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HAM RADIO HORIZONS

JULY 1981

volume 14, number 7

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publisher's log

by Skip Tenney

The verdict is starting to roll in and it looks like a good one. As I write this several weeks before you see it, we're already starting to receive a number of our readers' questionnaires from the June issue. Thus far, an overwhelming majority of both *ham radio* and former HORIZONS readers have told us that they like our new combined magazine as well as or even better than before. Your comments have not come without some good criticism, but overall the consensus is quite positive.

After meeting with many of you at hamfests, club meetings, and in the course of our normal business activities we had felt that this would be the case. However, as good as intuition may be, it is very reassuring to know for sure that you are on the right course. Equally reassuring, if not even a bit more so, is the news from our accounting department. After over two years of almost consistent bad news, primarily caused by Ham Radio HORIZONS, we have been in the black since the first of February. It's quite exciting to have the whole *ham radio* organization back on a solid footing once again.

I'm sure you have already noted the thicker magazine we have been able to put out several times already this year, thanks to our good response from advertisers. Not only will this mean more pages, but it will also allow us to add some excellent new features in the months ahead. For instance, in September we will be introducing a new license upgrading series by Robert Shrader, W6BNB. Bob's book, "Electronic Communication," published by McGraw-Hill, now in its fourth edition, has become the leading authority in both the commercial and Amateur license study field. Bob will be putting all his great experience in this area to work for you, and I'm sure you'll find this one of the most readable and rewarding parts of our magazine each month.

In addition to a number of other good ideas that our own staff has been working on, you readers have given us a considerable number of new projects that are worthy of serious thought. We are finding a lot of excellent suggestions being enclosed with the many questionnaires we have received so far. Of course, these questionnaires are just starting to roll in now, so we'll probably really have our hands full in another week or so when we are looking at several times the number currently on my desk.

While we are on the subject of the questionnaire I'd like to ask again that if you have not already filled it out, why not take a few moments to turn to page 49 of our June issue and give us your thoughts on *ham radio*'s new look. It's not often that you get an opportunity like this to help guide the future of what we hope is your favorite magazine.

In closing I'd like to thank all of you for your encouragement and support during our rather difficult transition period. It would have been a much greater task for all of us here at *ham radio* if we didn't feel that you were behind us in our efforts to bring you the very best magazine in Amateur Radio today.

Skip Tenney, W1NLB

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Observation & Opinion

This month we welcome a guest editorial by well-known DXer and author Bob Locher, W9KNI, who has a few words to say about today's Amateur transceivers. You, also, are encouraged to offer your observations and opinions. Those we consider to be in the best interest of Amateur Radio will be selected for future issues. Please type your material on 8-1/2 by 11-inch paper, double spaced, with 2-inch margins.

I would like to remind readers who have not already done so to please complete the readers' survey form that appeared in last month's issue. We need your input.

Alf Wilson, W6NIF, Editor

In most respects, the state of the art of Amateur Radio equipment achieved the high-frequency operator's requirements around 1954, with the introduction of the Collins 75A-4/KWS-1 combination. These big black boxes were stable, with repeatable frequency readout to less than one-half kHz. They offered outstanding performance on SSB and CW, were reliable, and were a joy to operate. In fact, a lot of them are still in active service.

On the other hand they were large, expensive, did not offer transceive capability, and depended on "hollow state" technology. But they established a new benchmark of performance for Amateur equipment and inspired a succession of fine equipment, both from Collins and other manufacturers. Phone operators never had it so good.

Neither did CW operators. At last — stable receivers; stable enough to make really sharp CW filters usable — and a new generation of fine CW filters as well! And, stable transmitter VFOs whose outputs stayed put. Use of heterodyne techniques instead of multiplier VFOs made CW signals clean and chirp free, even on 10 meters.

The new SSB rigs required a new kind of amplifier, called a linear, and the old push-pull pair of 250THs was obsolete. The new linears worked well on CW too, and didn't affect keying characteristics as did the old class C amplifiers; and they even had less TVI! The late fifties were great days for CW ops for sure, thanks to all that new SSB gear.

But then equipment design began to change. Collins brought out the KWM-1, and the dawn of the transceiver age arrived. It is certainly unnecessary to detail the success of this concept in high-frequency equipment. The convenience of operation for SSB and the reduction in costs and size made the concept a huge success.

