fig. 3.

1. Ray Moore, "Designing Communications Receivers for Good Strong-Signal Performance," *ham radio*, February, 1973, page 6.

new products

RTTY video display unit



Leland Associates has announced a new RTTY video display unit, the model 872 Viditype, which will provide a video display of RTTY signals on *any* standard television receiver's unused channel. No modifications are required to the TV receiver — simply connect the unit to the antenna terminals. The model 872 is directly compatible with all common RTTY terminal units and features CR-LF on line feed signal, automatic CR-LF on 40th character or a space in positions 36 to 40, automatic page unshift at the end of the 25th line, manual clear (starts print at upper left screen), selectable down-shift on space, manual letters key, and print suppres-

sion on all nonprinting functions. Character format is 40 characters per line, 25 lines of display and 1000 character display capacity. The video system uses a crystal-controlled sync generator with a video bandwidth of 3 MHz and 30 Hz refresh rate. Output is 2000 microvolts at 50 ohms on TV channels 3 to 6.

The model 872 video display unit is priced at \$450 in kit form (\$550 assembled and tested) plus \$3.00 shipping and insurance. Specify Baudot or ASCII input. For more information, write to Leland Associates, 18704 Glastonbury Road, Detroit, Michigan, 48219, or use *check-off* on page 94.

triad catalog

Triad-Utrad's new 1975-76 *Replacement Catalog and Television Guide for Transformers* is now available. The 70-page catalog features several hundred replacement transformers including color TV components, deflection yokes, flybacks, vertical outputs and filter chokes, as well as power, filament and audio transformers. Copies of the catalog are available on request from Steve Fisher, General Manager, Triad Utrad Distributor Services, 305 North Briant Street, Huntington, Indiana 46750, or use *check-off* on page 94.

450-MHz fm transmitter and power amplifier

VHF Engineering has recently announced the availability of a new 450-MHz fm transmitter and companion 10-watt, 450-MHz power amplifier. For the first time, simple kits are available to permit fm operators to get on 450 MHz without relying on expensive new or surplus equipment. Previously, the uhf fmer had to purchase surplus tube-type uhf fm equipment which was expensive (and difficult to maintain), or

he had to purchase new fm gear designed for the amateur market. The new gear is much more reliable than the older surplus, but it is very expensive.

VHF Engineering has announced the availability of a simple 1-watt, 450-MHz transmitter kit and a 10-watt 450-MHz amplifier kit designed for construction by the average amateur. These kits are relatively easy to build and do not require sophisticated test equipment. The kits are fully solid state and use readily available components. An experimenter who builds these kits will be able to maintain them himself, a distinct advantage over purchasing a wired and tested unit.

The 450-MHz transmitter consists of five simple stages starting with a varactor-modulated crystal oscillator using crystals in the 18-MHz range. The oscillator quadruples to 55 MHz and drives the first of three doublers. The first two doublers use 2N3866 transistors in a standard doubling configuration. The last doubler uses a 2N3553 and delivers output to the final on 450 MHz. The final amplifier transistor is a 2N5913 operating straight through at 450 MHz, delivering 1 watt output out on the 450 MHz fm band.

While one watt may be sufficient for some applications, additional power really helps in rough terrain when using a repeater and is an absolute must when operating direct on 450 MHz. The VHF Engineering 450-MHz, 10-watt amplifier will supply this extra power at nominal cost. The power amplifier is well designed and very easy to build. Most experimenters should be able to complete it in less than two evenings. The power amplifier uses two balanced-emitter uhf transistors and delivers slightly more than 10 dB gain. For one watt input, the minimum output is 10 watts.

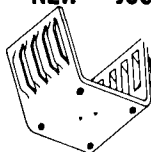
Each VHF Engineering kit consists of top quality components and epoxy-glass circuit boards. The instructions are

NEW SIZES — VERTICAL MOUNT PC BOARD POTENTIOMETERS

American made (CRL) high quality pots. Available in the following sizes: 750 ohms, 1500 ohms, 25,000 ohms, 50,000 ohms, 100,000 ohms, 750,000 ohms. Price is 5 for \$1.00 ppd.



NEW — JUST ARRIVED — FITS T03



ALUMINUM HEAT SINK
Very nice American made heat sink. 1/16 inch thick and approx. dimensions are 1 1/2" x 1" x 1" high for T03 transistor.

Price is a low 45¢ each or 3 for \$1.25 ppd.

ALSO Aluminum heat sink similar to above but with only 3/8" hole in center.
35¢ each or 3 for \$1.00 ppd.

NEW NEW NEW

SPDT MINI-SLIDE SWITCH, Imported, black, 3/4" O.C. with two 6" leads 40¢ ea. ppd.

COOL 30-0-30 V - 2.5 AMP SHIELDED TRANSFORMER — NEW — AMERICAN MADE YES — 3 pound with 1 3/4" deep core vertical end bell mount. 2 1/4" w. x 3" h. x 3 1/4" deep, with 6.3 V - 1A winding. \$4.85 ppd.

NEW . . . Red 6 foot #18-2 line cord with flanged safety plug — 55¢ ppd.



.1 MFD, 10V, CRL DISC CAPACITOR 3/8" dia., long leads. 11¢ ea., 10 for \$1.00 ppd.

IDEAL FOR 2M POWER — Transformer, 115 VAC primary, 18 volt, 5 amp ccs or 7 amp intermittent duty secondary \$6.00 ea. ppd.

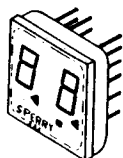
UNPOTTED TOROIDS — All toroids are center tapped, 88MHY or 44 MHY Price is a low 5 for \$2.75 ppd.



Transformer — American Made — Fully shielded. 115 V Primary. Sec. — 24-0-24 @ 1 amp with tap at 6.3 volt for pilot light.
Price — A low \$2.90 each ppd.

NEW NEW NEW

Sperry SP-332 contains two 7 segment readouts, .330 high, side by side layout, black glass face, orange characters with decimal. 3/4 in. square. W/specs.



\$3.50 each, 3 for \$10.00

NEW NEW NEW

AMERICAN MADE DUAL Electrolytic 1000 & 500 MFD. 15V, long leads. 3/4" dia. x 2 1/4" long. 55¢ each, 3/\$1.50 ppd.



3 inch 4 ohm VC Square frame with 4 mounting holes. \$1.20 each ppd.

AMERICAN MADE POWER CORD, 6 foot, gray, 7A, plugs into auto liter socket 75¢ ea. ppd.

SEND STAMP FOR BARGIN LIST
Pa. residents add 6% State sales tax
ALL ITEMS PPD. USA
Canadian orders for less than \$5.00 add \$1.00 to cover additional postage costs.

m. weinschenker
K 3DPJ BOX 353 · IRWIN, PA. 15642

DuPage FM

WILL NOT BE UNDERSOLD!
TPL SPECIALS

**TPL (TRANSISTORIZED
PROGRESS LINE)**
by General Electric fea-
tures all transistorized
receiver, exciter, power
supply, three or four
tubes in the transmitter.



6 & 2 METER

RE 72 JB3 — 42 to 50 MHz, 100 Watts Output.
With **NOISE BLANKER** to eliminate ignition and
other noises. Two frequency transmitter,
single frequency receiver. These should be
great for six meter use. With accessories.

Regular \$335.00 Special Only\$275.00

FE/RE 72 JA3 — 42 to 50 MHz, 100 Watts Out-
put. Single frequency transmit and receiver.
With acces. Reg. \$250. Special only \$225.00

RE/FE 53 JA6 — 152 to 162 MHz, 35 Watts
Output, single frequency transmit and re-
ceive. With accessories. Regularly \$175.00

Special Only\$155.00

QUANTITIES LIMITED SPECIFY SECOND CHOICE

DuPAGE FM INC.

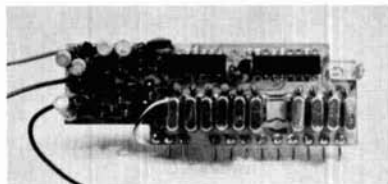
P. O. Box 1, Lombard, IL 60148 - (312) 627-3540

TERMS OF SALE: All items sold as is. If not as represented return for
refund or exchange (our option) within five days of receipt, shipping
charges prepaid. Illinois residents must add 5% sales tax. Personal
checks must clear before shipment. All items sent freight collect. Acces-
sories do not include crystals, relays, reeds or antennas.

straight forward and include sections on theory, construction, operation, and trouble-shooting. Also available from VHF Engineering are a companion solid-state 450 MHz receiver and a solid-state 450 MHz repeater.

The VHF Engineering 450-MHz transmitter kit sells for \$39.95, and the 10-watt amplifier sells for \$39.95. VHF Engineering kits are available from dealers or direct from the manufacturer at 320 Water Street, Binghamton, New York 13902. For more information, use *check-off* on page 94.

fm scanner



Topeka FM Communications has just released a ten-channel scanner designed for use with Regency's HR-2 series radios. This unit will also work on Regency marine radios MT-15, MT-25 and Aquaphone, and is designed to rapidly scan ten channels and lock on any frequency which has a strong enough signal to open the receiver's squelch circuit. A scan-lock feature prevents continued scan due to a momentary signal loss.

The scanner features a priority channel which is selected by the channel selector switch. While receiving on any frequency, the scanner periodically checks the priority channel and returns to it if a signal is present. This feature is ideal for the receivers that must monitor emergency frequencies. Delayed scan after transmit allows time for an answer before the scan is resumed. A simple modification allows selective channel bypass. The scanner is priced at \$52.50. Order from Topeka FM Communications, Inc., 125 Jackson, Topeka, Kansas, 66603.

ME-3 microminiature tone encoder

Compatible with all sub-audible tone systems such as Private Line, Channel Guard, Quiet Channel, etc.

- Powered by 5-15vdc, unregulated
- Microminiature in size to fit inside all mobile units and most portable units
- Field replaceable, plug-in, frequency determining elements
- Excellent frequency accuracy and temperature stability
- Output level adjustment potentiometer
- Low distortion, sawtooth output
- Available in all EIA tone frequencies, 67.0 Hz-203.5 Hz
- Complete immunity to RF
- Reverse polarity protection built-in



\$29.95 each

Wired and tested, complete with K-1 element

communication specialists

P. O. BOX 152
BREA, CALIFORNIA 92621
(714) 996-3021

K-1 FIELD REPLACEABLE,
PLUG-IN FREQUENCY
DETERMINING ELEMENTS
\$3.00 each

Dentron introduces **MORE SKY OPENERS**

**NEW
4 V**

4 BAND 27' VERTICAL

Covers entire 10, 15, 20 & 40 meter band
Full $\frac{1}{4}$ wave antenna on 20 meters
Self Supporting Heavy Seamless Aluminum
Weatherproof, wind survival, 80 mph
2 kW Power Capability
Factory Tuned & Sealed HQ Trap
Suitable For Ground, Roof or Tower Mounting
Radials are included

Dentron 4 V Four Bander \$84.50 ppd USA

**NEW
160M
NEW**

160 METER MOBILE ANTENNA

Now operate Top Band in your car, boat, plane or RV
10 kc Bandwidth without adjustment
Covers entire 160 meter band with adjustment
Slim, lightweight, factory-sealed, loading coil, 500 watt capability, 10 $\frac{1}{2}$ ft. Total Length, Standard Ball Mount Thread ($\frac{3}{8}$ " - 24)

Mobile Top Bander 160 M \$59.50 ppd USA

ALL BAND DOUBLET or Inverted Type 160-10 meters

- Center Fed Tuned Doublet • 130' Total Length — may be cut shorter if desired
- 100' 450 ohm open balanced Transmission Line
- 14 ga. stranded copper antenna wire
- Comes Assembled, just add rope to ends & pull up in the air and tune with the Dentron Super Tuner

Dentron All Band Doublet \$24.50 ppd USA

COMING ATTRACTIONS FROM DENTRON

- 160 meter solid state receiving converter
- "Dual-meter" in line wattmeter
- Audio Rectification Filters for RFI problems in HiFi, tape recorders, organs, intercoms, etc.

Write for full details

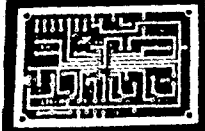


Dentron

RADIO CO., INC.
2100 Enterprise Avenue
Twinsburg, Ohio 44087
Phone: 216-425-8073


IC'S EXAR KITS

FUNCTION GENERATOR KIT



features sine, triangle and square wave. THD 0.5% TYP. AM FM capability.

XR-2206K
FUNCTION GENERATOR KIT



\$19.95
includes monolithic function generator IC, PC board, and assembly instruction manual

\$29.95
Same as XR 2206KA above and includes external components for PC board.

- TIMERS**
- XR 555CP Monolithic Timer \$ 1.10
 - XR 320P Precision Timer 1.55
 - XR 556CP Dual 555 Timer 1.85
 - XR 2550CP Dual Timing Circuit 3.20
 - XR 2240CP Programmable Counter/Timer 4.80
- PHASE LOCKED LOOPS**
- XR 210 FSK Demodulator 5.20
 - XR 567CP High Frequency PLL 6.60
 - XR 567CT Tone Decoder (TDS.5) 1.70
- STEREO DECODERS**
- XR 1310P PLL Stereo Decoder 3.20
 - XR 1310EP PLL Stereo Decoder 3.20
 - XR 800P PLL Stereo Decoder 3.20
- WAVEFORM GENERATORS**
- XR 205 Waveform Generator 8.40
 - XR 2206CP Monolithic Function Generator 5.50
 - XR 207CP Voltage Controlled Oscillator 3.85
- OTHER EXAR IC'S**
- Dual + 15V Tracking Regulator 3.85
 - XR 1468CN Quad Line Driver 5.80
 - XR 1488AN Quad Line Receiver 4.80
 - XR 2206CP Operational Multiplier 6.20
 - XR 2211 CP FSK Demodulator/Tone Decoder 5.70
 - XR 7261 Monolithic Proportional Servo IC System w/4 ea. Driver Transistor 3.79

* JAMES AUGUST SPECIALS*

NEW KITS

TTL Logic Probe Kit \$8.95 per kit
Directs TTL levels, pulser, with man. 3 readout

THE KILOBYTE RAM CARD
Completa 1K x 8 Memory
+ 500m Access Time
*Kit includes Sockets & Board. \$61.95

DIGITAL COUNTER UNIT
4 Each - Men? Display "Digit Latches"
+ 10000 Counter "On Board Oscillator"
*Completa with board. \$29.95 Kit

DIGITAL VOLTMETER KIT
0-10 Volt, 3 1/2 Digit (Men 7) DVM
MOD. (S) Design
Size: 3" x 3" x 1 1/2" **\$39.95**

POCKET CALCULATOR KIT

5 function plus constant - addressable memory with individual recall - 8 digit display plus constant - battery

Model 701
included 3" x 4 1/2" x 1 1/2" 115VAC Transformer
5 each "A" Alkaline Batteries **\$17.95 each**
4.95 each
2.80 set

.384" DIAM. TRIMMER

STANDARD RESERVANCE VALUES

MODEL	10K	50K	100K	500K	1M
TR11	10	20	30	40	50

Model TR 11

1/16 VECTOR BOARD

WALL OF TV. DIGITAL CLOCK

12 or 24 Hour
25 VIEWING DISTANCE
W/ out Case 6" x 3" x 1"
Hr. & Min. 6" High
Second 3" High
KIT Alt Comp. & Case \$39.95
Wired & Assembled \$44.95

4' POWER SUPPLY CORDS \$1.59 ea.

Black

Thumbwheel Switches

NEW PHOTO BOARD-100

Here's a low cost, big 100 IC capacity OTS board that will allow you to do all your prototyping and complete down to the board area - and screw. Includes light, nut, bolt and screw. Includes 2 DT 355 Sockets, 1 DT 388 Bus Strip, 1 DT 355 Socket, and every routing instructions.

COMPLETE KIT... \$19.95

7400N TTL

SN7400N	16	SN74151N	125
SN7401N	21	SN74152N	135
SN7402N	21	SN74153N	121
SN7403N	41	SN74154N	121
SN7404N	16	SN74155N	121
SN7405N	16	SN74156N	130
SN7406N	45	SN74160N	175
SN7408N	45	SN74161N	145
SN7409N	25	SN74163N	185
SN7410N	40	SN74164N	185
SN7412N	45	SN74165N	175
SN7413N	45	SN74166N	175
SN7414N	30	SN74167N	175
SN7415N	70	SN74168N	175
SN7416N	35	SN74169N	175
SN7417N	42	SN74170N	180
SN7418N	43	SN74171N	180
SN7419N	43	SN74172N	180
SN7420N	21	SN74173N	195
SN7421N	39	SN74174N	90
SN7422N	37	SN74175N	90
SN7423N	37	SN74176N	90
SN7424N	31	SN74177N	90
SN7425N	31	SN74178N	90
SN7426N	37	SN74179N	90
SN7427N	32	SN74180N	90
SN7428N	28	SN74181N	90
SN7429N	41	SN74182N	95
SN7430N	41	SN74183N	230
SN7431N	41	SN74184N	230
SN7432N	41	SN74185N	230
SN7433N	41	SN74186N	230
SN7434N	41	SN74187N	230
SN7435N	41	SN74188N	230
SN7436N	41	SN74189N	230
SN7437N	41	SN74190N	230
SN7438A	25	SN74191N	230
SN7439A	21	SN74192N	150
SN7440N	10	SN74193N	140
SN7441N	10	SN74194N	145
SN7442N	10	SN74195N	135
SN7443N	105	SN74196N	100
SN7444N	10	SN74197N	100
SN7445N	110	SN74198N	225
SN7446N	115	SN74199N	225
SN7447N	98	SN74200N	200
SN7448N	98	SN74201N	200
SN7449N	98	SN74202N	200
SN7450N	98	SN74203N	200
SN7451N	98	SN74204N	600
SN7452N	98	SN74205N	600
SN7453N	98	SN74206N	600
SN7454N	98	SN74207N	600
SN7455N	98	SN74208N	600
SN7456N	98	SN74209N	600
SN7457N	98	SN74210N	600
SN7458N	98	SN74211N	600
SN7459N	98	SN74212N	750
SN7460N	98	SN74213N	750

20% Discount for 100 Combined 7400's

LOW POWER

SN74100N	33	SN74100N	80
SN74101N	33	SN74602N	60
SN74102N	33	SN74603N	65
SN74103N	33	SN74604N	65
SN74104N	33	SN74605N	65
SN74105N	33	SN74606N	65
SN74106N	33	SN74607N	65
SN74107N	33	SN74608N	65
SN74108N	33	SN74609N	65
SN74109N	33	SN74610N	65
SN74110N	33	SN74611N	65
SN74111N	33	SN74612N	65
SN74112N	33	SN74613N	65
SN74113N	33	SN74614N	65
SN74114N	33	SN74615N	65
SN74115N	33	SN74616N	65
SN74116N	33	SN74617N	65
SN74117N	33	SN74618N	65
SN74118N	33	SN74619N	65
SN74119N	33	SN74620N	65
SN74120N	33	SN74621N	65
SN74121N	33	SN74622N	65
SN74122N	33	SN74623N	65
SN74123N	33	SN74624N	65
SN74124N	33	SN74625N	65
SN74125N	33	SN74626N	65
SN74126N	33	SN74627N	65
SN74127N	33	SN74628N	65
SN74128N	33	SN74629N	65
SN74129N	33	SN74630N	65
SN74130N	33	SN74631N	65
SN74131N	33	SN74632N	65
SN74132N	33	SN74633N	65
SN74133N	33	SN74634N	65
SN74134N	33	SN74635N	65
SN74135N	33	SN74636N	65
SN74136N	33	SN74637N	65
SN74137N	33	SN74638N	65
SN74138N	33	SN74639N	65
SN74139N	33	SN74640N	65
SN74140N	33	SN74641N	65
SN74141N	33	SN74642N	65
SN74142N	33	SN74643N	65
SN74143N	33	SN74644N	65
SN74144N	33	SN74645N	65
SN74145N	33	SN74646N	65
SN74146N	33	SN74647N	65
SN74147N	33	SN74648N	65
SN74148N	33	SN74649N	65
SN74149N	33	SN74650N	65
SN74150N	33	SN74651N	65
SN74151N	33	SN74652N	65
SN74152N	33	SN74653N	65
SN74153N	33	SN74654N	65
SN74154N	33	SN74655N	65
SN74155N	33	SN74656N	65
SN74156N	33	SN74657N	65
SN74157N	33	SN74658N	65
SN74158N	33	SN74659N	65
SN74159N	33	SN74660N	65
SN74160N	33	SN74661N	65
SN74161N	33	SN74662N	65
SN74162N	33	SN74663N	65
SN74163N	33	SN74664N	65
SN74164N	33	SN74665N	65
SN74165N	33	SN74666N	65
SN74166N	33	SN74667N	65
SN74167N	33	SN74668N	65
SN74168N	33	SN74669N	65
SN74169N	33	SN74670N	65
SN74170N	33	SN74671N	65
SN74171N	33	SN74672N	65
SN74172N	33	SN74673N	65
SN74173N	33	SN74674N	65
SN74174N	33	SN74675N	65
SN74175N	33	SN74676N	65
SN74176N	33	SN74677N	65
SN74177N	33	SN74678N	65
SN74178N	33	SN74679N	65
SN74179N	33	SN74680N	65
SN74180N	33	SN74681N	65
SN74181N	33	SN74682N	65
SN74182N	33	SN74683N	65
SN74183N	33	SN74684N	65
SN74184N	33	SN74685N	65
SN74185N	33	SN74686N	65
SN74186N	33	SN74687N	65
SN74187N	33	SN74688N	65
SN74188N	33	SN74689N	65
SN74189N	33	SN74690N	65
SN74190N	33	SN74691N	65
SN74191N	33	SN74692N	65
SN74192N	33	SN74693N	65
SN74193N	33	SN74694N	65
SN74194N	33	SN74695N	65
SN74195N	33	SN74696N	65
SN74196N	33	SN74697N	65
SN74197N	33	SN74698N	65
SN74198N	33	SN74699N	65
SN74199N	33	SN74700N	65

NEW PHOTO BOARD-100

Here's a low cost, big 100 IC capacity OTS board that will allow you to do all your prototyping and complete down to the board area - and screw. Includes light, nut, bolt and screw. Includes 2 DT 355 Sockets, 1 DT 388 Bus Strip, 1 DT 355 Socket, and every routing instructions.

COMPLETE KIT... \$19.95

CD4000	29	CMOS	74C10N	65	74C20N	65
CD4001	26		74C02N	65	74C04N	65
CD4002	29		CD4030	65	74C42N	2.15
CD4006	25.0		CD4035	1.85	74C73N	1.50
CD4007	29		CD4040	2.45	74C74	1.15
CD4008	58		CD4042	1.90	74C90N	3.00
CD4010	59		CD4044	1.50	74C95N	2.00
CD4011	29		CD4045	2.51	74C107N	1.25
CD4012	29		CD4047	2.75	74C151	2.90
CD4013	53		CD4049	.79	74C154	3.00
CD4016	65		CD4050	.79	74C157	2.15
CD4017	1.35		CD4051	2.58	74C160	3.25
CD4018	69		CD4052	2.89	74C161	3.75
CD4022	1.89		CD4060	3.25	74C163	3.00
CD4022	1.25		CD4066	1.75	74C164	3.25
CD4023	29		CD4069	4.5	74C173	2.60
CD4024	1.50		CD4071	.45	74C183	2.75
CD4025	34		CD4081	45	74C195	2.75
CD4027	85		74C000N	39	80C37	1.50
CD4028	1.65		74C02N	55		
CD4028	2.60		74C04N	75		

LM100H	15.00	LINEAR	LM1310N	2.95	LM1414N	1.75
LM1061	1.50		LM1313N	3.25	LM1458C	65
LM1371H	3.75		LM1308C	1.05	LM1496N	95
LM1217H	7.00		LM1301N	1.79	LM1556V	1.85
LM300A	80		LM1322N	1.95	LM1921N	1.95
LM301H	3.100		LM1382N	1.79	LM2901N	2.95
LM3020	75		LM1382N	1.79	LM3065FN	60
LM304H	1.00		NE501K	8.00	LM3900N	55
LM305H	95		NE510A	6.00	LM3905FN	60
LM307CN	35		NE531H	3.00	LM5556N	1.85
LM308H	1.00		NE536T	6.00	MC5558V	1.00
LM309CA	1.00		NE540L	1.00	LM7525N	90
LM309H	1.10		NE550N	.79	LM7528N	2.20
LM309K	1.25		NE553	2.50	LM7534N	2.20
LM310CN	1.15		NE555V	.75	LM7535N	1.25
LM3114	90		NE569H	1.25	80380	4.95
LM3119N	50		NE559N	1.95	0M75450	49
LM316CN	1.50		NE569CN	1.85	75451CN	38
LM319N	1.30		NE561N	1.26	75452CN	39
LM319D	9.00		NE567V	1.85	75453CN	39
LM320K	5.135		LM703CN	45	75454CN	39
LM320K 5.2	3.35		LM705N	79	75491CN	29
LM320K 12	1.75		LM708N	79	75492CN	68
LM320K 15	1.35		LM710N	79	75494CN	89
LM322K 5	14.00		LM711N	29		
LM324N	1.80		LM723N	55	RCA LINEAR	
LM339N	1.70		LM723H	55	CA3013	1.70
LM340A 5	1.95		LM734H	1.00	CA3023	2.15
LM340K 12	1.95		LM739N	1.29	CA3035	2.25
LM340K 15	1.95		LM741CN	3.100	CA3039	1.35
LM340K 24	1.95		LM741CN 3.1	0.00	CA3046	1.15
LM340n 5	1.75		LM741 14N	39	CA3059	2.40
LM340To 6	1.75		LM747H	79	CA3060	2.80
LM340 12	1.75		CA3080	95	CA3080	85
LM340to 15	1.75		LM748N	39	CA3083	1.60
LM340to 24	1.75		LM748N	39	CA3086	.59
LM350N	1.00		LM1303N	90	CA3089	3.25
LM351CN	65		LM1304N	1.18	CA3091	8.25
LM370N	1.15		LM1309N	1.40	CA3123	1.85
LM370H	1.15		LM1301N	85	CA3500	1.75


8000 SERIES			
R091	56	8552	2.49
R092	59	8554	2.49
R095	1.39	8230	2.59
R121	89	8263	7.00
R123	1.59	8267	4.00
8130	2.19	8280	7.59
8200	1.59	8281	8.5
8210	2.49	8288	1.15
8214	1.69	8290	1.79
8220	1.69	8551	1.65
8552		8830	2.59
		8836	2.59
		8820	2.00
		8826	3.00
		8836	2.59
		8837	2.59
		8880	2.00

DISPLAY LEDS

CA	Common Anode	CC	Common Cathode
MAN 1	Com Ana	270	\$1.95
MAN 3	Com Cath	125	.95
MAN 4	Com Cath	187	1.95
MAN 7	Com Ana	30	1.50
DL 33	Com Cath	125	1.58
DL 747	Com Ana	625	2.50

DISCRETE LEDS

MV 10	Red	5:1-100
MV 50	Red	6:1-100
MV 5024	Red	5:1-100
MV 5024	Green	4:1-100
MV 5024	Yellow	4:1-100
MV 5024	Orange	4:1-100



IC SOLDERTAIL - LOW PROFILE (TIN) SOCKETS

	1.24	25.49	50.100	1.24	25.49	50.100
8 pin	\$ 18	18	17	24 pin	\$ 68	62
14 pin	23	22	21	28 pin	89	81
16 pin	27	26	24	36 pin	1.10	99
18 pin	46	41	37	40 pin	1.25	1.13
22 pin	65	59	53			

SOLDERTAIL STANDARD (TIN)

14 pin	\$ 30	28	26	28 pin	\$ 99	90	81
16 pin	33	31	29	36 pin	1.38	1.28	1.15
18 pin	42	39	37	40 pin	1.59	1.45	1.30
	58	54	49				

SOLDERTAIL STANDARD (GOLD)

8 pin	\$ 30	27	24	24 pin	\$ 70	63	57
14 pin	35	32	29	28 pin	1.10	1.00	90
16 pin	38	35	32	36 pin	1.55	1.40	1.26
18 pin	57	47	43	40 pin	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL 3

10 pin	\$ 45	41	37	24 pin	\$1.05	95	86
14 pin	48	45	38	28 pin	1.40	1.25	1.10
16 pin	55	50	45	36 pin	1.59	1.45	1.30
18 pin	75	68	62	40 pin	1.75	1.55	1.40

50 PCS. RESISTOR ASSORTMENTS \$1.75 PER ASS'T.

ASS'T. 1	5 wtr	10 OHM 12 OHM 15 OHM 18 OHM 22 OHM 27 OHM 33 OHM 39 OHM 47 OHM 56 OHM	1/4 WATT 5% - 50 PCS.
ASS'T. 2	5 wtr	68 OHM 82 OHM 100 OHM 120 OHM 150 OHM 180 OHM 220 OHM 270 OHM 330 OHM 390 OHM	1/4 WATT 5% - 50 PCS.
ASS'T. 3	5 wtr	1.2K 1.5K 1.8K 2.2K 2.7K 3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	1/4 WATT 5% - 50 PCS.
ASS'T. 4	5 wtr	8.2K 10K 12K 15K 18K 22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	1/4 WATT 5% - 50 PCS.
ASS'T. 5	5 wtr	150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	1/4 WATT 5% - 50 PCS.
ASS'T. 6	5 wtr	1M 1.2M 1.5M 1.8M 2.2M 2.7M	1/4 WATT 5% - 50 PCS.

Satisfaction Guaranteed. \$5.00 Min. Order. U.S. Funds. California Residents - Add 6% Sales Tax. Write for FREE 1975S Catalog - Data Sheets .25¢ each

JAMES
P.O. BOX 822, BELMONT, CA. 94002
PHONE ORDERS - (415) 592-8097

Special Requested Items

8008 Processor	\$29.95	8267	\$ 4.00	4034P*	\$2.25
1101 256 x 1 RAM	2.25	2513*	1.00	N8797	3.00
2102 1024 RAM	5.50	2518	7.00	MC1741	4.00
AYS1101 UART	9.95	2519	4.00	MC4044	4.50
RC1194 TK	5.95	2524*	3.50	CA3130S	1.49
8101	18.00	2525	1.00	4012	1.75
8263	7.00	2523	11.85	40673	1.75

DIODES

(Zener)		TYPE		PRICE		VOLTS		W		PRICE	
IN746	3.3	400m	4:1-100	IN4003	200 PIV	1 AMP	10				
IN751A	5.1	400m	4:1-100	IN4004	400 PIV	1 AMP	10				
IN752	5.6	400m	4:1-100	IN4050	50	200mA	6/1-100				
IN753	5.2	400m	4:1-100	IN4148	75	10m	15/1-100				
IN754	6.8	400m	4:1-100	IN4154	35	10m	12/1-100				
IN9585	15	400m	4:1-100	IN4734	5.6	1w	28				
IN5232	5.6	500m	28	IN4735	6.2	1w	28				
IN5234	6.2	500m	28	IN4736	6.8	1w	28				
IN5235	6.8	500m	28	IN4742	1.2	1w	28				
IN5236	7.5	500m	28	IN4748	12	1w	28				
IN4552	25	40m	6/1-100	IN4744	15	1w	28				
IN4558	150	7m	6/1-100	IN1183	50	1W	35 AMP	1.60			
IN4654	180	10m	5/1-100	IN1184	100	1W	35 AMP	1.70			
IN4001	50 PIV	1 AMP	10	IN1185	200 PIV	35 AMP	1.80				
IN4002	100 PIV	1 AMP	10	IN1188	400	35 AMP	3.00				

TRANSISTORS

MP3-A05	5 S1	2N3905	4 S1
2N918	25	2N2906A	4 S1
2N219A	5 S1	2N2907A	4 S1
2N2222	4 S1	2N3503	4 S1
2N2222A	6 S1	2N3055	5 S1
2N3369	5 S1	2N3725A	2 S1
2N3269A	4 S1	2N3303	5 S1
2N2484	4 S1	2N3304	4 S1
		2N3906	4 S1
		2N3905	4 S1
		PN4250	4 S1
		PN4250	4 S1
		2N4040	5 S1
		2N5129	19
		2N5139	18
		1C1661 SCR	2 S1

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

10pf	1.9	1049	50.100		0.9	1049	50.100
22 pf	05	04	03	001	05	04	0305
47 pf	05	04	03	0047	05	04	0510
100 pf	05	04	03	01	05	04	0335
220 pf	05	04	03	022	08	05	04
470 pf	05	04	035	047	05	04	05

100 VOLT MYLAR FILM CAPACITORS

.001mf	12	10	07	022mf	13	11	08
.0022	12	10	07	847mf	21	17	13
.0047mf	12	10	07	1m	27	23	17
.01mf	12						

WE'RE STILL "THE FM PEOPLE" BUT . . .

IN ORDER TO HELP YOU FILL ALL YOUR AMATEUR NEEDS WE'VE JUST ADDED THE QUALITY, DRAKE LINE OF AMATEUR PRODUCTS. INCLUDING:

THE FABULOUS "C" LINE



R4C



T4XC



MS4/AC4



TR4C

PLUS FOR FM



TR22C



TR72

FOR US THIS IS A BIG STEP . . . AND WE'RE TAKING IT SERIOUSLY. OUR STAFF CAN OFFER YOU OVER 25 YEARS OF H.F. EXPERIENCE INCLUDING DXCC, WAZ, CONTESTS AND WHAT HAVE YOU. WE ALSO STOCK ANTENNAS BY HYGAIN AND HUSTLER TO COMPLETE YOUR STATION NEEDS.

AS ALWAYS WE WILL CONTINUE TO OFFER YOU THE BEST IN FM WHETHER IT BE USED MOTOROLA RADIOS AND PARTS OR ANY OF 38 QUALITY BRAND NAMES IN STOCK. SO WHATEVER YOUR NEEDS BE, GIVE US A CALL OR WRITE . . . YOU'LL BE GLAD YOU DID.

TERMS OF SALE: Sales to licensed Radio Amateurs for use on Amateur freqs only. All prices FOB Oak Park, IL. Check with order, COD or you can charge to your BankAmericard or Master Charge.

STORE HOURS: Mon.-Thurs. 9:30-6:00, Fri. 9:30-8:00, Sat. 9:30-3:00. Closed Sun. & Holidays
INQUIRIES WITHOUT ZIP CODE OR CALL . . . NO ANSWER

WANTED: Good used FM & test equipment. No quantity too large or small. Finders fees too.



SPECTRONICS INC.

1009 GARFIELD STREET
OAK PARK, ILL. 60304
(312) 848-6778

AMATEUR SALES ONLY / SPECTRONICS



NEW

FROM

TECO

TRI Model 6355 Digital Multimeter \$279

TRI Model 5163 250 MHz Frequency Counter \$295



MODEL 6355



MODEL 5163

High resolution $10\mu\text{V}$
on DCV/High accuracy
0.15% of rdg.

5 functions in one —
DCV, ACV, OHM, DCI,
ACI.

Fully automatic for
ease of operations
Truly portable — Free
from power cord.

Common input for all
measurements.

Safety design protects
from high voltage.

NEW!

\$279

*** 250 MHz**

25mV sensitivity
8 digits/LED

NEW!

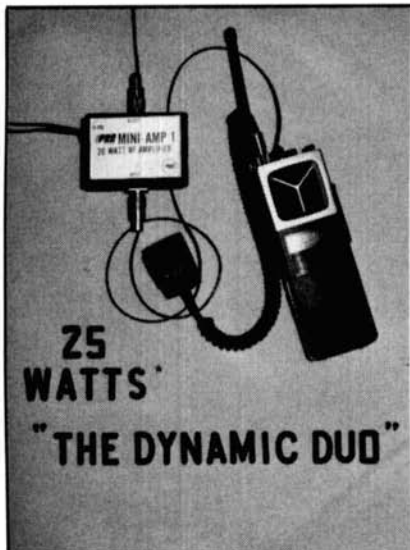
\$295

**NOW AVAILABLE FROM TECO!
CALL OR WRITE FOR COMPLETE SPECIFICATIONS**

 **TECO**

P. O. Box 1050 • Garland, Texas 75040

TOLL-FREE CALL
800-527-4642
(In Texas call collect 214-348-8800)



**25
WATTS***
"THE DYNAMIC DUO"

WELCOME TO THE WORLD OF VHF VERSATILITY!

The MINI-AMP I expands the versatility of your handi talki or low-power rig to equal that of a good mobile/base rig. Look at the advantages this kit offers:

1. Low cost/watt — **\$49.95** plus postage (12 oz.)
2. Interfaces with any rig from 100mW to 3 watts+
3. Can be used on motorcycles, in boats, planes, cars, campers, or anyplace where 12 volts DC is available.
4. Super compact — only 3" x 4" x 2".
5. Light weight — only 12 oz. Easily concealed in car or boat to reduce the possibility of theft.

If you are constantly worried about your mobile rig being stolen, conceal our Mini-Amp I under your dash, seat, etc. and use your handi-talki for maximum portability and security.

These are just some of the reasons that we feel our Mini-Amp I is the most practical and versatile amplifier on the market. For answers to any further questions, you may call our toll free number, 800-453-5717. I will be happy to help you.

Terrell F. Bird
WA7VRM

PRA
INDUSTRIES

COMMUNICATIONS
DIVISION

2285 SOUTH MAIN ST., SUITE 1
SALT LAKE CITY, UTAH 84115



20 WATTS/12VDC
25 WATTS/13.5VDC

P. S. Watch for 100 Watt amplifier coming soon.

ATLAS 210

for 10, 15, 20, 40 and 80 METERS AND THE COMPANION
MODEL 215 FOR 15 through 160 METERS.



Measuring only 0.18 cu. ft. and weighing less than 7 pounds, the Atlas 210/215 Solid State Single Sideband Transceiver is a real GIANT KILLER. It packs a hefty 200 watts P.E.P., offers 5 band coverage, and unprecedented selectivity (only 9200 cycles at 120 db down).

Priced at just \$599, it's the best transceiver value on the market today.