In design, the early transceivers treated CW purely as an afterthought. There was no provision for CW filters in the receiver section, nor was there any provision for moving the frequency of the receiver slightly to accommodate different offsets. Little thought was given to waveform shaping of the keyed output. In justice, however, all the manufacturers of these transceivers also offered separate receiver/transmitter combinations that made fine CW equipment.

Then, transceiver sales began to far outstrip sales of separates, largely due to economic considerations — a transceiver cost little more than a receiver *or* a transmitter. In response, the more enterprising suppliers offered provision for CW filters in their transceivers and began to pay attention to the keyed waveform output. About this same time, paired separate receiver/transmitter combinations were discontinued, and this is pretty much where we find ourselves today.

The current generation of transceivers, with few exceptions, have no capability for accurate zero-beating of another CW signal. The most guidance generally given is what the receiver offset is, if no receiver incremental tuning is in use. Beyond that, you're on your own.

What is the result of this? We have CW QSOs where the two stations walk up the band in tandem, each recentering the other in his receiver at each over. CW ops using transceivers usually end up getting creamed in pileups, because they can't accurately place their transmitted frequency. Even worse, many CW QSOs use two frequencies, separated by as much as 500 Hz, when only a single frequency is needed; but the transceiver-equipped operators can't find it. Obviously, this causes QRM.

Today, we even have a situation where two major manufacturers offer separate receivers matched to their transceivers, but with absolutely no realistic way to zero the transceiver's output in the "matching" receiver. What, then, is the value of the separate receiver?

There *are* ways to cure these deficiencies. The simplest technique is to see that the audio CW monitor is precisely equal in frequency to the differential frequency of the offset used between the transmitted and received frequency, with provision to key the monitor only. This is the method offered in the new Collins KWM-380.

A deluxe technique that would make transceivers as useful on CW as separates would be to make variable both the frequency of the CW monitor and the offset differential, with perfect tracking, so that the audio monitor only could be keyed, and then adjusted to zero beat the received station precisely. The additional cost would be negligible, and these techniques would work equally well with outboard VFOs.

Bob Locher, W9KNI

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- Built-in demodulator is a proven ST5000 demodulator, not a simple compromise.

[1]Use your own high voltage loop supply.
[2]External modem recommended for 300 baud.

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More Details? CHECK—OFF Page 106

comments

protecting Amateur Radio

Dear HR:

Where are the hams with legal training, lawyers who understand electronics and who have a desire to serve the Amateur community while possibly making a buck, who have imagination and verve?

It was depressing to read in *ham radio*, March, 1981, a brief statement concerning an Amateur who had been sued by a neighbor for causing interference in the neighbor's stereo. The Amateur was ordered by a judge to cease operation. This item seems quite newsworthy to the Amateur community, but it happened in 1977 and I had not previously been aware of it.*

Some of us have heard of situations where hams have been forced to choose between giving up the hobby or spending large amounts in legal fees to fight for their rights, but there has been no communication of the facts to Amateurs on a current, national basis. Those situations evidently arise infrequently and in widely scattered areas so none of us know the full story. We need to become aware before many legal rulings become precedent setting, adversely affecting all of us. What is needed is a central clearing house where hams experiencing problems can seek and find relief through action taken by professionals in the fields of electronics and law. If every ham were to participate, the necessary supporting fee would be very low, and every ham could be encouraged to participate regardless of affiliation or lack of affiliation in any other organization. We must all stand together. If support were denied to any ham, and he were to lose in court, undesirable precedents could adversely affect all hams.

In organizing there can be great strength, to wit, the National Rifle Association. We need such strength to protect us from the avarice of manufacturers who could build stereos immune to interference but reject that idea as too costly. Remember the rampant TVI problems of years ago? Nearly non-existent now, in part because of improved TV receivers.

If the logic used by the judge ordering an Amateur to cease operations were to be carried to its ultimate, we could shut down the airlines. At least, they come in 5 by 9 in my stereo.

We need to become organized. Won't someone take the initiative?

Donald E. Thomas, K2JIY
Millville, New Jersey

Two organizations are available to help Amateurs with legal problems related to Amateur Radio: the ARRL through its Membership Services section and the Personal Communications Foundation (PCF), which provides an Amateur's attorney with information pertaining to the Amateur's problem. This information is furnished by attorneys who are members of the PCF. The PCF may be reached through Mr. Joe Merdler, Suite 203, 9036 Reseda Blvd., P.O. Box 812 Northridge, CA 91328. The phone number is (213) 349-6950.