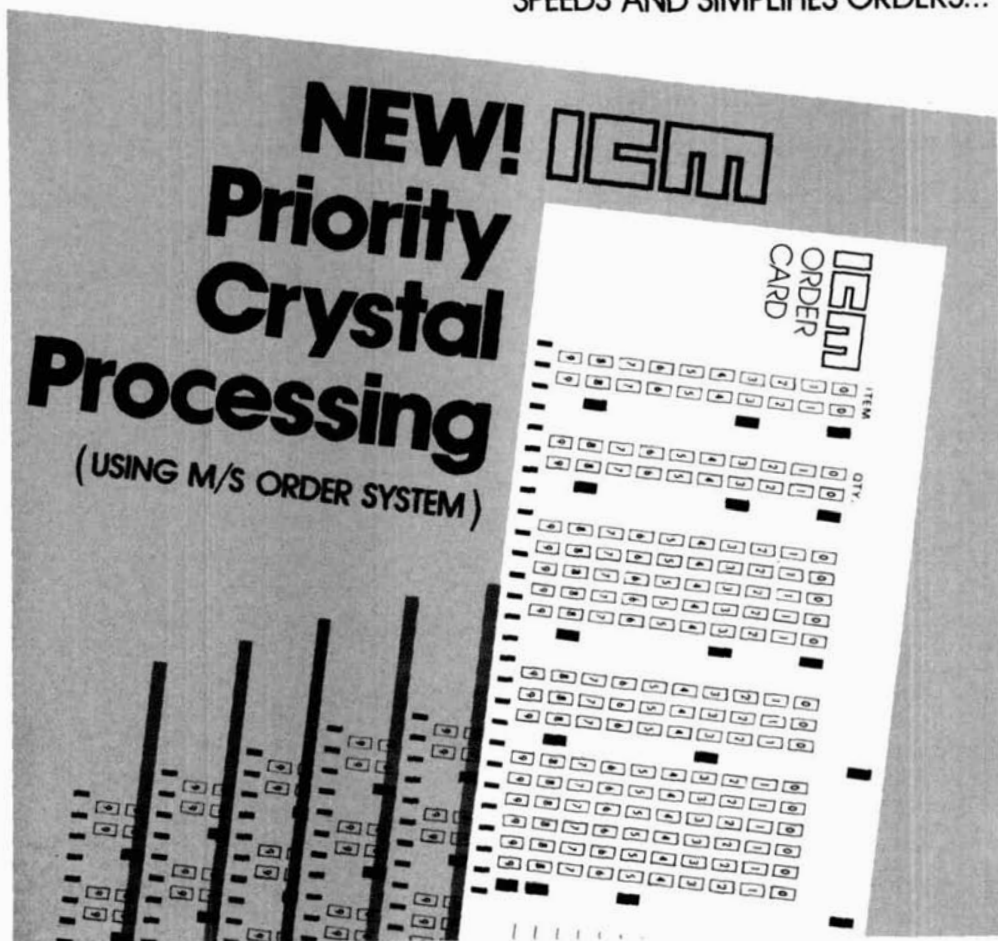
ATLAS
RADIO INC.

417 Via Del Monte Oceanside, CA 92054
Phone (714) 433-1983

Our new priority crystal processing, using a mark sensing order system, is designed to expedite orders for International Crystals and EX Kits. It's another effort to improve our order processing and make a proven reliable system even better. Your order in the future will be processed by using mark sensing order cards and prepunched name and address cards. Complete and return the coupon and we will mail you a special kit containing instructions, order cards and a prepunched name and address card. This is the first step in our new "no delay" order processing.

For International Crystals, EX Oscillators and Amplifiers

SPEEDS AND SIMPLIFIES ORDERS...



INTERNATIONAL CRYSTAL MFG. CO., INC.
EX Dept., P.O. Box 32497, Oklahoma City, Ok. 73132

Send Special Kit to . . .

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Wilson Electronics Corp.

ANNOUNCES ITS

NEWEST EDITION

WILSON 1405SM HAND HELD 5 WATT FM TRANSCEIVER

- * NEW SLIMLINE UNBREAKABLE LEXAN® CASE
- * SWITCHABLE 1 or 5 WATT OUTPUT
- * EXTERNAL EARPHONE MIC JACK
- * EXTERNAL POWER JACK

* FACTORY DIRECT AUGUST SALE INCLUDES:

Rubber Flex Antenna, NiCad Batteries, Leather Case, 52/52 Crystals, Plus Your Choice of 2 Extra Pairs of Common Frequency Crystals. Extra Common Pairs, \$9.00 pr.

\$390 VALUE ALL FOR JUST **\$269⁹⁵**

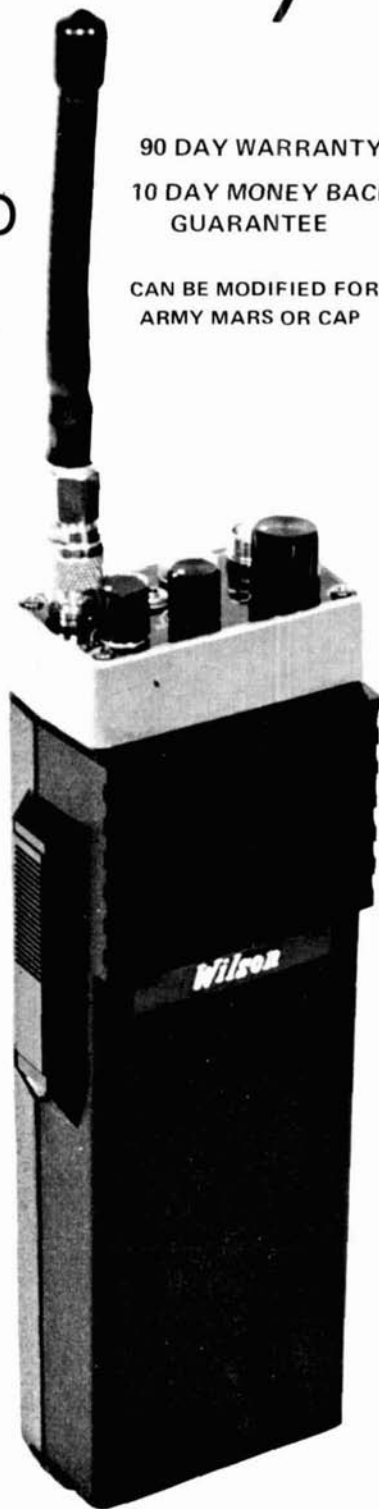
- 6 Channel Operation, Individual Trimmers on all TX and RX Xtals. All Xtals Plug In.
- 5 Meter Battery Indicator.
- 10.7 IF and 455 KC IF. 12 KHz Ceramic Filter.
- .3 Microvolt Sensitivity For 20dB QT.
- 5 Watts Nominal Output 12 VDC.
- Microswitch Mike Button.
- Size 8-7/8 x 1-3/4 x 2-7/8 Inches.
- Weight 1 lb. 4 ounces, Less Battery.
- Current Drain RX 14MA TX 800 MA.

ACCESSORIES:

- SM2 Speaker Mike \$24.00
- BC2 Battery Charger \$29.95
- XF-1 10.7 MHz monolithic IF filter (installed) \$10.00
- TE-1 Continuous Sub-Audible Tone Encoder (installed) \$39.95

90 DAY WARRANTY
10 DAY MONEY BACK
GUARANTEE

CAN BE MODIFIED FOR
ARMY MARS OR CAP



To: *Wilson Electronics Corp.*
P.O. Box 794
Henderson, Nevada 89015
(702) 451-5791

Ship _____ 1405 August Packages

Plus SM2 BC2 XF-1 TE-1

Enclosed is \$ _____ Check Money Order

Master Charge Bank Americard

Expiration Date _____ M/C Interbank # _____

Card # _____

Xtals _____

Name _____

Address _____

City and State _____ Zip _____

Signature _____

All orders will be shipped Parcel Post within 48 hours after receipt of order (excluding weekends). Enclose additional \$4.00 for prepaid shipping & handling. Nevada residents add sales tax. Sale ends August 31, 1975.

Wilson Electronics Corp.

FACTORY DIRECT

SPECIAL AUGUST SALE!!!

WILSON 1402SM HAND HELD 2.5 WATT FM TRANSCEIVER

*Rubber Flex Antenna

*Complete Set NiCad Batteries

*Leather Case

*Three Sets of Crystals, 52-52,

Plus Your Choice of 2 Pair of Common Frequencies
Extra Crystals, \$4.50 ea., Common Frequencies Only

\$320 VALUE ALL FOR JUST **\$199⁹⁵**

- 6 Channel Operation, Individual Trimmers
On All TX and RX Xtals. All Xtals Plug In.
- S Meter Battery Indicator.
- 10.7 IF and 455 KC IF. 12 KHz Ceramic Filter.
- .3 Microvolt Sensitivity For 20dB QT.
- 2.5 Watts. Nominal Output 12 VDC.
- Microswitch Mike Button.
- Size 8-7/8 x 1-7/8 x 2-7/8 Inches.
- Weight 1 lb. 4 ounces. Less Battery.
- Current Drain RX 14MA TX 450 MA.

ACCESSORIES:

SM1 Speaker Mike \$24.00

BC1 Battery Charger \$29.95

1410A Amplifier Mobile Mount \$99.00

XF-1 10.7 MHz monolithic IF filter (installed) \$10.00

TE-1 Continuous sub-audible tone encoder (installed) \$39.95

COMING
SOON !!!
220 & 420 MHz
HAND HELD
TRANSCEIVERS



90 DAY
WARRANTY

10 DAY MONEY BACK GUARANTEE
CAN BE MODIFIED
FOR ARMY MARS OR CAP

To: Wilson Electronics Corp.
P.O. Box 794
Henderson, Nevada 89015
(702) 451-5791

Ship _____ 1402 August Packages

Plus SM1 1410A BC1 XF-1 TE-1

Enclosed is \$ _____ Check Money Order

Master Charge Bank Americard

Expiration Date _____ M/C Interbank # _____

Card # _____

Xtals _____

Name _____

Address _____

City and State _____ Zip _____

Signature _____

All orders will be shipped Parcel Post within 48 hours after receipt of order (excluding weekends). Enclose additional \$4.00 for prepaid shipping & handling. Nevada residents add sales tax. Sale ends August 31, 1975.

2 Rigs in one!

Comcraft's **NEW** VHF Two-Band Transceiver for 2 and 1¼ meters with Digital Frequency Synthesis



Model CST-50

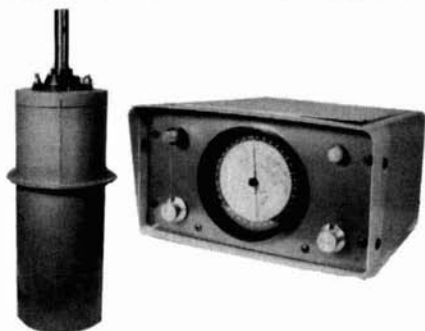
The new CST-50 Two-Band Transceiver provides coverage of two complete amateur bands with all the features needed by most operators. Imagine! The two most popular VHF bands in one rig with Phase Locked Loop frequency synthesis. In the CST-50 all frequencies are generated digitally by reference to one highly accurate and easily adjustable crystal. As soon as a new repeater is on you can use it, no waiting for crystals. Write for further information.

- Covers entire 2 meter and 1¼ meter bands
- Covers MARS, CAP and CD frequencies from 142 to 149.995 MHz
- Full digital frequency synthesis with 5 kHz steps
- Lighted thumbwheels for night mobile operation
- No crystals to buy — ever
- Built-in repeater offsets of 600 kHz, 1 MHz and 1.6 MHz
- 25 watts output on each band
- No transmitter retuning across either band
- FM-AM receiver
- 8 pole crystal filter
- Front mounted speaker
- PTT microphone and mobile mount included
- Operates on 12 volts DC
- AC supply available
- Accessory connector for tone burst and tone coded squelch

CST-50 two-band transceiver \$869.95
CPS-6 AC power supply \$139.95



MADE IN USA by
COMCRAFT
P.O. BOX 266, GOLETA, CA 93017



OLD OLD OLD
RELIABLE RELIABLE RELIABLE
\$425.00 RX 1 ROTATOR \$425.00

10 YEARS OF PROVEN SERVICE. THE HEAVY DUTY ROTATOR THAT WILL TURN ANY BEAM ARRAY YOU WANT TO INSTALL. CONTROL BOX TO MATCH S LINE. 115VAC SELSYN IND. 380 DEGREES ROTATION. LIMIT SWITCH UNIT IS 9½" DIA. 28" IN HEIGHT.



Designed Built Backed
by ANTENNA MART
Box 7, Rippey, Iowa 50235

S A R O C

Amateur Radio's
Prestige Convention
Hotel Sahara
Las Vegas
Special Air Fares
from selected cities

SAROC
Box 945
89005

JANUARY 8-11, 1976

NEW NEW NEW!!

TOUCH TONE ENCODERS

SOLID STATE CRYSTAL CONTROL TONE ENCODERS

- 12 or 16 Touch Tone digits
- Ideal for hand held units
- Choice of 4 keyboard styles
- RF proof
- Temperature, -20° to 150°F
- CMOS IC Encoder

- Bell System Compatibility
- Easy Installation
- Sub-miniature size
- Crystal Controlled
- Single Tone capability
- Low cost



Style A



Style B



Style C



Style D

SELF-CONTAINED KEYBOARD ENCODERS

Complete 12 or 16 digit Touch Tone keyboard encoders for mounting directly to side of hand-held transceivers. All electronics included WITHIN keyboard, nothing to add inside of transceiver. Only 1/4" thick. Ready for easy installation, just add three connections to unit. RF proof. Select keyboard style when ordering.

DTM \$49.50

SUB-MINIATURE TOUCH TONE ENCODER AND KEYBOARD

Touch-Tone encoder for mounting INSIDE hand-held transceiver, keyboard mounts on side of transceiver. P.C. board only 0.8" x 1.2". RF proofed. Assembled and ready for easy installation. Select keyboard style when ordering.

SME \$29.50

DO IT YOURSELF ENCODERS

Now, buy all the major parts — "ala-carte" and build your own Touch Tone Encoder. All you need is a Keyboard, Digital Touch Tone Encoder, a 1-MHz crystal, and P.C. board. Parts come with complete set of application notes, schematics and instructions.

Keyboard, your choice of keyboard style \$8.50

Digital T. T. Encoder with 1-MHz HC-6 Crystal \$12.50

Digital T. T. Encoder with 1-MHz Slim HC-6 Crystal \$13.50

P.C. board 0.8" x 1.2" \$2.50

All resistors, capacitors, and P.C. board FREE

(With purchase of keyboard, encoder and crystal)

AUTOMATIC TOUCH TONE DIALER

Automatic mobile telephone dialing is now available. By the push of a single button you can automatically dial up to six separate 7-digit numbers. All solid-state micro-power CMOS design. Automatic PTT operation. Programmable to send telephone number only, access code plus telephone number or telephone number plus an identification number. Low profile dash mount, easy installation. Compatible with most radio equipment. Available with keyboard for manual dialing of numbers. Manual operation provides automatic PTT operation with 1/2 second transmitter hold.



AD-6 Without keyboard 99.50

AMD-6 With keyboard 119.50

Factory programming of numbers \$7.50.

ORDER TODAY — SEND FOR FREE NEW CATALOG

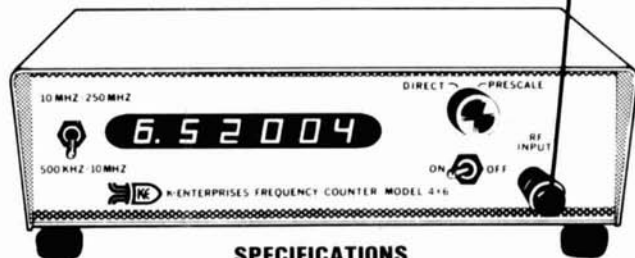
DATA SIGNAL, INC.

Successor to Data Engineering, Inc.

2212 PALMYRA ROAD, ALBANY, GA. 31701

912-435-1764





SPECIFICATIONS

Frequency Range	500 KHz—250 Mhz
Sensitivity	Less than 80 mV at 150 Mhz
Input Z...(500 KHz to 10 Mhz)	1 Meg.
Input Z...(10 Mhz to 250 Mhz)	50 ohms
Max. Input Voltage	15 V rms, 50 V dc
Time Base	Crystal Clock plus-minus 10 ppm 0°C to 40°C ambient
Readout	6 Digit 7 Segment LED
Power	120 V ac
Dimensions	2 1/4" H, 10" L, 7" D
Cabinet	Light Blue

Model 4x6 250 Mhz FREQUENCY COUNTER

250 Mhz for \$1.00 per Mhz
Wired and Tested

\$250

Price FOB Shawnee, Okla.

Include \$2.50 for Postage
& Insurance

Model 4x6-C Wired &
Tested with Temperature
Compensated Oscillator &
Temperature Certification
furnished with coun-
ter....\$270.00.



Phone:
405-273-9024



K-ENTERPRISES 1401 E. Highland • Shawnee, Okla. 74801

An Almost Perfect Package

NEW! Deluxe PORTA-PAK

Attaches Easily
No Holes To Drill

Attractive But Tough

Operates In Any Position

Comes With AC Charger

\$59.95

WRAP A PORTA-PAK AROUND YOUR MOBILE RADIO AND YOU HAVE A POTENT PORTABLE THAT OPERATES FOR DAYS BETWEEN CHARGINGS. IN STOCK FOR IMMEDIATE SHIPMENT. MODELS TO FIT ALL POPULAR FM TRANS-CIVERS. SEE YOUR LOCAL DEALER OR DROP "CORK" A LINE AT

PORTA-PAK

P. O. BOX 67
SOMERS, WISCONSIN 53171

Dealer inquiries invited



the BIG ONE!

NEW IMPROVED

INSTANT-WELD Adhesive

Now a choice of 5
formulas . . . and in Big
1900 drop application
container.

SAVE BIG only \$8.95

(less than 1/2¢ an application)

ORDER FROM
YOUR ONEIDA DISTRIBUTOR
OR DIRECT FROM US.



ONEIDA ELECTRONIC MFG. INC.
P.O. Box 678 — Dept. 761-D
Meadville, Pa. 16335

Many hams say...