*A subscription to *HR Report*, issued every two weeks, will keep you posted on the latest happenings in Amateur Radio. Editor

county awards

Dear HR:

I am the Western States county award manager for the CHC award program. The CHC award program is active again through the efforts of interested Amateurs now assuming various responsibilities since the death of the former manager, Cliff Evans, K6BX.

The Western States part of the county award program encompasses Alaska, Hawaii, California, Oregon, Washington, Nevada, Arizona, Utah, Idaho, Wyoming, and Montana. The awards are available to both licensed Amateurs and SWLs.

Also available are the 10K and 20K U.S. Pacific awards, which are issued for confirmed contacts with 10, 20, or more of those prefixes issued to Amateurs in the islands under the jurisdiction of the U.S.A.

Another fine award is our version of the A-1 operator award. This is quite different from the ARRL A-1 Operators' Club, and is structured to allow recognition of superior Amateur operating practice by any three Amateurs.

Details on these and other awards in the program are available for an SASE to Scott R. Douglas, Jr., KB7SB, Post Office Box 46032, Los Angeles, California 90046.

We hope to hear from you.

Scott R. Douglas, Jr., KB7SB
Los Angeles, California

good work

Dear HR:

I am surprised about your combined magazines. It will be great if some of the really good features of *HORIZONS* are put in your magazine, like DXer's Diary, and mixed-general ham radio and technical features.

I am looking forward to getting your great magazine!

Donald Youtkus, KA2GSX
Scotch Plains, New Jersey

wearing cans

Dear HR:

I'm writing in reference to the article on better audio for mobile operation that appeared in *ham radio*, February, 1981, pages 48-49. Although reference is made to some headphones, such as Sennheiser, not blocking out road noises, I think your magazine should point out that in many states (including Illinois) it is illegal to drive an automobile while wearing headphones (whether they block out road noises or not). Readers should be warned to check local and state laws before setting out wearing "cans."

Ken Van Andel, WB9FRV
Aurora, Illinois

presstop

ARRL'S BOGUS-QSL INVESTIGATION continues, with three DXers now suspended from the DXCC program. A prominent DXpeditioner has resigned from DXCC, and still others are being checked for apparently submitting questionable cards for credit.

Phoney DX Cards First Attracted the attention of DXCC program manager W3AZD late last year. Photocopies of questionable cards, with the submitter's call blocked out, were sent to the DX station or his manager along with a request for a list of the stations worked around the time shown. Not only did the submitter's call not appear in that list, but some of the DX stations even responded with "not on that band...or mode...or even on the air" at the time shown, and further commented the writing was not theirs or any assistant's.

Bogus Cards For About two dozen different rare DX stations have thus far shown up in Newington, though there have been claims that far more than that have been printed. Most are for stations who were active in the 60s or early 70s, though a few are current. The one DXer whose suspension is definitely related to the counterfeits is W6NZX. Two Europeans, whose calls have not been announced, have also been suspended but for alterations or other apparently unrelated QSL questions. The DXpeditioner who is resigning is Dr. Dave Gardner, K6LPL, who discussed his involvement freely in a telephone conversation with HR Report.

K6LPL Said The Bogus Card Idea began at an informal meeting of a dozen or so DXers (including a number of Honor Roll Members) at the 1980 Fresno DX convention. Several were also DXpeditioners and all agreed that DXing was in a sad state with pursuit of QSLs an obsession. Cheating was rampant, they felt, yet the ARRL had seemed unresponsive to calls for change. Then they hit on the idea of wholesale counterfeiting of rare cards, as a means of demonstrating the present system's weakness. Dave believes at least 20,000 of the phoney cards were printed, and they've been passed out by both U.S. and overseas Amateurs to hundreds of others. Because of his part in the scheme, he has now submitted his letter of resignation to DXCC to the ARRL.

Just How Many DXers Will eventually be involved is still to be determined. In the meantime, all DXers are warned to beware of cards from long past contacts or coming from unusual sources.

AMATEURS SERVING AS POLICE "eyes and ears" in a Los Angeles Police Department project found themselves providing needed communications in a kidnapping/shooting incident on May 8th. The volunteer program, operating just over a month, puts Amateurs with hand-helds at vantage points in likely crime areas. They report suspicious activities to others riding in prowl cars for follow-up. Thus far they've broken up one attempted rape and reported several possible car break-ins.

The Episode On May 8th Began when four Amateurs and a police advisor, atop the Hollywood Holiday Inn, heard shots fired from a room just beneath them. Police from various agencies, converging on the scene, found an immediate problem with a lack of common communications frequencies and portables. The Amateurs stepped into the breach, providing coordinating communications for several hours during negotiations with the gunman, who was holding a girl hostage in his room. Eventually she escaped, and early the next morning the gunman apparently shot himself.

160 METER POWER LIMITS will be lifted shortly, at least on the bottom half of the band. At its May 21 agenda meeting the Commissioners agreed to restore full privileges to 1800-1900 kHz now that Loran A is phased out in the U.S. However, since Canada is still using Loran A above 1900 kHz, the present restrictions must remain in effect on the top half for the time being.

Effective Date For The Relaxation has not yet been announced, but should be sometime early in the summer.

10 MHZ SHOULD BE RESERVED for narrow-band (CW and RTTY) Amateur use only, the 200 Amateurs attending the Region I IARU conference in Brighton, England, generally agreed late in April. A couple of nations, however, still want SSB on the new band. Representatives of IARU member societies from around the world attended the busy four-and-a-half-day session. The meeting saw the best turnout ever of African IARU representatives.

Contests Should Also Be Kept Off the new 30-meter band, the conference agreed, though unlike the ARRL the Region I societies felt that awards for 10-MHz operating achievements would be OK. They also agreed on SSB for the new 18- and 24-MHz bands, with narrow-band modes taking the bottom half and phone the top. A new satellite working group was also established and satellite band plans set up.

10-GHZ MOBILE OPERATION has been demonstrated by three Canadian Amateurs, VE2DWG, VE2FMF, and VE2FRJ. The first contact was made back in February, and even with antennas inside the cars usable signals were found at distances up to a mile despite intervening buildings and other autos. Doppler shift was quite noticeable, however.

More Details? CHECK—OFF Page 106

FSK adapter for SSB transmitters

An easy method for exploring RTTY

I wanted a new mode of operation for my station. I've been thinking about a microcomputer for both domestic and radio use, and two recent FCC rulings made me interested in RTTY.

My station was designed for SSB or CW only, but there should be a way to operate RTTY using an audio modulator-demodulator, or modem. The following article describes how I did it. I hope others will follow suit.

the modem

The FCC now allows ASCII seven-bit code on high-frequency Amateur bands at 110 or 300 Baud.* ASCII is similar to the five-bit Baudot code of mechanical teleprinters, but has the advantage of being able to communicate with all modern computer systems for character transmission. This might be a breakthrough for Amateurs who want to use their computers for communicating rather than for the more conventional purposes of logging, satellite tracking, or home games.

I decided to build a modem that would make possible FSK using my SSB equipment. I'd read that some Amateurs use audio tones for FSK, and so an audio modem seemed a good route. A keyboard for character generation and a CRT display would complete the FSK adaptation. This would work with either ASCII or Baudot.

The second FCC ruling on F1 emissions indicated that this was the correct choice. F1 emissions are allowed on high-frequency bands, but the ruling states that audio tones into the audio input of a single-sideband transmitter must have good carrier and unwanted sideband suppression to qualify for F1 emission. Certain precautions would be required to meet these criteria.

This article concerns the modem design and describes how to incorporate the modem into a complete video terminal for either ASCII or Baudot. Such a system could eventually lead to exchanging computer programs over the air.

design concepts

Modem design began with the following primary goals:

1. Use a single 5-volt power supply.
2. Use a minimum number of ICs.
3. Use TTL-compatible interfaces for expansion.
4. Use audio-frequency operation for standard SSB equipment input and output.

The demodulator is a single chip made for this purpose, an Exar XR-2211 demodulator/tone decoder. It contains a preamp, phase locked loop (PLL), and comparators. Preamp dynamic range guarantees tracking with 3 mV - 3 volt rms input levels. Center frequency, bandwidth, and output delay are inde-

*ASCII is an acronym for "American Standard Code for Information Interchange." A Baud equals bits per second in this code.