The only thing better than the Drake 4-Line is the Drake C-Line

- 1 kHz Dual Concentric Dial Readout
- Receiver and transmitter lock together in transceive operation
- No side controls
- Iridited cadmium-plated chassis
- Compatible with all previous Drake lines



R-4C Receiver

R-4C FEATURES:

- 8-pole crystal filter combined with passband tuning, SSB filter supplied
- Provision for 15 additional accessory 500 kHz ranges
- Transistorized audio
- Optional high-performance noise blander
- AVC with 3 selectable time constants
- Optional 8 pole filters available for CW, AM, RTTY



T-4XC Transmitter

T-4XC FEATURES:

- Plug-in relay
- More flexible VOX operation; Including separate delay controls for phone and CW
- Crystal control from front panel for amateur, Mars, commercial uses
- Provision for AFSK RTTY operation

For complete details on the C-Line and other Drake equipment, contact:

R. L. DRAKE COMPANY



540 Richard Street, Miamisburg, Ohio 45342 • Phone (513) 866-2421 • Telex 288-017

VANGUARD NOW HAS THE WORLD'S LARGEST SELECTION OF FREQUENCY SYNTHESIZERS FROM \$129.95

*You'll never
have to buy Crystals
again!*



**AVAILABLE FOR
AIRCRAFT, FIRE, POLICE
AND AMATEUR FREQUENCIES**

**SEND NO MONEY.
WE SHIP C.O.D.
ORDER BY PHONE
AND SAVE TIME.**

*We ship open account only to U.S. and
Canadian government agencies, univer-
sities and selected AAA rated corpora-
tions.*

Check these features:

- Smallest size of any commercially available synthesizer — only 1-3/8" x 3-3/4" x 7".
- Excellent spectral purity since no mixers are used.
- .0005% (5 parts per million) accuracy over the temperature range of -10 to +60 C.
- Immune from supply line voltage fluctuations when operated from 11 to 16 volts D.C.
- Up to 8000 channels available from one unit. Frequency selected with thumbwheel switches.
- Available from 5 MHz to 169.995 MHz with up to 40 MHz tuning range and a choice of 1, 5 or 10 kHz increments (subject to certain restrictions depending on the frequency band selected).
- Top quality components used throughout and all ICs mounted in sockets for easy servicing.
- All synthesizers are supplied with connecting hardware and impedance converters or buffers that plug into your crystal socket.

Vanguard frequency synthesizers are custom programmed to your requirements in 1 day from stock units starting as low as \$129.95 for transmit synthesizers and \$139.95 for receive synthesizers. Add \$20.00 for any synthesizer for 5 kHz steps instead of 10 kHz steps and add \$10.00 for any tuning range over 10 MHz. Maximum tuning range available is 40 MHz but cannot be programmed over 159.995 MHz on transmit or 169.995 MHz on receive (except on special orders) unless the i-f is greater than 10.7 MHz and uses low side injection. Tuning range in all cases must be in decades starting with 0 (i.e. — 140.000 — 149.995 etc.). The output frequency can be matched to any crystal formula. Just give us the crystal formula (available from your instruction manual) and we'll do the rest. We may require a deposit for odd-ball formulas. On pick-up orders please call first so we can have your unit ready.

VANGUARD LABS

Call 212-468-2720 between 9:00 am and 4:00 pm
Monday through Friday
196-23 JAMAICA AVE. HOLLIS, N. Y. 11423



INTERNATIONAL MORSE DECODER

- International Morse Code IN
Parallel ASCII OUT
- Display Morse Code on Alpha Numeric Displays, TV
Typewriters, Scopewriters, Printers
- Complete Board — Wired and Tested — Not a kit
- Single 5 volt supply required
- 64 different output characters
- Dot/Dash and space timing adjustments on the board
- Speed controlled by external potentiometer
- End of word output for automatic word spacing
- Display your C.W. qso's so that others can
enjoy them
- Use as a code teaching aid
- Produce hard copy records of your C.W. contacts
- Experiment with high speed C.W. transmission
and reception

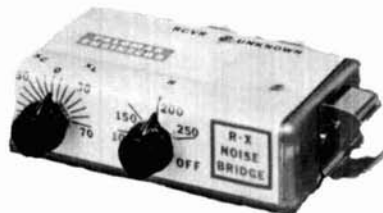
Price — \$72

plus \$1.00 postage and handling



**PIÑON
ELECTRONICS**
P. O. BOX 2192
MESA, ARIZONA 85204

R-X NOISE BRIDGE

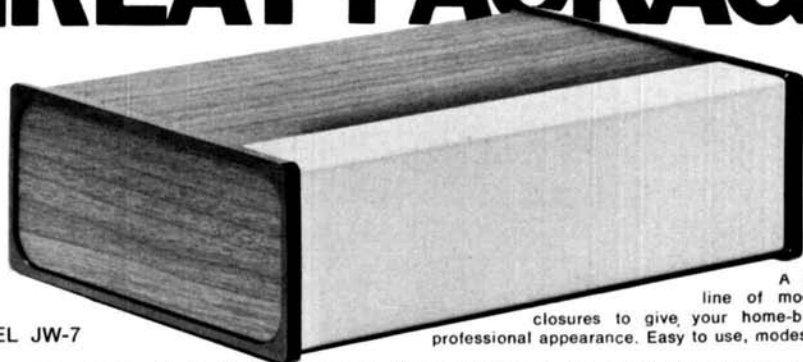


- Learn the truth about your antenna.
- Find its resonant frequency.
- Find R and X off-resonance.
- Independent R & X dials greatly simplify
tuning beams, arrays.
- Compact, lightweight, battery operated.
- Simple to use. Self contained.
- Broadband 1-100 MHz.
- Free brochure on request.
- Order direct. \$39.95 PPD U.S. & Canada
(add sales tax in Calif.)

PALOMAR ENGINEERS

BOX 455, ESCONDIDO, CA 92025

GREAT PACKAGE



MODEL JW-7

A complete line of modern enclosures to give your home-brew gear professional appearance. Easy to use, modest in cost.

SERIES "D" Series D is our largest enclosure style providing a low profile decorative case. DW types have walnut grain vinyl tops and side panel trim, and eggshell white front panels. DG models are styled in grey tops and front panels with black pebble side panels. Both have Cycolac molded side panels and .062" aluminum cases.

Model	H"	W"	D"	Weight	Price
DG-8	4-3/16	7-3/4	10-7/32	2 lb- 0 oz	\$15.50
DG-10	↓	9-3/4	↓	2 lb- 5 oz	16.50
DG-12	↓	11-3/4	↓	2 lb-12 oz	18.00
DG-14	↓	13-3/4	↓	3 lb- 0 oz	19.50
DW-8	↓	7-3/4	↓	2 lb- 0 oz	16.50
DW-10	↓	9-3/4	↓	2 lb- 5 oz	18.00
DW-12	↓	11-3/4	↓	2 lb-12 oz	20.00
DW-14	↓	13-3/4	↓	3 lb- 0 oz	23.00

SERIES "M" Series M enclosures provide styling and finishes similar to the D series, but in a somewhat shorter depth. They are also available in models down to five inches in width.

Model	H"	W"	D"	Weight	Price
MG-5	4-3/16	4-3/4	6-5/16	1 lb- 0 oz	\$ 5.50
MG-6	↓	5/3-4	↓	1 lb- 0 oz	6.50
MG-7	↓	6-3/4	↓	1 lb- 4 oz	7.75
MG-8	↓	7-13/16	↓	1 lb- 6 oz	8.75
MG-10	↓	9-15/16	↓	1 lb-11 oz	11.00
MG-12	↓	11-15/16	↓	2 lb- 0 oz	13.50
MW-5	↓	4-3/4	↓	1 lb- 0 oz	6.50
MW-6	↓	5-3/4	↓	1 lb- 2 oz	7.75
MW-7	↓	6-3/4	↓	1 lb- 4 oz	8.75
MW-8	↓	7-13/16	↓	1 lb- 6 oz	10.00
MW-10	↓	9-15/16	↓	1 lb-11 oz	12.00
MW-12	↓	11-15/16	↓	2 lb- 0 oz	14.25

SERIES "J" Series J is a low profile, decorative enclosure designed for small, fine equipment. Basic construction features and styling similar to the D and M series. Molded Cycolac side panels and .062" aluminum housing.

Model	H"	W"	D"	Weight	Price
JG-4	2-1/8	3-5/8	5-9/16	11 oz	\$ 4.25
JG-5	↓	4-11/16	↓	13 oz	5.00
JG-6	↓	5-11/16	↓	15 oz	5.75
JG-7	↓	6-11/16	↓	1 lb- 0 oz	6.50
JG-8	↓	7-3/4	↓	1 lb- 2 oz	7.25
JG-10	↓	9-7/8	↓	1 lb- 5 oz	9.25
JW-4	↓	3-5/8	↓	11 oz	5.00
JW-5	↓	4-11/16	↓	13 oz	5.75
JW-6	↓	5-11/16	↓	15 oz	6.50
JW-7	↓	6-11/16	↓	1 lb- 0 oz	7.25
JW-8	↓	7-3/4	↓	1 lb- 2 oz	8.25
JW-10	↓	9-7/8	↓	1 lb- 5 oz	10.50

SERIES "T" Series T is a new series that brings the beauty of TEN-TEC enclosures to the low priced market. Constructed of two formed .062" aluminum sections. Finished in (W) wood grain walnut vinyl and egg shell white, or (G) instrument grey and black pebble vinyl.

Model	H"	W"	D"	Weight	Price
TG-24	1-7/8	4-1/4	4-1/8	6 oz	\$2.00
TG-26	1-7/8	6-1/4	↓	8 oz	2.50
TG-34	3	4-1/4	↓	8 oz	2.50
TG-35	3	6-1/4	↓	10 oz	3.25
TW-24	1-7/8	4-1/4	↓	6 oz	2.00
TW-26	1-7/8	6-1/4	↓	8 oz	2.50
TW-34	3	4-1/4	↓	8 oz	2.50
TW-36	3	6-1/4	↓	10 oz	3.25

AVAILABLE FROM YOUR DEALER OR DIRECT

NAME _____ STREET _____
 CITY/STATE _____ ZIP _____

Estimate shipping charges at \$1.00 for each enclosure of D and M series, 50¢ each for J and T series.

QUANTITY	MODEL	UNIT PRICE	AMOUNT

Sales Tax if Applicable _____
 Shipping & Handling _____
 Total Enclosed _____

TEN-TEC
 INCORPORATED
 SEVIERVILLE, TENNESSEE 37862

CORE SIZE	IRON POWDER TOROIDS			A _L -VALUE CHART (uh per 100 turns)				SIZE OD (in)	PRICE USA
	MIX-41 u=75 .02-.1MHz	MIX-3 u=35 .05-.1MHz	MIX-2 u=10 .5-30MHz	MIX-6 u=8 10-90MHz	MIX-10 u=6 30-150MHz	MIX-12 u=3 60-200MHz			
T-200	755	360	120	105			2.00	3.25	
T-130	785	330	110	96			1.30	2.25	
T-106	900	405	135	116			1.06	1.50	
T-94	590	248	84	70	58	32	.94	1.00	
T-80	450	180	55	45	35	22	.80	.80	
T-68	420	195	57	47	32	21	.68	.65	
T-50	320	175	50	40	31	18	.50	.55	
T-37	240	110	42	30	25	15	.37	.45	
T-25	200	100	34	27	19	13	.25	.40	

Number of turns = 100 $\sqrt{\text{desired L (uh)} \div A_L\text{-value (above)}}$

IRON POWDER TOROIDS
 PROVIDE INDUCTORS WITH AN EXCELLENT 'Q' FACTOR AND GOOD STABILITY. USED FOR RF AND TUNED CIRCUITS, FILTER AND NOISE CIRCUITS, TANK CIRCUITS, IF COILS, T AND PI NETWORKS, WIDE-BAND BALUNS, OSCILLATORS, ETC. TOROIDAL INDUCTORS ARE HIGHLY SELF-SHIELDING AND ARE LITTLE AFFECTED BY STRAY MAGNETIC FIELDS. OTHER TYPES AVAILABLE.

FERRITE TOROIDS: SUITABLE FOR LOW FLUX DENSITY APPLICATIONS. MATERIALS 72 AND 75 ARE RECOMMENDED FOR THE LOW KILOHERTZ REGION, AND MATERIALS 63, 61 AND 43 FOR THE HIGHER FREQUENCIES. USEFUL FOR POWER TRANSFORMERS, PULSE TRANSFORMERS, ANTENNA LOADING COILS, NOISE FILTERS, WIDE-BAND BALUNS AND INVERTER & CONVERTER CIRCUITS.

CORE SIZE	FERRITE TOROIDS					A _L -VALUE CHART (mh per 1000 turns)		O. D. (in)	PRICE USA
	MIX-63 u=40	MIX-61 u=125	MIX-43 u=950	MIX-72 u=2000	MIX-75 u=5000				
FT-114	25.4	79.3	603.0	1268.0	3170.0		1.14	1.20	
FT-82	23.4	73.3	557.0	1172.0	2930.0		.82	.90	
FT-50	22.0	68.0	523.0	1100.0	2750.0		.50	.65	
FT-37	17.7	55.3	420.0	884.0	2210.0		.37	.55	
FT-25	7.9	24.8	189.0	396.0	990.0		.25	.45	

Number turns = 1000 $\sqrt{\text{desired L (mh)} \div A_L\text{-value (above)}}$

FERRITE BEADS: FOR RF SHIELDING, PARASITIC SUPPRESSION, SPIKE AND TRANSIENT CLIPPING, ETC. ACT AS TINY RF CHOKES WHEN SLIPPED OVER A LEAD. '101' SIZE FOR #18 WIRE; '801' SIZE FOR #12 WIRE; MATERIAL 43 MOST EFFECTIVE BETWEEN 50 MHz AND 200 MHz. MATERIAL 73 BELOW 50 MHz. AND MATERIAL 64 BEST ABOVE 200 MHz. '101' SIZE \$2.00 DOZ. '801' SIZE \$3.00 DOZ.

SPECIFY CORE SIZE AND MIX PRICES APPLY IN USA ONLY
 PACK & SHIP ----- 50¢ (USA)
 CALIFORNIANS - 6% SALES TAX.
 NO MINIMUM ORDER
 WRITE FOR FREE FLYER.

AMIDON USA

AMIDON ASSOCIATES
 12033 OTSEGO STREET
 N. HOLLYWOOD, CAL. 91607

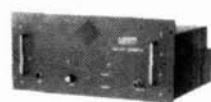
AMIDON EUROPE

AMATEUR RADIO IMPORT/EXPORT
 E. RUSCHMANN - Im HELDENRECHT 9
 D-76 OFFENBURG, WEST GERMANY

AMIDON ORIENT

TOYOMURA ELECTRONICS CO. LTD.
 2-7-9 SOTO-KANDA
 CHIYODA-KU, TOKYO, JAPAN.

DYCOMM for RF POWER



ECHO III REPEATER



MODEL 34 WATTMETER



A4950



A8949

A COMPLETE LINE OF FM AMPLIFIERS
 model - power output - gain - price

6 METER FM

A4950 - 50W - 10db - \$183.

A4960 - 50W - 8db - \$192.

A8949 - 100W - 10db - \$270.

450 - UHF

MODEL 25 - 30W - 7db - \$167.

MODEL 30 - 30W - 9db - \$194.

MODEL 50 - 50W - 5db - \$251.

OTHER PRODUCTS

ECHO III FM REPEATER - \$949

MODEL 34 WATTMETER - \$70.

2 METER FM

MODEL C - 25W - 4db - \$69.

MODEL D - 50W - 7db - \$99.

SUPER D KIT - 80W - 3.5db - \$60

MODEL DS - 80W - 3.5db - \$139

MODEL E - 35W - 10db - \$80.

SUPER E KIT - 40W - 11db - \$60

MODEL ES - 40W - 11db - \$115

10-0 - 100W - 7db - \$209.

1-10-0 - 100W - 14db - \$226.

35-0 - 100W - 4db - \$185.



DYNAMIC

COMMUNICATIONS

948 AVE. "E" P.O. BOX 10116
 RIVIERA BEACH, FLA. 33404
 (305) 844-1323

WE'RE FIGHTING INFLATION NO PRICE RISE IN '75

FOR FREQUENCY STABILITY



Depend on JAN Crystals. Our large stock of quartz crystal materials and components assures Fast Delivery from us!

CRYSTAL SPECIALS

Frequency Standards
 100 KHz (HC 13/U) \$4.50
 1000 KHz (HC 6/U) 4.50
 Almost all CB sets, TR or Rec \$2.50
 (CB Synthesizer Crystal on request)
 Amateur Band in FT-243 ea. \$1.50
 4/\$5.00

80-Meter \$3.00 (160-meter not avail.)
Crystals for 2-Meter, Marine, Scanners, etc. Send for Catalog.

For 1st class mail, add 20¢ per crystal. For Airmail, add 25¢. Send check or money order. No dealers, please.



Div. of Bob Whan & Son Electronics, Inc.
 2400 Crystal Dr., Ft. Myers, Fla. 33901
 All Phones: (813) 936-2397

Send 10¢ for new catalog with 12 oscillator circuits and lists of frequencies in stock.

SUPER CW FILTER

The IMPROVED CWF-2BX offers RAZOR SHARP SELECTIVITY with its 80 Hz bandwidth and extremely steep sided skirts. Even the weakest signal stands out.

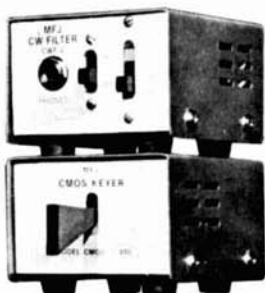
Plugs into any receiver or transceiver. Drives phones or connect between receiver audio stage for full speaker operation.

- Drastically reduces all background noise
- No audible ringing
- No impedance matching
- No insertion loss
- 8 pole active filter design uses IC's
- Bandwidth: 80 Hz, 110 Hz, 180 Hz (selectable)
- Skirt rejection: at least 60 db down one octave from center frequency for 80 Hz bandwidth
- Center frequency: 750 Hz • 9 volt transistor battery not included.
- 400 Hz or 1000 Hz center frequency available add \$3.00.

- IMPROVED CWF-2BX, assembled \$23.95**
CWF-2, PC board, includes 4 position selectivity switch . . \$16.95
CWF-2, kit \$14.95



A STACK FOR CW MEN



4 x 3 1/4 x 2 3/16 inch

Dealer Inquiries Invited

CMOS ELECTRONIC KEYS

Feature for feature the CMOS-440RS gives the most for your money: • State of the art design uses digital CMOS ICs and NE555 sidetone • Built-in key with adjustable contact travel • Sidetone and speaker • Adjustable tone and volume • Jack for external key • 4 position switch for TUNE, OFF, ON, SIDETONE OFF • Two output jacks: direct relay, grid block keying • Uses 4 penlight cells (not included) • Self completing dots and dashes • Jam proof spacing • Instant start with keyed time base • Perfect 3 to 1 dash to dot ratio • 6 to 60 WPM • Relay rated 250 VDC, 1 1/2 amp, 30 VA

CMOS-440RS, Deluxe . . \$37.95

Write for FREE catalog and CW filter test reports. Please include \$1.50 per unit for shipping and handling. Money back if not satisfied. One year UNCONDITIONAL guarantee.



MFJ Enterprises, P. O. Box 494, Miss. State, MS 39762, (601) 323-5869



Radio Amateurs Reference Library of Maps and Atlas

WORLD PREFIX MAP — Full color, 40" x 28", shows prefixes on each country . . . DX zones, time zones, cities, cross referenced tables **\$1.25**

RADIO AMATEURS GREAT CIRCLE CHART OF THE WORLD — from the center of the United States! Full color, 30" x 25", listing Great Circle bearings in degrees for six major U.S. cities: Boston, Washington, D. C., Miami, Seattle, San Francisco & Los Angeles. **\$1.25**

RADIO AMATEURS MAP OF NORTH AMERICA! Full color, 30" x 25" — includes Central America and the Caribbean to the equator, showing call areas, zone boundaries, prefixes and time zones, FCC frequency chart, plus useful information on each of the 50 United States and other Countries **\$1.25**

WORLD ATLAS — Only atlas compiled for radio amateurs. Packed with world-wide information — includes 11 maps, in 4 colors with zone boundaries and country prefixes on each map. Also includes a polar projection map of the world plus a map of the Antarctica — a complete set of maps of the world. 20 pages, size 8 1/2" x 12" **\$2.50**

Complete reference library of maps — set of 4 as listed above **\$3.75**

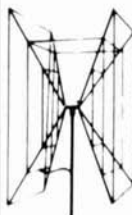
See your favorite dealer or order direct.