By Thomas B. Zeltwanger, WA3PLC, Box 62, State College, Pennsylvania 16801

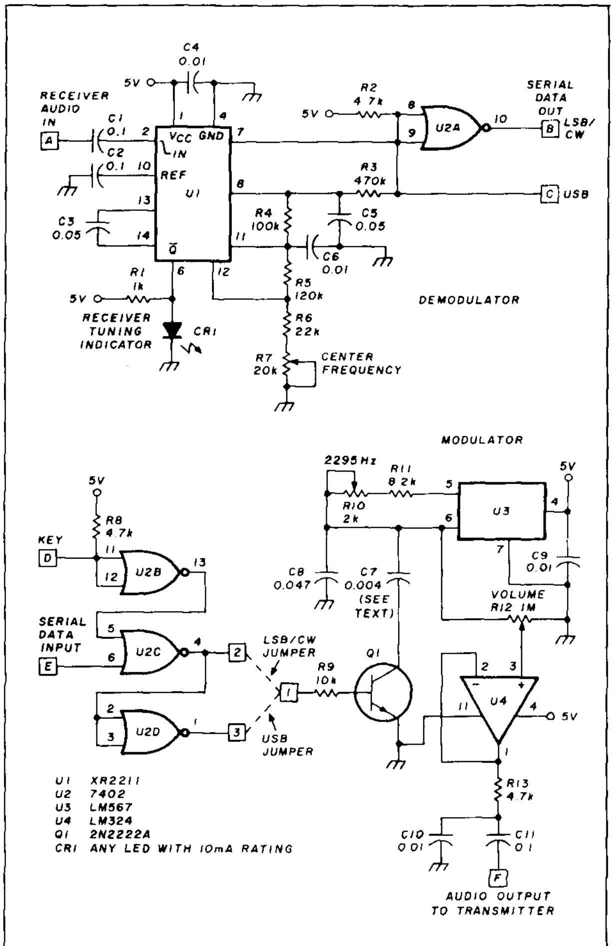


fig. 1. Modem schematic diagram.

pendently set; breadboarding and alignment are very easy.

Receiver audio output is connected to the audio input, A, of **fig. 1**. Normal FSK *shift* frequency is 170 Hz, so a CW receiver filter worked best. Its narrow bandwidth reduces noise and allows the demodulator to track the audio mark and space tones faithfully. Different receiver filters may require different center frequency adjustments (R7). Demodulator center frequency is given by:

$$f_0 = \frac{1}{C3(R6+R7)} \qquad (1)$$

All values are in Hz, farads, and ohms. (I started with 900-Hz center frequency but had to decrease this to 750 Hz for my receiver.)

Tracking bandwidth for shift frequency f_s is determined by R5 and is given by:

$$R5 = (R6+R7)(f_0/f_s) \qquad (2)$$

Other values were taken from the XR-2211 specification sheet. A useful feature is the PLL lock signal: A LED connected to pin 6 is used for a tuning indicator. Serial-data output goes to the video board and is explained later.

modulator section

The current-controlled oscillator section of an LM567 tone decoder, U3, generates mark and space tones of 2125 and 2295 Hz. C8, R10, and R11 set the 2295-Hz frequency with Q1 cut off. When Q1 is conducting, C7 is in parallel with C8, and the frequency shifts down by 170 Hz. C7 may have to be trimmed slightly for the correct shift.

Ideally, a pure sine wave should be used for modulation. U3 produces a triangular waveform. A triangular shape, or any continuous waveform, can be thought of as a combination of harmonics differing in amplitude and phase. A triangular waveform can be expressed by the Fourier series:

$$V = \sum_{i}^{\infty} \frac{A}{i^2} \sin(i\omega_0 t) \qquad (3)$$

where:

i = 1, 3, 5, 7,...(harmonics, 1 = fundamental)
A = normalized peak amplitude of fundamental signal
$\omega_0 = 2\pi f_0$ = radian frequency of fundamental signal
$t = 1/f_0$ = period of waveform

The triangular waveshape is composed of the fundamental and odd harmonics. Calculation indicates that the third harmonic of 2125 Hz is 1/9th the power level of the fundamental, or down 9.5 dB.