Mail orders please include 75¢ per order for postage and handling.

WRITE FOR FREE BROCHURE! RADIO AMATEUR **callbook** INC. Dept. E 925 Sherwood Drive Lake Bluff, Ill. 60044

GEM-QUAD FIBRE-GLASS

ANTENNA FOR 10, 15, and 20 METERS



Two Elements **\$129.00**
 Extra Elements **\$90.00**

Price is F.O.B. Transcona
INCLUDES U.S. Customs Duty
KIT COMPLETE WITH
 *SPIDER
 *ARMS
 *WIRE
 *BALUN KIT
 *BOOM WHERE NEEDED

WINNER OF MANITOBA DESIGN INSTITUTE AWARD OF EXCELLENCE

Buy two elements now — a third and fourth may be added later with little effort.

Enjoy up to 8 db forward gain on DX, with a 25 db back to front ratio and excellent side discrimination.

Get a maximum structural strength with low weight, using our "Tridetic" arms.

GEM QUAD PRODUCTS

Box 53
 Transcona, Manitoba, Canada R2C 2Z5

LOWEST PRICES IN POLY PAKS SMASHES 'CALCULATOR' PRICES

U.S.A.!

9-FUNCTION, 8-DIGIT MEMORY CALCULATOR KIT

It's the easiest multi-function kit today!

- DOUBLE MEMORY
- Percent. Constant
- Display Restore

\$16.95



4-Function Arithmetic 22 KEYS!



LED MITY DIGIT "DCM'S"

"Digital Counting Modules" outperform any other DCM on the market today! More features than ever before! Not gaseous, not incandescent, not noisy but the modern LED! Choose from such famous manufacturers as Monsanto's MAN-1, MAN-4, Litronics 707 and 704, Opco's SLA-1 (the last 4 having character heights of 0.33" at no extra charge). Each kit includes 2 1/2" p.c. board with fingers, a FREE edge connector, side-mounting pin socket, LED readout of your choice, resistors, 3 IC's, and Molex connectors (this kit INCLUDES SOLD BRN YOUR IC's and FREE booklet. INCLUDES P.C. EDGE CONNECTOR - FREE! Includes: Pin-for-pin MAN-1, Pin-for-pin MAN-4, -ALC.

- Only \$8.88
- MAN-1 27 h. Monsanto
- MAN-4 19 h. Monsanto
- 707 33 h. Litronics
- 704 33 h. Litronics
- SLA-1 33 h. Opco
- MAN-4 4 h. Monsanto

Same as above except uses MAN-6...\$9.95 Character Size: 0.4

Touch Tone KEYBOARD KIT \$4.95

Kit includes 4 x 2 1/2" G-10 glass etched pc board, with 10 OAK "smooth touch" white keys with black numerals, plus diagram on "touch tone encoder". Makes many "keyboard systems" readily available. 0-to-9.



Wow! INCREDIBLE PRICES

BUY ANY 10 TAKE 15%

BUY 100 TAKE 25%

TINS

SN7400 \$.16	SN7462 \$.22	SN74122 .48	SN74123 .85
SN7401 .16	SN7470 .29	SN74125 .59	SN74126 .59
SN7402 .16	SN7472 .26	SN74127 .59	SN74128 .59
SN7403 .16	SN7473 .39	SN74129 .59	SN74130 .59
SN7404 .16	SN7474 .36	SN74131 .59	SN74132 .59
SN7405 .16	SN7475 .39	SN74133 .59	SN74134 .59
SN7406 .16	SN7476 .39	SN74135 .59	SN74136 .59
SN7407 .35	SN7477 .39	SN74137 .59	SN74138 .59
SN7408 .19	SN7478 .52	SN74139 .59	SN74140 .59
SN7409 .19	SN7479 .52	SN74141 .59	SN74142 .59
SN7410 .16	SN7480 .52	SN74143 .59	SN74144 .59
SN7411 .25	SN7481 .99	SN74145 .59	SN74146 .59
SN7413 .59	SN7482 .89	SN74147 .59	SN74148 .59
SN7414 .65	SN7483 1.25	SN74149 .59	SN74150 .59
SN7415 .34	SN7484 1.25	SN74151 .59	SN74152 .59
SN7416 .34	SN7485 3.95	SN74153 .59	SN74154 .59
SN7417 .34	SN7486 3.95	SN74155 .59	SN74156 .59
SN7418 .34	SN7487 3.95	SN74157 .59	SN74158 .59
SN7419 .34	SN7488 3.95	SN74159 .59	SN74160 .59
SN7420 .16	SN7489 2.45	SN74161 1.25	SN74162 1.35
SN7421 .45	SN7490 .59	SN74163 1.35	SN74164 1.50
SN7422 .29	SN7491 1.10	SN74165 1.35	SN74166 1.50
SN7423 .29	SN7492 .59	SN74167 1.20	SN74168 1.50
SN7424 .29	SN7493 .59	SN74169 1.20	SN74170 1.20
SN7425 .29	SN7494 .95	SN74171 1.20	SN74172 1.20
SN7426 .25	SN7495 .75	SN74173 1.45	SN74174 1.30
SN7427 .25	SN7496 .75	SN74175 1.30	SN74176 1.30
SN7428 .25	SN7497 .75	SN74177 1.30	SN74178 1.30
SN7429 .25	SN7498 .75	SN74179 1.30	SN74180 1.30
SN7430 .16	SN7499 .75	SN74181 2.98	SN74182 .78
SN7431 .25	SN7500 1.40	SN74183 1.98	SN74184 1.98
SN7432 .25	SN74101 .40	SN74185 1.98	SN74186 1.98
SN7433 .49	SN74102 .44	SN74187 1.98	SN74188 1.98
SN7434 .34	SN74103 .44	SN74189 1.98	SN74190 1.40
SN7435 .34	SN74104 .44	SN74191 1.40	SN74192 1.25
SN7436 .34	SN74105 .44	SN74193 1.25	SN74194 1.20
SN7437 .34	SN74106 .44	SN74195 1.20	SN74196 1.20
SN7438 .34	SN74107 .44	SN74197 1.20	SN74198 1.20
SN7439 .34	SN74108 .44	SN74199 1.20	SN74200 4.95
SN7440 .34	SN74109 .44	SN74201 4.95	
SN7441 1.00	SN74110 .89		
SN7442 .70	SN74111 .89		
SN7443 1.25	SN74112 .89		
SN7444 .89	SN74113 .89		
SN7445 1.15	SN74114 .89		
SN7446 .99	SN74115 .89		
SN7447 .99	SN74116 .89		
SN7448 .99	SN74117 .89		
SN7449 .99	SN74118 .89		
SN7450 .17	SN74119 .89		
SN7451 .17	SN74120 .89		
SN7452 .17			
SN7453 .17			
SN7454 .17			
SN7455 .22			
SN7456 .17			
SN7457 .17			
SN7458 .17			
SN7459 .17			
SN7460 .17			

555 Timer OR 558 Dual 741 2 for \$1 Sale good till OCT. 15, 1975

XENON FLASH STROBE TUBE
\$1.95

"BLASTAWAY" ON 1N4000 RECTIFIER PRICES

NATIONAL LM-340T VR's
+10-220 Case - 1 Amp POSITIVE VOLTAGE
\$1.75 Each
Buy 3 - Take 10%

SCRS! TRIACS! QUADRACS!
10-Amp Power Tab Plastic Units

PRV	Sale
50	\$.75
100	.98
200	1.28
300	1.50
400	1.98
500	2.25
600	2.50

CLOCK CHIPS ON A "DIP"

MMS3311 6-digit 28-Pin	\$5.50
MMS3312 4-digit 24-Pin	5.50
MMS3313 6-digit 28-Pin	5.50
MMS3314 8-digit 24-Pin	5.50
MMS3316 4-digit 40-Pin, alarm	5.50
MMS3318-A no alarm	3.95

WITH DATA SHEETS

MICROPROCESSORS! ROMS! RAMS! MEMORIES!

8008 Microprocessor	\$44.00
8080 8-bit ROM	250.00
2102 1024 Static RAM	3.90
1101 256 bit RAM	1.50
1103 1024 bit RAM	2.95
MMS260 1024 RAM	2.95
MMS282 2048 bit RAM	6.50
2513 Character generator	12.50
MMS203Q Erasable PROM	19.95
MMS202Q Erasable PROM	19.95
1702A Erasable PROM	19.95
8223 Programmable ROM	2.95

\$4.95 6-VOLT NICAD POWER PAK
Includes 4 "A" cell nicad batteries hooked up to give you 6-volts for all types of energy uses. The best batteries made. Rechargeable.

LED Revolution!

MONSANTO! XCITONI! LITRONIX! OPCOI!

5 for \$1	
.340x.2 Jumbo	.240x.200 Medium
Red	Red
Green	Yellow
Yellow	Green
Amber	Amber
Clear	Clear
.340x.160 Medium	.210x.125 Micro
Red	Red
Green	Green
Amber	Amber

Micro (Axial) MV-50 style
 MV-50 Clear 10 for \$1.
 MV-55 Red 6 for \$1.

7-SEGMENT READOUT SALE!

* Up to 20 mils per seg. at 5V. MAN-1
* All fit into 14-pin IC socket.

Type	Size	Color	Sale 3 for
MAN-1	.27	Red	\$2.50 \$6.00
MAN-3MA	.12	Red	69 20.00
MAN-4AB	.27	Red	1.95 5.00
MAN-5	.27	Green	1.50 4.00
MAN-6	.27	Red	4.50 12.00
MAN-7	.27	Red	3.50 9.00
MAN-8	.27	Red	1.00 2.50
MAN-8	.27	Yellow	1.50 4.00

ALL ABOVE BY MONSANTO

Type	Size	Color	Sale 3 for
SLA-1	.33	Red	\$1.95 \$5.00
SLA-1	.33	Green	1.95 5.00
SLA-1	.33	Yellow	1.95 5.00
SLA-3	.7	Green	4.95 12.00
SLA-3	.7	Yellow	4.95 12.00
707	.33	Red	1.95 5.00
704A	.33	Red	1.95 5.00
701C	.33	Red	1.95 5.00
FND-70	.25	Red	1.50 3.00

A—Common Cathode, others Common Anode
 B—With bubble magnifier
 C—Plus or Minus 1

LITRONIX "JUMBO'S"

* Singles size: 1 x 3/4 x 5/16
 * Duals size: 8 x 9 x .29
 * 7-Segment, 28-mils per segment

Type	Size	Color	Sale 3 for
721D	.5	Red	\$8.95 \$15.00
727E	.5	Red	5.95 15.00
748F	.6	Red	3.95 11.00
747	.6	Red	3.95 11.00

D—Plus or Minus 1 plus a digit (1 1/2 digits)
 E—Dual digits
 F—Plus or Minus 1

Terms: add postage. Rated: net 30
 Phone Orders: Wakefield, Mass. (617) 245-3829
 Retail: 16-18 Del Carmine St., Wakefield, Mass.
 (off Water Street) C.O.D.'S MAY BE PHONED

20c CATALOG Fiber Optics, IC's, Semi's. Parts
 MINIMUM ORDER — \$4.00

POLY PAKS

P.O. BOX 842N LYNNFIELD, MASS. 01940

flea market



RATES Non-commercial ads 10¢ per word; commercial ads 35¢ per word both payable in advance. No cash discounts or agency commissions allowed.

HAMFESTS Sponsored by non-profit organizations receive one free Flea Market ad (subject to our editing). Repeat insertions of hamfest ads pay the non-commercial rate.

COPY No special layout or arrangements available. Material should be type-written or clearly printed and must include full name and address. We reserve the right to reject unsuitable copy. **Ham Radio** can not check out each advertiser and thus cannot be held responsible for claims made. Liability for correctness of material limited to corrected ad in next available issue.

DEADLINE 15th of second preceding month.

SEND MATERIAL TO: Flea Market, Ham Radio, Greenville, N. H. 03048.

MODEL 32 ASR LIKE NEW, for sale, \$300 or best offer over that, shipping extra. B. Rowan W2GKF, 55 Runnymede Rd., Berkeley Heights, N. J. 07922.

RADIO MUSEUM NOW OPEN. Free admission. 25,000 pieces of equipment from 1850 telegraph instruments to amateur and commercial transmitters of the 1920's. Amateur Station W2AN. Write for information. Antique Wireless Association, Main St., Holcomb, N. Y. 14469.

F.R.R.L. HAMFEST — August 17th. U.S. Rt. #30 east of Aurora, Ill. Phillips Park — Picnic — Zoo — Family Fun. Advance donation \$1.00, \$1.50 at park. S.A.S.E. to P. O. Box 443, Aurora, 60507. Two grand prizes and many others.

FINDLAY HAMFEST — Sept. 7 — Riverside Park, Findlay, Ohio. For advance drawing tickets write Clark Foltz, W8UN, 122 W. Hobart, Findlay, 45840.

FLEA MARKET, HAMFEST & AUCTION. Hilliard, Ohio. Franklin County Fairgrounds. Sunday, August 10, 1975. 8 a.m. to 6 p.m. rain or shine. Details from CORC, Box 23, Delaware, Ohio 43015.

FIGHT TVI with the RSO Low Pass Filter. For brochure write: Taylor Communications Manufacturing Company, Box 126, Agincourt, Ontario, Canada. MIS 3B4.

23rd ANNUAL NORTHWEST DX CONVENTION, August 2-3. Double Tree Inn just south of Seattle. Details from W9IRH/7, 14041 - 159th NE, Woodinville, Wash. 98072.

SURPLUS TEST EQUIPMENT, VHF and microwave gear; write for bulletins. David Edsall, 2843 St. Paul, Baltimore, Md. 21218.

DANE COUNTY SWAPFEST. Dane Co. Expo Center, Madison, Wis. Sept. 28, 8 a.m. Box 3403, Madison, Wisc. 53704 for information.

RTTY — NS-1 PLL TU (HR 2/75). Undrilled board \$4.75 ppd. Wired/tested \$29.95 ppd. Nat Stinnette Electronics, Tavares, FL 32778.

CLAMBAKE HAMFEST, Sept. 21, 10 a.m. to sunset. Tewksbury (Mass.) Rod & Gun Club, 11 Chandler St. Tickets & program — Box 221, Malden, Mass. 02148.

RADIO ARCHIVES, amateur anecdotes solicited for (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 4th St. N., Minneapolis, Minn. 55412.

50 FREE INTERNATIONAL QSL EXCHANGE COUPONS — Send large self addressed stamped envelope, or 2 stamps. Swaney, Box 54, Goose Creek, SC. 29445.

TELETYPEWRITER PARTS, gears, manuals, supplies, tape, toroids. SASE list. Typetronics, Box 8873, Ft. Lauderdale, Fl. 33310. Buy parts, late machines.

SWAN 350 with 117C PS/Spkr, DC PS, ext. osc. for MARS, etc. Mint condition. \$275 FOB my QTH. R. Davis, W9KK, RR 1, Box 12, Colfax, In. 46035.

MANUALS for most ham gear made 1940/65, some earlier. Send SASE for specific quote. Hobby Industry, W0JJK, Box H-864, Council Bluffs, Iowa 51501.

TOWER, 75 ft. crankover with HAM-M rotator, 4-element 10-40M beam antenna, new hardware incl. mounting hardware. \$750 FOB my QTH. R. Davis, W9KK, RR 1, Box 12, Colfax, In. 46035.

WANTED: tubes, transistors, equipment, what have you? Bernard Goldstein, W2MNP, Box 257, Canal Station, New York, N. Y. 10013.

SELL YAESU FT101, \$525, 2 meter H.T. Tempo FMH, 2 watts, 6 channel, touchtone pad, nicads, 12 xtals, 2 antennas, charger, cost \$350 — mint only \$245. Dycem E40 2 meter amplifier, \$50.00, 2 in 40-50 out. Call Marty, 215-884-6010, W3A1FQ.

EXCLUSIVELY HAM TELETYPE 21st year, RTTY Journal, articles, news, DX, VHF, classified ads. Sample 30¢. \$3.00 per year. Box 837, Royal Oak, Michigan 48068.

NOBARC HAMFEST, Aug. 16 and 17th at the Middlefield Fairgrounds, Middlefield, Mass. Talk ins on 31-91, 43-03, 34-94, 52 simplex, 52.525 and 223.50. Admission fee \$3.00 per adult or \$5.00 per family. Flea market parking \$1.00 per car. Free camping. Activities both days starting Aug. 16th, at 12 noon.

PC's, Send large S.A.S.E. for list. Semtronics, Rt. #3, Box 1, Bellaire, Ohio 43906.

"HAM BUY LINES", Send name and address for literature. Iacopelli, 1720 77 St., Brooklyn, N. Y. 11214.

CANADIAN JUMBO SURPLUS and Parts Catalogs. Bargains Galore. Send \$1. ETCO-HR, Box 741, Montreal "A" H3c 2V2.

CINCINNATI HAMFEST: 38th annual — Sunday, September 21, 1975 at the New Stricker's Grove on State Route 128, one mile west of Ross (Venice), Ohio. Flea market, contests, model aircraft flying, food and beverages all day. Advanced Tickets \$7.00, covers everything; \$8.00 at gate. For tickets or further information: Carl J. Dettmar, WBNCV, 8630 Cavalier Drive, Cincinnati, Ohio 45231.

SELL — Quality nylon cable ties 6 inch for \$2.75 pp/hundred. New Manuals for AN/ARC-3, AN/ARC-12, AN/TRC-1 for \$5.00 pp. W4VQD/Ø, 106 Sheridan Ct., Leavenworth, Ks. 66048.

MT. BEACON A.R.C. 3rd Annual Hamfest, Aug. 16, 1975, 8 a.m. to 6 p.m. at Stewart Airport, Newburgh, N. Y. Hangar E. Flea market and auction, door prizes, talk-in 37/97, 94 and 52, rain or shine. Free parking, admission \$1.00, tailgating \$1.00, under 12 free. For advance tickets write: Marty Irons, WB2TBI, 46 Magic Circle Drive, Goshen, N. Y. 10924.

THE ORIGINAL FM HAMFEST, August 3, 1975, near Angola, Indiana. Free flea market, picnic grounds, swimming, boating available. Talk-in on 146.16/76, 146.94. For information contact Ft. Wayne Rept. Assn., Box 6022, Fort Wayne, Indiana 46806.

CFP Enterprises

Fixed or Mobile HF or VHF

CFP is your source for Ham Gear

Featuring:

ATLAS, ICOM, STANDARD, TEN-TEC

We also have a good supply of used equipment. Send us some SASE and we'll send you our monthly listing as long as the envelopes last.

Please Note: During the month of August we get busy outside on the farm so we won't have any regular hours from July 28 through Labor Day. Please write or call for an appointment.

Mail orders and Master Charge accepted.

Open 8:30 - 5:30
Mon., Tues., Thurs.
By appointment Fri.,
Sat. and evenings.

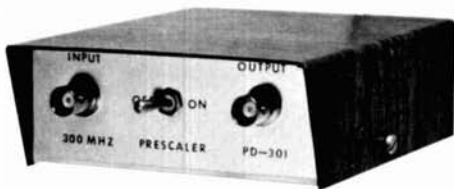
Closed all
day Wed.
and Sun.

CFP ENTERPRISES

866 RIDGE RD.
LANSING, N. Y. 14882

24 Hour Phone:
607-533-4297

K-ENTERPRISES



PD 301 PRESCALER with Power Supply

Kit \$43.50 Assembled \$55.50

Add \$1.50 Postage & Insurance

Model PD 301 is a 300 MHz prescaler designed to extend the range of your counter ten times. This prescaler has a built-in preamp with a sensitivity of 50 mV at 150 MHz, 100 mV at 260 MHz, 175 mV at 300 MHz. The 95H90 scaler is rated at 320 MHz. To insure enough drive for all counters, a post amp. was built-in. The pre-amp has a self contained power supply regulated at 5.2V + .08%. (Input 50 Ohms, Output Hi Z)

All prescalers are shipped in a 4" by 4" by 1 1/2" cabinet. All are wired and calibrated.

K-ENTERPRISES

1401 East Highland, Shawnee, Okla. 74801
Phone: 405-273-9024

VERY in-ter-est-ing! Next 5 big issues \$1. "The Ham Trader," Sycamore IL 60178

TWO PLASTIC HOLDERS frame & display 40 QSL's for \$1.00, or 7 holders enhance 140 cards for \$3.00. Guaranteed & prepaid, TEPABCO, Box 198H, Gallatin, Tennessee 37066.

PORTA-PAK the accessory that makes your mobile really portable. \$59.95 and \$39.95. Dealer inquiries invited. P. O. Box 67, Somers, Wisc. 53171.

GOLDEN SPREAD SWAPFEST, August 23 & 24 in Amarillo, Texas at the Villa Inn Convention Center, 1-40 & Grand Street. Various activities are planned for Saturday the 23rd and swapping will take place Sunday the 24th. Information from Golden Spread Swapfest, P. O. Box 7002, Amarillo, Texas 79103.

HAMFESTERS 41st Hamfest and Picnic, Sunday August 10, 1975, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OM's and XYL's, famous swappers row. Information contact John Raiger, K9DRS, 8919 West Golfview Drive, Orland Park, Illinois 60462. Tickets write Joseph Poradyla, WA9IWU, 5701 South California, Chicago, Illinois 60629.

NORTH ALABAMA HAMFEST in Decatur, Alabama on Sunday, August 17. Location is the campus of Calhoun Junior College at the Decatur-Athens Municipal Airport. Doors open 8 a.m. Tickets @ \$1.00 each at the door or in advance from Ken Hixon, WB4NLN, P. O. Box 9, Decatur, Ala. 35601. Talk-in will be on 34-94 and 3.965 MHz.

QRP TRANSMATCH for HW7, Ten-Tec, and others. Send stamp for details to Peter Meacham Associates, 19 Loretta Road, Waltham, Mass. 02154.

FREE BARGAIN CATALOG. LEDs, xtals, microphones, headsets, IC's, relays, ultrasonic devices, precision trimmer capacitors, unique components. Chaney's, Box 15431, Lakewood, Colo. 80215.

WARREN HAMFEST! Sunday, August 17. Yankee Lake, Ohio. Dealers' displays. Swimming and picnicing. Giant flea market (vendor's fee: \$1.00/car plus registration). A \$3.00 registration includes: Door prize, main prize, and XYL tickets. More info: Hamfest, P. O. Box 809, Warren, Ohio 44482.

WANTED: PP-2765A/URA-36 (PS-4A) Low voltage power supply for TMC KW linear amplifier AM-2785A/URA-36 (PAL-1K (A)). Have a spare HV supply (PP-2766/URA-36) for above to trade. K4CFJ, 265 Kenlock, Lexington, Kentucky 40503.

SOCIETY OF WIRELESS PIONEERS offers Life Membership to active and former C.W. operators on comm'l., military, gov't., etc. wireless/radio circuits. Contact: Society of Wireless Pioneers, Dept. H, P. O. Box 530, Santa Rosa, California 95402.

FOR SALE: Drake R-4B with extra crystals and manual. \$300. Hammarlund HC-10, \$40. You pay shipping. Wanted, National NC101X, HRO-5 and HRO-7 with power supply and coil sets. State condition and modifications if any. QRP rig for 80 and 40. 18AVT Hy-Gain vertical. Please include shipping in well protected case in price. Joe Torzewski, 51625 Chestnut Road, Granger, In. 46530.

NOW PAYING \$2000.00 and up for ARC-94/618T ARC-102/618T. \$1200.00 and up for ARC-51BX, \$1500.00 and up for 490T-1 antenna couplers. We also need these control boxes — C-6287/ARC-51BX, C-6476/ARC-51BX, C-714E-2. We also need R-1051 receivers, RT-662/GRC-106 transceivers. We buy all late aircraft and ground radio equipment. Also pack radios. You are buyers not talkers. Bring your equipment in, you are paid on the spot. Ship it in, you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment, call us. Call collect if you have, and want to sell or trade. We also sell. What do you need? D & R Electronics, R.D. #1, Box 56, Milton, Pa. 17847. Phone — 717-742-4604 - 9:00 a.m.-9:00 p.m.

WANTED: Johnson Navigator. State condition and price. W6ENZ, 2131 W. Palmyra, Apt. B, Orange, CA. 92668.

BURGLAR — FIRE ALARM EQUIPMENT. Free catalog of supplies. Burglar Alarm Supply, 1172 E. Delano Dr., Casa Grande, Ariz. 85222.

RECIPROCATING DETECTOR, write Peter Meacham Associates, 19 Loretta Road, Waltham, Mass. 02154.

LAPORTE COUNTY HAMFEST, 24 August, at the County Fairgrounds in LaPorte, Indiana. Paved midway or inside tables for sellers. On-site camping. Advance tickets \$1.00 each, \$1.50 at gate. Cold drinks and food available. Contact WB9AOU, RR 7, Box 275, Valparaiso, Ind. 46383.

OSCAR SLIDES, set of 5, \$1.25. Launch and spacecraft. Proceeds AMSAT. K6PGX, P. O. Box 463, Pasadena, CA 91102.

MELBOURNE, FLORIDA — PCARs 10th annual Hamfest at Melbourne Auditorium, September 6 & 7. Prizes galore, exhibits, swap-tables, auction, Florida's, QCWA, etc. First prize 40' crank-up tower, tri-band beam, rotator & coax-complete! For info - Box 1004HR, Melbourne, FL 32901.

RECONDITIONED TEST EQUIPMENT for sale. Catalog \$50. Walter, 2697 Nickel, San Pablo, Ca. 94806.

MILITARY QUALITY FIELD STRENGTH METER Instruments for industry model EFS-1. New condition w/manuals. \$475 new — selling for \$225 or trade for ? K. Schreiber, Route 2, New Concord, Ohio 43762.

MANUFACTURERS, Distributors! The Memphis Hamfest will be bigger than ever. The dates are Saturday and Sunday, October 4 and 5. Best location possible — State Technical Institute, Interstate 40 at Macon Road. Security. Contact Chairman, Harry Simpson W4SCF, Box 27015, Memphis, TN 38127, phone 901 358-5707.

R-390A/URR — like new, recent overhaul, with manuals and connectors, \$500. WA1TEJ, 603-880-2788 days.

MOBILE IGNITION SHIELDING provides more range with no noise. Available most engines in assembled or kit forms, plus many other suppression accessories. Free literature. Estes Engineering, 930 Marine Dr., Port Angeles, WA. 98362.

AN/URA-8A — complete RTTY diversity group: 2 CV-89A/URA-8B converters, CM-22A/URA-8B comparators, MT-719/URA-8B cabinet, connectors and manuals, all like new, \$250. WA1TEJ, 603-880-2788 days.

QSL'S — BROWNIE W3CJ1 — 3035B Lehigh, Allentown, Pa. 18103. Samples with cut catalog 35¢.

AN/FGC-20 — RTTY TT-100/FG Kleinschmidt printer, like new, with table, 60, 66, 75, 100 gears and manual, \$150. WA1TEJ, 603-880-2788 days.

MEMPHIS is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, on Saturday and Sunday, October 4 and 5. Demonstrations, displays, MARS meetings, Flea Market, XYL entertainment, prizes. Informal dinners Saturday night. Dealers and Distributors welcome. Talk-in on 3980, 34-94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis, TN 38127 or telephone 901 358-5707.

STANDARD 830L-3 Hi-band 3-channel, 2-watt HT less accessories, \$100. WA1TEJ 603-880-2788 days.

NEW CANADIAN MAGAZINE. "Electronics Work Shop". \$5.00 yearly, sample \$1.00. ETCOB, Box 741, Montreal, H3C 2V2.

STANDARD 840ZA carrier squelch pocket paging receiver, like new, now on 154.19, with charger and spare nicad, \$125. WA1TEJ, 603-880-2788 days.

TRAVEL-PAK QSL KIT — Send call and 25¢; receive your call sample kit in return. Samco, Box 203, Wynantskill, N. Y. 12198.

SNOOPERSCOPE M-3 — 20 KV infrared see-in-the-dark telescope in excellent working condition with power supply, \$150. WA1TEJ, 603-880-2788 days.

COMING TO FLORIDA? Use our Club station or your own rig and our all-band antennas to work DX or your home town. All hams welcome. Details — H. E. Saxton, W4QED, c/o Spanish River Inn, Delray Beach, Fla. 33444.

TELL YOUR FRIENDS about Ham Radio Magazine.

Now Two Great Ideas Got Their Start In Boston

BUYERS & SELLERS

ham radio brokerage

to sell: Call or write with a list of what you have to sell and how much you want for each item. Include serial no.s, age, condition, etc.

to buy: Call us. We'll put you in touch with someone selling what you're looking for in your vicinity.

There is never a charge to the buyer for our service.

The seller pays 10% of the asking price upon the sale of the equipment. If no sale is made, the seller pays nothing.

call

617-536-8777

W F Sun 12pm-6pm EST
T Th Sat 6pm-12am EST

or write

BUYERS & SELLERS

Post Office Box 73
Boston, Mass. 02215

VOLTAGE REGULATORS TO-3

1 AMP POSITIVE			1 AMP NEGATIVE		
	each	10 pak		each	10 pak
LM 309K 5V	\$1.25	\$10.00	LM 320 5V	\$1.95	\$17.50
7806 6V	1.50	13.00	LM 320 5.2V	1.95	17.50
7812 12V	1.95	17.50	LM 320 12V	1.95	17.50
7815 15V	1.95	17.50	LM 320 15V	1.95	17.50
7824 24V	2.25	20.00			

2N3055 NPN TRANSISTOR



2N3055 Transistor (power): PD-115W
VCE-60V; HFE-50; FT-30K; Case-T0-3
Each \$1.15 10 pak \$6.95

DIP RC NETWORKS



14 and 16 pin IC packages containing precision resistors and capacitors.

NO SCHEMATICS AVAILABLE

Sample indicates most contain 10 to 15R and 1 or 2C.

Assortment of 8 \$1.00



MEMORY

82S129

1024 bit ROM(256x4 PROM)

-Access time 50 NS
-Power dissipation .5 MW/BIT
-Tri-state output
-Field programmable
-16 pin DIP

Each \$5.95 10 pak \$49.95

2N3565 NPN T0-106
30v Beta 150 min.
500 mw.

Each \$ 15

10 pak \$1.00



**SEND FOR
FREE FLYER**

All merchandise is new unused surplus and is sold on a money back guarantee. Five dollar minimum order. Free first class postage on all orders. California residents please add sales tax.

Write to:

VALU-PAK

box AF Carmichael, Ca. 95608

2 METER FM

STANDARD'S NEW Horizon/2!



low cost
high performance

- 12 channels — 20+ W out
- front facing speaker — 3 W audio
- 70 dB adjacent channel rejection
- 4+ MHz spread includes MARS, CAP
- Standard's unique 6 month warranty

Get ERICKSON'S

LOW introductory price

also...ICOM/TPL/TEMPO/KENWOOD/LARSEN/ASP/CUSHCRAFT/MIDLAND

ERICKSON COMMUNICATIONS

4135 Main Street (New Location)
Skokie, IL 60076 (312) 677-2161
Hours: 9-4:30 M-S; 6:30-9 M, Th

GROTH-Type

COUNTS & DISPLAYS YOUR TURNS



- 99.99 Turns
- One Hole Panel Mount
- Handy Logging Area
- Spinner Handle Available

PRICES

	POST PAID
TC 2	\$7.00
TC 3	\$7.50
Spinner (S)	\$1.00
Add \$0.75 for Air or UPS	

Case: 2x4"; shaft 1/4"x3"
Model TC2: Skirt 2 1/2"; Knob 1 1/2"
Model TC3: Skirt 3"; Knob 2 1/2"

R. H. BAUMAN SALES

P.O. Box 122, Itasca, Ill. 60143

NEW!

IMPROVED VHF FM RECEIVER KIT \$64.95

• UHF RECEIVER KIT \$80

- VHF CONVERTER KIT \$25
- SUPER VHF PREAMP, KIT \$9, WIRED \$14
- UHF CONVERTER FOR 432-450-470 MHz, ETC.
KIT \$20, XTALS \$5.50
- PREAMP FOR 432-450-470 MHz, ETC.,
KIT \$15/WIRED \$30
- STANDARD VHF PREAMP KITS \$6, WIRED \$10
— FREQ. FROM 20 TO 230 MHz
- LED SCANNER KITS \$10.
- CLUB & DEALER INQUIRIES INVITED.

— SEND SASE FOR LITERATURE —

HAMTRONICS, INC.

182 BELMONT RD., ROCHESTER, N. Y. 14612

DELUXE QSLs. Samples 20¢. Shipley, W8GZX, P. O. Box 145, Dabel Stn., Dayton, Ohio 45420.

FOR SALE: Drake SW4-A, \$160. You ship. Wanted, National NC300 in good condition. State condition and modifications if any. Include shipping in well protected case in price. Joe Torzewski, 51625 Chestnut Road, Granger, In. 46530.

PRINTED CIRCUIT TECHNIQUES for the hobbyist. Booklet: \$2.00. H. S. steel and carbide drill bits and PC artwork. Send SASE for flyer. Trumbull, 833 Balra Dr., El Cerrito, Ca. 94530.

SUBMINIATURE TUBES for Handi-Talkies. Unused in original boxes. Also assortment of oxtals, loctals. Write Bob Williams, WA9BZY, 230 Stanley, Chippewa Falls, WI. 54729.

DO-IT-URSELF DXPEDITION — Stay at ZF1SB — Cayman Is. Vertical antenna and Caribbean by your doorstep. Diving/fishing if band folds. Write Spanish Bay Reef Resort, Box 800K, Grand Cayman, B. W. I.

SIMPSON 460 DIGITAL VOLT-OHMETER for sale, \$195. WAØFOV, Box 1010, Minnetonka, MN. 55343.

HAMFEST, Sunday, September 28 from 8 a.m. to 3 p.m. at the Lenawee County Fair Grounds, Dean Street in Adrian, Mich. Talk-in 146.46 - .52 - .94 MHz. All welcome. Plenty of refreshments. Cost \$1.00 in advance, \$1.50 at the gate. Table size 8 ft., \$1.50 per half. Write Adrian ARC, Box 26, Adrian, Michigan 49211.

160 METER TOP LOADING SECTIONS for vertical antennas, \$34.50 ppd. 80 meter sections, \$31.50 ppd. Details write Bill Turney, WAØRFF, 1414 East 9th, Hutchinson, Kansas 67501.

MANUALS for Govt. surplus gear, only \$6.50 each: URM-25D, R-220/URR, SP-600JX, TT-63A/FGC, TS-497B/URR, R-274/FRR, TS-382D/U, ALR-5, URM-32, TS-173/UR, TS-174/U, TS-175/U, BC-779B, TS-344/AP, CV-591A/URR, TS-431A/U, SG-3/U, TS-452B/U, LM-21, PRC-10, BC-639A, LP-5, OS-8B/U, OS-8A/U, OS-8C/U, BC-348JNQ, TV-2/U, OS-46/U, CV-278/GR. Immediate delivery. Thousands more in stock for radar, teletype, test sets, scopes, receivers, transmitters. Send 50¢ (coin) for 20-page catalog. W3IHD, 7218 Roanne Drive, Washington, D. C. 20021.

WANTED: Bird #43 and elements for same. Also need C.P.1 Collins xtal pack. Call Marty, WA31FQ, 215-884-6010.

YAESU FT-101/B/E OWNERS — For detailed Service Notes on ALC circuits, send dollar (creditable towards dues) for July Newsletter of International Fox-Tango Club. Or SASE for free club information and sample newsletter. Milt Lowens, WA2AOQ, 3977F Sedgwick Ave., Bronx, N. Y. 10463.

HAM RADIO has all the license manuals you need! Write for details.

FERRITE BEADS: Ferroxcube beads w/specification and application sheet — 10 @ \$1.00 postpaid. Includes latest catalog. CPO Surplus, Box 189, Braintree, Mass. 02184.

AMAZING NEW REPORT How to enjoy your ticket more. Crammed with information guaranteed to surprise Novice or Extra. Free literature. Richard C. Iams Reports, P. O. Box 462, Canonsburg, Pa. 15317.

TIRED OF THIS SMALL PRINT? Buyers & Sellers Ham Radio Brokerage. See our display ad.

LEARN DESIGN TECHNIQUES. Electronics Design Newsletter. Digital, linear construction projects, design theory and procedures. Annual subscription \$6.00, sample copy \$1.00. Valley West, Box 2119-C, Sunnyvale, CA 94087.

MOTORHOME FOR SALE. 25 ft. Sportscoach (RB) 1973, excellent condition, many extras. Antennas - 2 mtr, TV, (2) HF - 4 KW generators, sleeps six. \$1,500 down, assume loan. Send SASE for more info. W6KHS, 212 Magellan St., Capitola, CA 95010.

YOUR AD belongs here too. Commercial ads 35¢ per word. Non-commercial ads 10¢ per word. Commercial advertisers write for special discounts for standing ads not changed each month.

BULLET ELECTRONICS

• 48 HOUR MAIL SERVICE
• CASH REFUNDS ON OUT-OF-STOCK ITEMS

• QUALITY PARTS — NO JUNK!
• COMPLETE SATISFACTION OR MONEY BACK

• POSTAGE PAID ON ALL
ORDERS OVER \$5.00

SPECIAL PURCHASE!

50 OHM RF COAX
Similar to RG58/U only
slightly smaller in diameter

- 29 pfd/ft.
- 15.5 DB/100 ft. attenuation
- 90% Shield
- #22 stranded conductor



100 FT. COIL 3.99
2000 FT. ROLL 60.00

J
U
M
B
O

L
E
D
S



FND-70 1/4" LED
READOUTS
75¢ ea.
10/5.90



COMMON CATHODE
RH Dec.

2N3055 TO 3 69¢
2N3771 " 1.75¢
2N1490 " 49¢
2N3054 TO 66 49¢

HA2825 HARRIS
Phase Locked Loop out per-
forms NE565
1.75 with specs

TCA430
Quad oscillator IC use two
for touch tone generator
14 Pin Dip 1.75 ea.