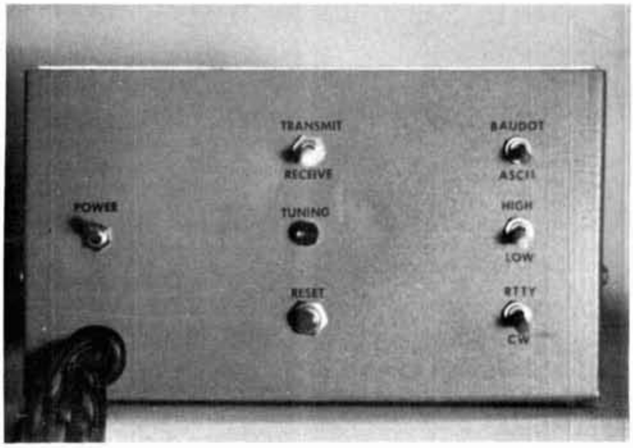
Buffer amplifier U4 isolates the oscillator and provides a means of setting transmitter audio input level. Legal operating practice requires a bandwidth under 3 kHz. The RC lowpass filter, R13, C10, smooths harmonics; the −3 dB point is at 3386 Hz.

calibration

The modulator must be calibrated with a frequency counter or accurate oscilloscope. With Q1 cut off, R10 is set for a 2295-Hz tone. With Q1 conducting through the serial-data input gate (input ground, output to Q1 base high), a value of C7 is found to lower the tone to *exactly* 2125 Hz.

My calculations indicated a 0.0037-μF cap should do the job. A 0.005-μF was tried, but the shift was too great, according to one Amateur with a tunable i-f filter. A 0.0015- and 0.0022-pF cap in parallel worked fine.*

*A high-value mica padder capacitor from the junkbox would be ideal for this trimming. **Editor**



Front panel of the modem box. All switches are accessible. A tuning indicator is included, which is helpful when receiving narrowband signals on RTTY.

Volume control level R12 should be set for an equivalent-to-strong voice input. Adjust this pot with caution, since the RTTY duty cycle is 100 percent and can strain the final. It's the same as CW operation with the key held down continuously. I turn down the drive power input; the final still runs very warm.

Demodulator center-frequency adjust pot, R7, is the only adjustment used for receiving. Tune the receiver so that both FSK tones are in the receiver passband. Adjust R7 for maximum LED intensity or until characters are visible on the monitor screen.

operation

Best reception is obtained with the narrowest receiver filter available. I use a 500-Hz i-f filter and CW mode — sometimes with an additional audio filter. Transmission must occur in the sideband mode.

Provisions have been included for inverting the FSK tones, as indicated by the jumpers and alternate data outputs in **fig. 1**. (This is required for frequency offsets and filter bandwidths in different receivers and transmitters.)

Upper sideband mode was first tried for both transmitting and receiving, but I couldn't use my 500-Hz receiver filter in the SSB mode. Reception is now in CW mode, and transmission is on lower sideband. I offset-tune the receiver to zero-beat received signals. Tones are "right-side-up" in CW/LSB; that is, the higher tone is higher on the dial; they are inverted when using USB. Keep this in mind, because the demodulator will be working fine but printing will be garbled.

In CW/LSB, the idle (mark) tone will be lower in frequency, and jumper 1-2 is used. Demodulated output is taken from **B (fig. 1)**.

test results

On-the-air tests have been encouraging. The narrow receiver bandwidth makes tuning somewhat critical but is eased appreciably by the LED indicator. After a few hours' experience, I became familiar with the response and had no real problems.

Very weak stations can be copied, but the PLL tends to unlock from noise. I've copied strong stations in 60 wpm Baudot for as long as an hour and a half with no loss of information. At higher Baud rates, the noise on 40 meters becomes a problem, but copy is still possible. I've also copied ASCII at 110 Baud on 20 meters.