HEATshrink TUBING
1 FOOT CUT LENGTHS
assorted sizes: 1/4, 1/8
& 1/16
16 PACK OF 10
49¢

LITTLEFUSE SERIES
815 CIRCUIT breaker
trips at .65A 29¢

SUPER! KIT

+5V 1.5A
±15V 150 ma
1% regulation
low ripple

POWER SUPPLY SPECIAL

We brought a large quantity of parts
to make a quality power supply for
TTL & linear work.

YOU GET: • Drilled & Plated Board
• All components including
transformer
• Complete instructions
12.95

7490 decade counters 65¢

60HZ CRYSTAL TIME BASE KIT

Use with mos clock chips requiring 60HZ to provide portable
or standby operation

KIT INCLUDES: PC Board \$9.95
7.68kc xtal
Transistors, resistors, etc.
Mos binary divider

Programmed Diode Array
ONE-OF-TEN TO BCD Encoder
Great for Keyboard encoder,
frequency synthesizers, etc.
14 PIN DIP 1.45 ea.



BULLET ELECTRONICS
P. O. BOX 1465
LAKE WORTH, FLORIDA
33460

Send 25¢ for Catalog
FREE WITH ORDER

NO C.O.D.'S
CHECK OR MONEY ORDER
INCLUDE 50¢ for handling on all orders less than \$5.00.

WE SHOOT STRAIGHT!

10.7 MHZ CERAMIC FILTER

\$1.69



Miniature Size
No Tuning Required

3DB Bandwidth: 220 KHZ
50DB Bandwidth: 700 KHZ (Max)
Insertion Loss : 10 DB (Max)
Impedance : 330 ohms

The bandwidth can be narrowed by
loading filter with a higher impedance

LIMITED QUANTITY AVAILABLE!
RCA CA3089 1.75 ea.
IF amp, Quadrature detector, AF Pre-
amp, AGC, AFC, Muting & Tuning
meter on one chip!



AMPLIFIERS with VERSATILITY



- Selectable biasing for true linear use.
- No tuning across entire Amateur band.
- Fully VSWR and reverse voltage protected.
- Switchable from Linear SSB to Class C.

Announcing the newest additions to
the growing line from SCS, leader in
linearized Power Amplifiers for the dis-
criminating amateur.

2 METER

2M10-140L \$199.95 10W IN, 140W OUT
2M30-140L \$179.95 25-30W IN, 140W OUT
2M10- 70L \$139.95 10W IN, 70W OUT

220 MHz

1.3M10-120L \$219.95 10W IN, 120W OUT
1.3M30-120L \$199.95 25-30W IN, 120W OUT
1.3M10- 60L \$159.95 10W IN, 60W OUT

Write now or contact your nearest dealer!

SPECIALTY COMMUNICATIONS SYSTEMS

4519 Narragansett Avenue, San Diego, CA 92107

Louis N. Ancaux, WB6NMT

(Dealer inquiries invited.)

714-222-8381



Chomerics ER22092 Key Pad \$8.50pp
Touch-Tone Coded Key Pad with 2-of-8 Matrix

The Chomerics Key Pad ER22092 is a 16 position 2-of-8
key pad switch matrix ideally suited to use with a Digital
Touch-Tone* encoder for VHF FM such as the encoder in
the April, '75, issue of Ham Radio (p. 28). The
overall key pad size is only 2.080" x 2.080" x
.154"; keys are on 1/2" centers.

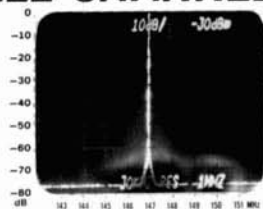
*Touch-Tone is a registered Trademark of AT&T.



Marketing East, Inc.

44 Maple Street
Danvers, MA 01923
Tel: (617) 777-1747

— CLEAN SIGNAL —
— ALL CHANNELS —



Actual Spectrum Analyzer Photograph
of an RP Synthesized Radio

ONLY RP GIVES YOU BOTH
PLUS

- SUPER ACCURACY (.0005%)
- FULL 2M FM COVERAGE

144-148 MHz

WORKS WITH MOST FINE AMATEUR
OR COMMERCIAL GRADE RADIOS

MFA-22 SYNTHESIZER

SEND FOR
FULL DETAILS



RP Electronics

810 DENNISON DRIVE
BOX 1201
CHAMPAIGN, IL 61820
Phone: 217-352-7343

500 MHZ PRESCALER



3" x 4" x 1 1/2"

EXTEND YOUR COUNTER TO **500 MHZ !!!**

Can be used with Any counter capable of 5Mhz.

- * F_{MAX} greater than 500Mhz.
- *HIGH INPUT SENSITIVITY: less than 150mv. needed at 500Mhz - overload protected
- *HIGH INPUT IMPEDANCE: 500 ohms
- *OUTPUTS: ± 10 and ± 100 TTL compatible
- *INCLUDES POWER SUPPLY

ORDER NOW!

PS-K kit \$ 89.00

PS-A wired and tested \$109.00
plus \$ 85 postage

Calif residents add 6% sales tax

500 MHZ COUNTER AVAILABLE NOW!
(see May Ham Radio pg 113)

LEVY ASSOCIATES

PO Box 961 R
Temple City, Calif. 91780

FEELING LEFT OUT?



Do you sometimes feel as though the world
of amateur radio is moving a good deal faster
than you are?

Here are two perfect answers to this problem — one for the technical side — one for the news side.

hr REPORT

Amateur Radio's most exciting & complete newsletter sent first class mail every Friday. Covers all the important news of amateur radio as it happens — not weeks or months later. Indispensable to anyone who wants to be among the best informed people in amateur radio today.

1 year - 52 issues - \$12.00 (U.S. & Canada)

ham radio

The unquestioned leader in the technical and construction side of amateur radio. Many dozens of interesting projects each year introduce you to the latest in the modern world of electronics and will give your station more capability than ever before.

Don't let another month go by without your own copy of this pace-setting magazine.

1 year - 12 issues - \$ 8.00 (U.S. & Canada)

3 years - 36 issues - \$18.00 (U.S. & Canada)

ham radio

GREENVILLE, NH 03048

Please enter my order for:

HR REPORT

_____ 1 year (52 weekly issues) \$12.00
(\$15.00 foreign)

HAM RADIO

_____ 1 year (12 monthly issues) \$8.00
(\$10.00 foreign)

_____ 3 years (36 monthly issues) \$18.00
(\$26.00 foreign)

NAME _____ CALL _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____



Mobilize with Midland

Ready for mobile? Midland's ready for you with three compact transceivers in both 2-meter and "220". Midland has been a leading name in communications for over a dozen years. Ask your dealer. Ask the guys that own one. Try one yourself. You'll see why!

P.S. Midland's R.S.V.P. program gives positive, practical support to your repeater service. Your Midland dealer has details.

MIDLAND
INTERNATIONAL
Communications Division

Write for free
amateur catalog:
P.O. Box 19032,
Kansas City, Missouri
64141



VHF/UHF

CONVERTERS PREAMPS

Ten meters through 432 MHz. A post card will bring our full 1974 Catalog.



JANEL laboratories

BOX 112, SUCCASUNNA, NJ 07876
Telephone 201-584-6521

THE ULTRA-BAL 2000

NOW -----An extremely rugged, weather-proof BALUN!
• Full 2KW, 3-30 MHz., 1:1 or 1:4 ratios.
• Special Teflon insulation. May be used with tuned lines and tuners.
• With dipole insulator and hang-up hook.

ONLY \$9.95ppd. (state ratio)

At your dealer or order direct

K.E. Electronics Box 1279, Tustin Calif. 92680



R648/ARR-41 RECEIVER

Mini version of R-390A with many features of R390A
Digital Readout: 500 kHz to 24,999 MHz
1.4 kHz to 6 kHz Mechanical Filters
Crystal Calibrator: 500 ohm Output. 17 tubes.
Input: 28 Volt-115 V. 400 Hz — 250 V @ 100 MA
Size: 8"x17"x22". Weight: 34 lbs.
Information sheet available
Price: \$199.50 tested: FOB Tucson, Arizona

KOLAR, INC.

4484 E. TENNESSEE ST., TUCSON, AZ. 85714
TELEPHONE: AREA 602-325-3391



RACOM, INC.

EST. 1964



Desk Model

AUTOMATIC VOICE IDENTIFIER

- WILL NOT DISRUPT CHANNEL
- TAPE DISC — NO LOOPS
- 15 OR 30 MIN. BETWEEN I.D.
- CHANGE RECORDINGS EASILY
- SOLID STATE
- NO FALSING

RACOM, INC.

5504 State Road
Cleveland, Ohio 44134
Phone (216) 351-1755

Distributors & New Dealers Welcome

CW FILTER



- New! Stereo enhancement.
 - 8 pole IC filter.
 - 80 Hz bandwidth.
 - Steep skirts. No ringing.
- Simulated-stereo technique filters out QRM but lets you hear off-frequency answers to your CQ's. Great for contest ops, CW nets.
 - 800 Hz center frequency. (Stereo headphones, 9-v battery not included.)
 - Send for free brochure.
 - Order direct. \$39.95 PPD U.S. and Canada. (Add sales tax in Calif.)

PALOMAR ENGINEERS

BOX 455, ESCONDIDO, CA 92025



RTTY VIDEO DISPLAY UNIT

1000 CHARACTERS - ANY TV SET
VIDYTYPE
MODEL 872 \$550
 WRITE FOR BROCHURE

LELAND ASSOCIATES
 18704 GLASTONBURY RD.
 DETROIT, MI. 48219

DIPOLE ANTENNA CONNECTOR



HYE-QUE (HQ-1) dipole connector has coax SO-239 socket molded into glass filled plastic body to accept coax PL-259 plug on feedline. Drip-cap keeps coax fittings dry. Instructions included. Guaranteed. At your dealers or **\$3.95 postpaid**. Companion insulators 2/\$.99.

BUDWIG MFG. Co. PO Box 97H, Ramona, CA 92065

Webster radio



Everything from Set to Signal!

New FT101E Yaesu \$749.00
 with New Speech Processor

2602 E. Ashlan Write for catalog
 Fresno, Calif. 93726 Phone (209) 224-5111

CASHAROOONIE

Money! You can get top dollars now for U.S. surplus electronics, particularly Collins. Write or call now for your bigger than ever quote. Space Electronics Corp., 76 Brookside Ave., Upper Saddle River, N.J. 07458 (201) 327-7640.

WN1USO

JOHN YOUNG

8460 North River Road
 Mesa, Arizona 80950

AMATEUR RADIO CALL LABELS

HAM IT UP with these Combination Call and Address Labels — Black Print on Silver Foil — 1" x 1 1/2". These Deluxe Self-Stick Labels add your personal touch to the Amateur Radio Field — Up to four 22 character lines plus Call Letters.

300 Labels \$4.75 ppd
 500 Labels \$6.25 ppd

SKANDIA, INC., Dept. 7Y
 Londonderry, N. H. 03053

Call Letters
 Name
 Address
 City
 State Zip

NEW! SILVERPLATE NEW!

SINGLE SOLUTION • NO MIXING • NO FUSS • NO LETHAL CHEMICALS • FAST ACTING ON COPPER • BRASS • BRONZE • BRUSH ON OR DIP • RINSE AND DRY • IDEAL FOR THOSE COMPLICATED JOBS • 6 LIQUID OZ. BOTTLE SILVERPLATES UP TO 1800 SQUARE INCHES OF METAL • \$7.00

ABAR RESEARCH .
 11118 PARKER STREET, MOKENA, IL. 60448

ELPROCON 1 WATT 2 METER TRANSMITTER



- TWO CHANNEL CAPABILITY
- FREQUENCY RANGE 144-148 MHz
- POWER OUTPUT 1 WATT INTO 50 OHM LOAD
- SUPPLY VOLTAGE 12 VDC
- MULTIPLICATION FACTOR 8X
- NARROW BAND FM ± 5 KHZ
- RUGGED BALANCED EMITTER OUTPUT TRANSISTOR
- SIZE 3 3/4" X 1 7/8"
- TESTED & FULLY ASSEMBLED (Less X'tals)
- \$29.50 postpaid in U.S.

ELPROCON
 DEPT. DS • 1907 W. CAMPBELL
 PHOENIX, ARIZONA 85015

RADIO COMMUNICATION

Many thousands of you have become familiar with the various Radio Society of Great Britain books and handbooks, but very few of you are familiar with their excellent magazine, Radio Communication.

We can now offer this fine magazine to you along with the other advantages of membership in the RSGB (such as use of their outgoing QSL Bureau) for \$11.95 a year.

ham radio Greenville
 NH 03048

Don't miss Chicago's

RADIO EXPO

SEPTEMBER 6-7 '75

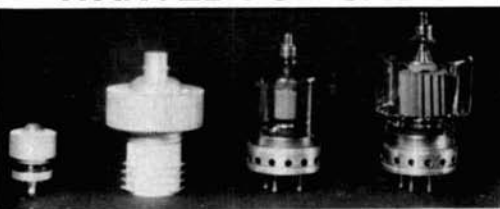
Thousands of dollars in door prizes
Manufacturer's displays-Giant flea-market

Lake County Fairgrounds-routes 45&120

Grayslake, IL HALFWAY BETWEEN CHICAGO & MILWAUKEE

For tickets in advance send \$1.50 per to: EXPO, Box 1014, Arlington Hts, IL
Convention HQ: Holiday Inn, Mundelein, IL 312-949-5100 60006

WANTED FOR CASH



4X150 4CX1000 4-65 4-250
or 4 or 5CX1500 or 4-125A or 4-400
4CX250 3000 or 5000 or 4-1000

Other tubes and Klystrons also wanted

The Ted Dames Company

308 Hickory Street
(201) 998-4246

Arlington, N.J. 07032
Nites (201) 998-6475

NOW — PROGRAMMABLE ELECTRONIC KEYS



COMPLETE KIT
ONLY \$79.95 ppd.
ASSEMBLED \$97.50 ppd.

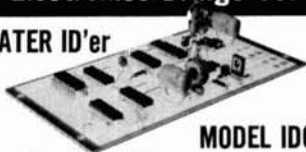
FEATURES: Dot and Dash Memory, Two Independent 256 Bit Memories, Keys up to -150V, Self Completing Char. 6 to 60 WPM, Iambic Keying. Does not include paddle.

NEW ENGLAND DIGITAL ELECTRONICS

BOX 684 KENMORE STATION
BOSTON, MA. 02215

Hale Electronics Brings You . . .

REPEATER ID'er



MODEL IDC-100

- All solid state fully automatic repeater identifier and ID control mtd on 3" x 6" PC board
 - Includes CW ID memory, interval timer, hvy duty xmmitter-hold switch, tone generator, CW speed and audio level controls.
 - Unique activity sensing circuit allows ID only at end of transmission - no ID over conversation
 - Requires 5vdc @ 200 ma, regulated
Wired, tested and programmed with your call
- \$46.50**

HP-2A 2 meter Preamp



SMALL . . . only 1 x 3 x 1/2 inches
PERFORMANCE . . . 18 to 20 dB gain, low noise, ultra stable.
GIVE NEW LIFE to your 2-meter receiver.
KIT only \$9.95 WIRED & TESTED \$13.95

Call or write for details on regul. pwr supply kit and CG-256 CW/RTTY Generator.
(Mo. res. add 4% sales tax) Prices ppd US & Canada

Hale Electronics

P. O. Box 682 — Cape Girardeau, Mo. 63701
Tel. 314-334-0420



New ATLAS 210 SSB TRANSCEIVER

200 watts • 10-15-20-40-80 meters. All solid state.

- Plug in design for quick installation or removal from optional mobile mount. 12 volt DC operation.
- AC consoled for desk-top operation.
- All solid state modular construction with plug-in P.C. boards.
- Only 3½ in. high x 9½ in. wide x 9½ in. deep.

ELECTRONICS DISTRIBUTORS, INC.

Communication Specialists for over 35 years
1960 Peck St., Muskegon, Michigan 49441
Tel. (616) 726-3196 • Telex 22-8411

RMS CORPORATION

THE ELECTRONIC STORE

675A GREAT ROAD (ROUTE 119)

LITTLETON, MASS.

(617) 486-4973

ICOM

MATRIC-KEYERS

HUSTLER

ANTENNA SPECIALISTS

VHF ENG. KITS

VENUS SSVT

KLM

LARSEN

LARGE INV. COMPONENTS

USED EQUIP.

I-495 to Rte. 119 Groton Exit 19

2 miles on Right

FLEA MARKET

SEPTEMBER 27 9 A.M. - 5 P.M.

SEE SEPT. HAM RADIO FOR LOCATION!

BIGGER THAN EVER!

\$3.00 Per Seller

Free To Buyers

ARR-52 SOLID STATE VHF RECEIVER

Easily converted to 2-meter FM. Now set for 163-173 MHz, 16 channels. \$19.95 postpaid continental US. Includes schematic diagram and conversion details. As described in the Surplus Sidights Column, (Pg. 58 Oct. CQ).



\$19.95

OVER 300 SOLD POSTPAID
BankAmericard & COD Welcome



Electronic Equipment Bank, Inc.

516 Mill Street, N.E. Vienna, Virginia 22180
(703) 938-3350



CURTIS KEYSER CHIP as low as \$7.95

8043; IC only, 50-up group rate \$ 7.95

8043-1; IC, PCB, Manual \$ 24.95

8043-2; Semi-kit \$ 49.95

Add for air postage and handling ... \$ 1.50

(See Feb 75 CQ and Apr 75 HR articles)

KB4200 Keyboard Keyer (Oct 74 QST) ... \$549.95

EK420/KM420 Keyer/Memory (Oct 73 QST) \$439.90

EK430 CMOS Keyer (uses 8043 chip) \$124.95

IK440 Instructokeyer (Jun 75 '73') \$224.95

CURTIS ELECTRO DEVICES, Inc.

(415) 964-3136

Box 4090, Mountain View, Cal. 94040



GOT YOUR COMMERCIAL LICENSE?

Here are some excellent NEW books to make the job easier than ever.

First Class Radio Telephone Handbook

4th edition

Ed Noll, W3FQJ 416 pgs. \$7.50

Second Class Radio Telephone Handbook

5th edition

Ed Noll, W3FQJ 448 pgs. \$7.50

Here are new editions of two old favorites for those preparing for FCC Commercial exams. These excellent study guides include all the information necessary to pass your test plus actual sample exams.

Second Class FCC Encyclopedia

Ken Sessions, K6MVH 604 pgs. \$7.95

This very complete new book covers the complete FCC study questions for the second class FCC radiotelephone exam in great detail giving the reader the complete theory behind each correct answer. Sure to make your preparation faster and more complete.

Please add 25¢ per volume for shipping and handling.

ham radio

Greenville, NH 03048

NEW!