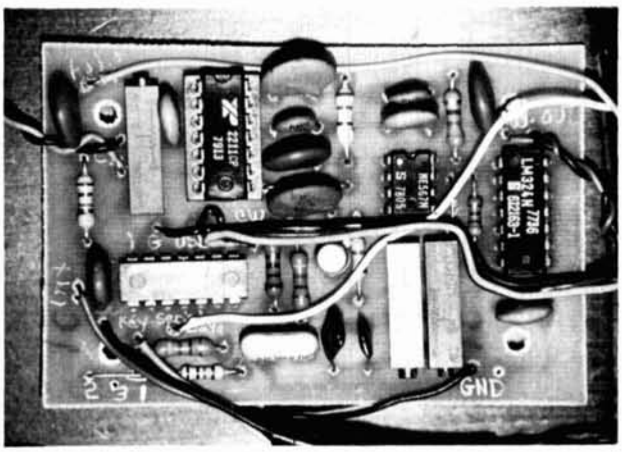
ASCII reception was over 95 percent error-free under normal circumstances. Most RTTY on the hf bands has been heard between 14.075 and 14.100 MHz, including many DX stations. I have not yet heard anyone using 300-Baud ASCII.

some uses

The modem will interface with any TTL-compatible serial video terminal. It can also be used with a teleprinter to replace an RTTY converter; input and output must be modified for the 20-mA current loop in teleprinters.

Keyboards are readily available from surplus dealers for under $50. Video monitors with 12-MHz minimum bandwidth may be used for the display. The most expensive part of my FSK system is the video board.

Video boards are made in many configurations. The one I used is the Xitex SCT-100 and seems to have been designed with the Amateur operator in mind. It's capable of both ASCII and Baudot operation; its speeds are 60 and 100 wpm in Baudot, 110 or 300 baud in ASCII. It may be purchased in kit form or fully assembled.



Printed-circuit board of the FSK modem. The two ICs at left make up a computer interface, allowing the video terminal to be used on the air or as a computer console.

A block diagram of my terminal system is shown in **fig. 2**. The modem is installed between the video board and all other equipment. The "key" is any switch connected to terminal **D** in **fig. 1**, and is used for calibrating the modulator tones.

The same system, less transmitter and receiver, has been used as a microprocessor terminal with no problems. Future applications will include the addition of a cassette tape, instead of paper tape, for prerecorded messages. Limited tests indicate that this is feasible.

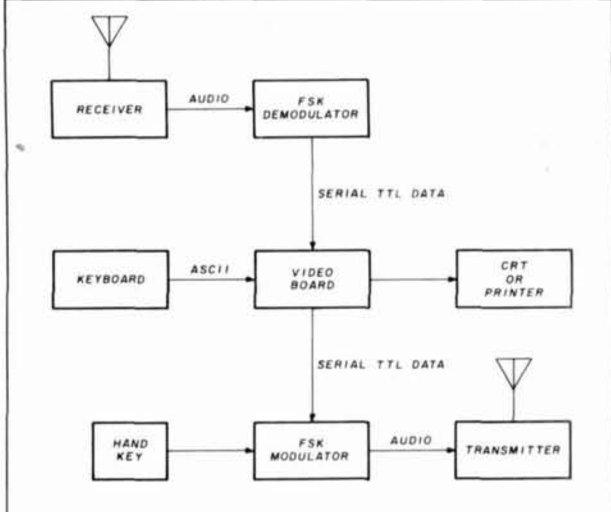


fig. 2. System block diagram.

some final thoughts

My system works well but my station is in an apartment, with the antenna about ten feet (3 meters) from my rig. Rf shielding was a problem, because the video board generates a lot of RFI on 20 meters. I've heard the same complaint from others using computers on RTTY. Tests at another location indicated that RFI is minimal with the antenna farther away from the transmitter.

PC boards are available from the author for $5.00 plus postage. All circuit components are readily available from hobby dealers.

I'd like to extend special thanks to K4YI and KØWVN, who were very helpful with my first on-the-air tests.

video board suppliers

Xitex Corporation (manufacturer), 13628 Neutron, Box 402110, Dallas, Texas 75240. Mini Micro Mart, Incorporated, (distributor), 1618 James Street, Syracuse, New York 13202.

ham radio

Solid advice
for
mail-order buyers

shopping for parts by mail

To many hams, buying parts simply means a trip to the local franchised radio store, where the counter salesman is given a parts list to fill. All too often, however, the enthusiasm for your latest project is spoiled either by "out-of-stock," or by high prices. The instant-delivery convenience of the round-the-corner radio store is frequently paid for in great cost of both dollars and wasted time.

What to do? It's a good idea to *preplan* construction projects far in advance; to develop a complete parts list, with a breakdown into separate lists — those that are best filled by mail-order means, and those that are best filled locally.

I'm not knocking local buying; there are many occasions when it *is* best to shop locally. I'll cover the development and breakout of parts lists for mailorder purchase, present some tips on making parts substitutions, offer some general mail-order buying hints, and discuss the pros and cons of buying in advance of needs. Also I'll discuss the problem of component identification.

The list: getting it together

Most published construction projects include an itemized parts list that states each part's nomenclature, size, value, required voltage, current, or power-handling capacity, and other necessary information. Some projects even list brand names and recommended sources for difficult-to-obtain components.

The basic parts list can be broken down in several ways — by type of component, or — in the way I prefer — into two lists: by parts that are best locally procured, and by those that are best acquired by mail order. The two lists can be broken down *again* by type component to facilitate shopping and ordering. You must know something about the electronic marketplace to set up the lists, of course, and it helps to have on hand a generous selection of current catalogs and flyers to sort out which components should go on which list.

Having a good-size pile of catalogs will enable you to find almost any desired part in one of them and will often allow you to locate a single mail-order firm that may have all, or nearly all, of what you need. Having a variety of catalogs also allows you to easily make price comparisons.

Table 1 is a list of dealers. Many offer free catalogs that can be obtained by filling out the reader service cards found in electronic and Amateur-Radio magazines.

After thoroughly checking your junkbox, the buy-local list is used first, so that out-of-stock items can be identified and added to the mail-order list. You'll want to at least scan the mail-order flyers and check out local sales and hamfests to see if any bargains turn up that would suggest switching an item from one list to the other. It pays, too, to consolidate mail-order "buys," due to steep postage charges, minimum order limits, and handling fees. The word is: plan ahead.

By Karl Thurber, Jr., W8FX, 317 Poplar Drive, Millbrook, Alabama 36054

table 1. Direct-mail electronic parts dealers.

Active Electronics Sales Corp.
P. O. Box 1035
Framingham, MA 01701
(617) 879-0077

ADVA Electronics
Box 4181
Woodside, CA 94062
(415) 328-1500

Alaska Microwave Labs
4335 E. 5th Street
Anchorage, AK 99504

All Electronics
Box 20406
905 S. Vermont
Los Angeles, CA 90006

Adelco
2789 Q Milburn Avenue
Baldwin, NY 11510
(516) 378-4555

Ancrona
P. O. Box 2208
Culver City, CA 90230
(213) 641-4064

Applied Invention
RD 2, Route 21
Hillsdale, NY 12529
(518) 325-3911

B & F Enterprises*
119 Foster Street
Peabody, MA 01960
(617) 531-5774

Bullet Electronics*
P. O. Box 401244
Garland, TX 75040
(214) 278-3553

Chaney Electronics
P. O. Box 27038
Denver, CO 80227
(303) 781-5750

Digi-Key Corp.
P. O. Box 677
Thief River Falls, MN 56701
(218) 681-6674

Digital Research Corp. of Texas*
P. O. Box 401247A
Garland, TX 75040
(214) 271-2461

Edlies Electronics, Inc.
2700-DP Heampstead Turnpike
Levittown, NY 11756
(516) 735-3330

Electronic Distributors, Inc.
4900 Elston Avenue
Chicago, Il 60630
(312) 283-4800

ETCO Electronics
North Country Shopping Center
Plattsburgh, NY 12901
(518) 561-8700

Fair Radio
1016 E. Eureka
Box 1105
Lima, Ohio 45802

Formula International, Inc.
12605 Crenshaw Blvd.
Hawthorne, CA 90250
(213) 973-1921

Fuji-Svea Enterprise**
P. O. Box 40325
Cincinnati, OH 45240
(800) 421-2841 (Nationwide)
(800) 421-2877 (Ohio)

Godbout Electronics
Box 2355
Oakland Airport, CA 94614
(415) 562-0636

Hal-Tronix
P. O. Box 1101
Southgate, MI 48195
(313) 285-1782

Hobbyworld
19511 Business Center Drive
Northridge, CA 91324
(800) 423-5387 (Nationwide)
(800) 382-3651 (California)

Integrated Circuits, Unlimited*
7889 Clairmont Mesa Blvd.
San Diego, CA 92111
(800) 854-2211 (Nationwide)
(800) 542-6239 (California)

International Components Corp.
P. O. Box 1837
Columbia, MO 65201
(314) 474-9485

International Electronics Unlimited
225 Broadway
Jackson, CA 95642
(209) 223-3870

Jameco