LOGIC MEMORY PROBE KIT \$18.99

AT LAST! A professional quality Digital Logic Memory Probe in case to build kit form

- CHECKS RFL, DTL & TTL IC LOGIC
- MEMORY & PULSE Synchronizing CKT
- SONS PULSE DEFLECTION
- POWER FAILURE DEFLECTION
- LOW V_{CC} DEFLECTION
- REVERSE POLARITY POWER PROTECTION
- INPUT OVERVOLTAGE PROTECTION
- HIGH INPUT IMPEDANCE

— ORDER NOW FROM —

PHILLCURT
DIGITAL PRODUCTS

4440 ELM RD GURNEE, ILL. 60031

Eico Model 720. New Factory wired novice transmitter, 90 watts. 10 thru 80 meters \$80.00
DRAKE — In stock for immediate shipment.
 R4-C Receiver \$549.00
 SPR-4 Solid State Gen. Cov. Receiver \$579.00
 T-4XC Transmitter \$580.00
 MS-4 Speaker \$22.00
 AC-4 Power Supply \$120.00
 WV-4 Wattmeter 20-200 MHz \$74.00
 Unique antenna tuner. Reg. \$80.00
 good, used \$60.00
 Globalman EK-108D Electronic Keyer, wired, complete with paddle. \$74.95
 SABA 5-2T Broadband low noise preamp with built-in power supply and T-R switch for transceiver or receiver \$102.50
 Collins phone patches, removed from equipment, nice condition with schematic \$24.95
 Standard SR-C826M with matching SR-C12 AC power supply.
 Collins 516-F2 A.C. Power Supply — Used, good cond., lab tested O.K. \$110.00

ANTENNAS — TA-36, TH6-DXX, in stk.
 Savoy DGA-2M, 2 meter collinear \$29.95
 Trunk lip bracket for DGA-2M \$14.95
 HyGain 1/4 wave 2M grd plane \$13.00
 Hustler 4 BTV Vertical Antenna \$79.95
 HyGain 18V 10-80 m. vertical \$33.00
 HyGain BN86 Deluxe Balun \$15.95
 HyGain 18 AVT/WB 10-80 meters vertical \$97.00
 Newtronic CGT-144 5.2 dB gain. Trunk lip mount \$39.95
 Newtronic G6-144A fixed station antenna 6dB gain \$52.00
 Gold Line Single Pole, 5 position coaxial switch, wall bracket or panel mount, 1 KW AM \$17.95
 Times Wire & Cable, T-4-50, RG-8 foam 28¢/ft.

Bird We are official distributors for Bird Wattmeters and elements.

C.D. Ham II Rotator

New Improved \$159.95 net **\$139.95**
 SAVE \$20

8 conductor cable for HAM II or CD-44 16¢/ft.
 IC-230 In Stock now. Call or write.
 Drake — Most in stock for immediate shipment.
 Johnson small matchbox. Millen KW Transmatch.
 Astatic D-104 Mike new \$26.10
 Astatic UG-8 Stand for D-104 new \$19.95
 B & W 850A or 852 for PiNet Band switching inductor for \$66.75
 B & W 334A Dummy Load-Wattmeter 0-300MHz 52Ω, 0-10, 100, 300, 1000 watts \$149.95
 B & W 374 Dummy Load-Wattmeter 0-300MHz, 52Ω 0-15, 50, 300, 1500 watts \$175.00
 Sockets for 8072, 8121, 8122 \$3.95
 EBC Jr.-2 meter FM synthesized XCVR \$599.00

MC Jones Mod. 575.5 Micro Match SWR bridge, N Connectors. Use with 200 μa meter. New value \$100.00 \$24.95
 Johnson 154-10 or equal. Single section 23 thru 347 pF for KW transmatch. Replaces Millen 16520 \$35.00
 Johnson 229-202 18 mH variable inductor 10 to 80M for KW transmatch \$35.00
 Johnson 229-203 28 mH variable inductor 10 to 160M for KW transmatch \$37.00
 B & W Minductors - Air-Dux coil stock
 Kenwood TS-520 \$629.00
 Stocking TEN-TEC — Fast Availability!
VENUS Finest SSTV, Latest Models, Ready to Operate. SS-2, SLOW SCAN MONITOR \$349.00
 C1, FAST SCAN/SLOW SCAN CAMERA & CONVERTER \$469.00
We have VIBROPLEX in stock!
 In line Wattmeter — 144-162 MHz, 0-50W., 50Ω \$17.50
 Matched-reflected Power Meter, 144-220 MHz, 1000 W. \$35.00

NPC POWER SUPPLIES

115 VAC Input - 12 VDC 4 amps out \$29.95
 Same as above but regulated \$47.95
 Model 108R — 115 VAC/13.6 VDC 8 amps continuous 12 amps surge. Regulated \$69.95

CONSTANT VOLTAGE TRANSFORMER. Input 115 VAC @ 60Hz output, 24V @ 15 amps \$14.95 ea.
 Call Barry for thousands of unadvertised specials!
 Hammarlund Dual Section 320/320 per section Xmit'g Capacitor \$29.95
 Tubes for worldwide and domestic, commercial service. Large stocks of meters and capacitors.
 Multi 2000 FM, SSB & CW Synthesized 2 meter transceiver \$695.00
 R-389 Receiver. 15-1500 kcs, mechanical digital readout, motorized tuning \$375.00
 Ameco Model PT Preamp, factory wired \$69.95
 Regency HR-6 6 meter FM transceiver, new condition \$199.00
 Sommerkamp FL-2277 Linear Amp. Pair 572B's 10 thru 80 \$290.00
 Heath Warrior HA-10 Amplifier with 4 811A's and power supply \$185.00
 Swan 700-CX with matching 117XC power supply and speaker, plus WM-1500 Wattmeter. All mint, like new \$650.00
 Realistic DX-160 Solid-State General Coverage Receiver with SP-150, like new \$120.00
 Recently received! 2000 meters. What do you need?
 Lots of other goodies.
BARRY BUYS UNUSED TUBES AND VACUUM CAPACITORS. Send Your List. Tube Headquarters. Diversified Stock. Heavy Inventory of Eimac tubes, chimneys, sockets, etc. 3-500Z or 3-400Z Specify \$50.00.

BARRY 512 Broadway NY, NY 10012

DEPT. H-8
 212-WA-5-7000

ELECTRONICS

TELEX 12-7670

Add shipping-excess refunded-Quoted FOB N.Y.C.

Summer Hours

Saturday, 10 a.m. - 2 p.m.

Monday-Friday, 9 a.m. - 6:30 p.m.

For Your Operating Pleasure — A NEW TUNABLE ACTIVE FILTER

How about a tunable active filter for all modes of operation — CW, RTTY, AM, SSB? We've evolved PEAK-N-NOTCH based upon the latest filter theory and integrated circuit technology to yield unparalleled performance. A single knob tunes a deep rejection notch or a high selectivity peak over the 50 to 5000 Hertz band separating desired from undesired signals by more than 30 dB. Q of the filter may be adjusted to meet your individual preference.



In addition, PEAK-N-NOTCH can be used as a versatile test instrument in harmonic and intermod distortion measurements. Battery power eliminates hum and other A-C line induced signals. Phones, a speaker, and high impedance loads may be used with the filter. Silicon integrated circuits and a premium, hot-moulded tuning pot ensure a long, noise free life. It's so good we offer a two year warranty. Only \$44.50 via parcel post or UPS within the USA. Add \$1.00 for shipment by air, plus any applicable local taxes.

RADIATION DEVICES CO., P. O. Box 8450, Baltimore, MD 21234

Advertisers check-off

... for literature, in a hurry — we'll rush your name to the companies whose names you "check-off"

Place your check mark in the space between name and number. Ex: Ham Radio 234

INDEX

Abar	325	K. E.	072
Adva	265	KLM	073
Amidon	005	Kenwood	341
Antenna Mart	009	Kolar	334
Atlas	198	Leland	193
Barry *		Levy	291
Bauman	017	MITS *	
Budwig	233	MFJ	082
Bullet	328	Marketing East	343
Buyers & Sellers	329	Midland	086
CFP	022	N. E. Digital	036
Comcraft	028	Oneida	144
Comm. Spec.	330	PRA Indus.	316
Curtis	034	Palomar	093
Cush Craft	035	Phillcort Digital	344
Dames, Ted	324	Pinon	337
Data Signal	270	Poly Paks	096
Dentron	259	Porta-Pak	274
Drake	039	RMS	239
Dupage	287	RP	098
Dycamm	040	Racom	317
Ehrhorn	042	Radiation Devices	099
Eimac	043	Callbook	100
Electronic Dist.	044	Radio Expo	147
Elect. Equip. Bank	288	Regency	102
ELPROCON	301	Skandia	338
Erickson	047	Southwest Tech.	263
Gem Quad	295	Space	107
Hal	057	S. P. S.	318
Hale Elect.	302	Spectronics	191
Ham Radio	150	Spectrum	108
Hamtronics	246	Teco	113
Henry	062	Ten-Tec	114
Hy-Gain	064	Topeka	115
Icom	065	Triad-Utrad	345
International		VHF Engineering	121
Crystal	066	Value-Pak	264
James	333	Vanguard	346
Jan	067	Webster	255
Janel	068	Weinschenker	122
K-Enterprises	071	Wilson	123

*Please contact this advertiser directly

Limit 15 inquiries per request.

August 1975

Please use before September 30, 1975

Tear off and mail to
HAM RADIO MAGAZINE — "check off"
 Greenville, N. H. 03048

NAME.....
 CALL.....
 STREET.....
 CITY.....
 STATE.....ZIP.....

Advertisers iNdex

Abar Research	90
Adva Electronics	55
Amidon Associates	80
Antenna Mart	74
Atlas Radio Co.	70
Barry	93
Bauman	86
Budwig Manufacturing Co.	90
Bullet	87
Buyers & Sellers	85
CFP Enterprises	84
Comcraft Co.	74
Communications Specialists	64
Curtis Electro Devices	92
Cush Craft	Cover II
Dames, Ted	91
Data Signal, Inc.	75
Dentron Radio Co.	48, 49, 65
Drake Co., R. L.	77
Dupage, FM, Inc.	64
Dycamm	80
Ehrhorn Technological Operations	1
Eimac, Div. of Varian Assoc.	Cover IV
Electronic Distributors	92
Electronic Equipment Bank, Inc.	92
ELPROCON	90
Erickson Communications	86
Gem Quad Products	81
Hal Communications Corp.	59
Hale Electronics	91
Ham Radio	88, 90, 92
Hamtronics, Inc.	86
Henry Radio Stores	Cover III
Hy-Gain Electronics Corp.	95
Icom	5
International Crystal Mfg. Co., Inc.	71
James Electronics	66, 67
Jan Crystals	80
Janel Labs	89
K-Enterprises	76, 84
K. E. Electronics	89
KLM Electronics	2
Kenwood	96
Kolar, Inc.	89
Leland Associates	90
Levy Associates	88
MITS, Inc.	29
MFJ Enterprises	81
Marketing East, Inc.	87
Midland Electronics Co.	89
New England Digital Electronics	91
Oneida Elect. Mfg. Co.	76
PRA Industries	70
Palomar Engineers	78, 90
Phillcort Digital Products	92
Pinon Electronics	78
Poly Paks	82
Porta-Pak	76
RMS Corporation	92
RP Electronics	88
Racom, Inc.	89
Radiation Devices Co.	93
Radio Amateur Callbook, Inc.	58, 81
Radio Expo '75, Chicago FM Club	91
Regency Electronics, Inc.	41
Skandia, Inc.	90
Southwest Technical Products	23
Space Electronics Corp.	90
Specialty Communications Systems	87
Spectronics, FM	68
Spectrum international	45
Teco	69
Ten-Tec, Inc.	79
VHF Engineering, Div. of Brownian Elect. Corp.	7
Valu-Pak	85
Vanguard Labs	78
Webster Radio	90
Weinschenker	63
Wilson Electronics	72, 73

TH6DXX

The ultimate Tri-band

Up to 9.5 db Gain



No other antenna gives you the performance on 10, 15 and 20 meters equal to that of the Thunderbird. Built, without compromise, to be electrically and mechanically superior to everything else.

- Separate "Hy-Q" traps for each band. Tuned at the factory for peak performance. Get optimum results for your preferred mode on transmission, phone or CW, using factory supplied charts.
- Cast aluminum, tilt-head, boom-to-mast bracket accommodates masts from 1 1/4" to 2 1/2" and provides mast feed-through for stacking. (Extra heavy gauge, formed element-to-boom brackets used throughout.)
- All taper-swaged, slotted aluminum tubing for easy adjustment, lightweight, with full circumference, compression clamps instead of usual self-tapping screws used throughout.
- Exclusive Beta Match for optimum matching on all three bands and positive DC ground path.
- 3 active elements on 20 and 15 meters, 4 on 10.
- 25 db front-to-back ratio.
- SWR less than 1.5:1 on all bands at resonance.
- 24' boom, longest in the industry.
- 20' turning radius, 6.1 sq. ft. surface area, 61.5 lbs. net weight.

6-Element Super Thunderbird Model 389

Other Popular Tri-band Beams by Hy-Gain:

3-Element Thunderbird
Model 388

2-Element Thunderbird
Model 390

3-Element Thunderbird Jr.
Model 221

*For best results, always use a
BN-86 Balun with your beam.*

For prices and information, contact your local Hy-Gain distributor or write Hy-Gain.

hy-gain

Hy-Gain Electronics Corporation; 8601 Northeast Highway Six; Lincoln, NE 68507; 402/464-9151; Telex 48-6424.
Branch Office and Warehouse; 6100 Sepulveda Blvd., #322; Van Nuys, CA 91401; 213/785-4532; Telex 65-1359.
Distributed in Canada by Lectron Radio Sales, Ltd.; 211 Hunter Street West; Peterborough, Ontario.

KENWOOD

...Why settle
for less!

There are several good transceivers on the market today. But if you compare them carefully . . . study the specifications, note the important features, and finally talk to some Kenwood owners, you will have to come to the same conclusion that thousands of others have come to . . . you can't buy a better rig for the money than a Kenwood. Every unit is built with pride and designed to give top performance year after year. Join the switch to Kenwood.



The TS-520 shown
with the VFO-520 and SP-520

The TS-520 is the final word in SSB transceivers . . . the "hottest little rig on the air." It is a compact, mostly solid state, all-in-one transceiver with built-in AC/DC power supply and speaker. It operates SSB and CW on 80 thru 10 meters. Features include 2-position ALC and double split frequency controlled operation.

Available at select Kenwood dealers throughout the U.S.

Distributed by



**TRIO-KENWOOD
COMMUNICATIONS INC.**

116 East Alondra / Gardena, California 90248

either way... you can save from \$50 to \$500 with a Henry Radio antenna package

A

Special packages with special savings...

Package No. 1

Swan TB-2A
Tristao MM-40 or Triex SM-40
CDR CD-44
RG-58 100'
Control Cable 100'
Retail Price: approximately \$565
Package Price: \$489

Package No. 2

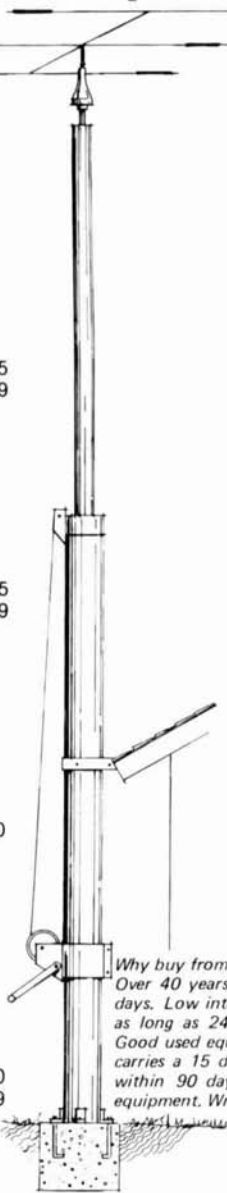
Swan TB-3HA
Tristao MM-40 or Triex SM-40
CDR Ham-11
RG-8 100'
Control Cable 100'
Retail Price: approximately \$695
Package Price: \$579

Package No. 3

Swan TB-3HA
Tristao CZ-454 FS or Triex W-51
5' mast
CDR Ham-11
RG-8 100'
Control Cable 100'
Retail Price: approximately \$1090
Package Price: \$889

Package No. 4

Swan TB-4HA
Tristao CZ-454 FS or Triex W-51
5' mast
CDR Ham-11
RG-8 100'
Control Cable 100'
Retail Price: approximately \$1150
Package Price: \$ 939



B

or design-it-yourself...and you'll still save

For many years Henry Radio has been providing a beam-antenna package program for amateurs who wanted an efficient but economical package. Thousands have benefited from this offer in the past. In recent years we have offered the customer the versatility of designing their own system with the components that they want. Our only requirement is the purchase of at least:

- 1 Antenna
- 1 Rotator
- 1 Tower
- 100' Rotator Cable
- 100' Coax Cable

We stock merchandise from the following manufacturers and our packages normally include their products.

- Hy Gain Antennas
- Mini Product Antennas
- Mosley Antennas
- Swan Antennas
- CDR Rotators
- Ascom Towers
- Tristao Towers
- Triex Towers
- Accessories of all kinds

Send us a note telling us what your choice is and we'll send you our low package price.

Why buy from Henry Radio?

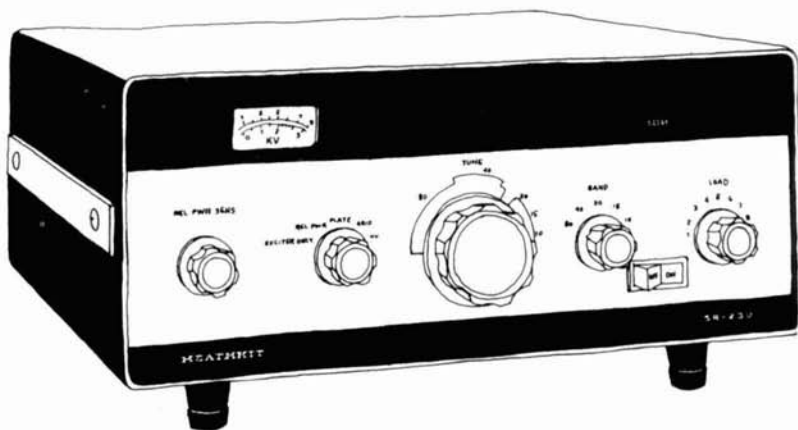
Over 40 years experience. No finance charges if paid within 90 days. Low interest contracts - 8%/yr add on (14% annual rate) - as long as 24 months. 10% down or trade-in down payments. Good used equipment. Most makes and models. Used equipment carries a 15 day trial, 90 day warranty and may be traded back within 90 days for full credit towards the purchase of NEW equipment. Write for literature.

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

Prices subject to change without notice.

Heathkit chooses EIMAC.



Again.

The new, system-engineered Heathkit SB-230 conduction-cooled linear amplifier uses the rugged EIMAC 8873 to provide 1200 watts PEP SSB input with less than 100 watts drive power.

Rated to 500 MHz; the conduction-cooled 8873 coasts along at 30 MHz, providing low intermodulation distortion and high gain in a cathode driven circuit.

Companion air-cooled power triodes are the 8874, with an axial-flow anode, and the 8875, with a transverse-flow anode.

Join Heathkit as one of the knowledgeable users of EIMAC power triodes. For full information, write EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California 94070. Telephone (415) 592-1221. Or get in touch with any of the more than 30 Varian/EIMAC Electron Device Group Sales Offices throughout the world.

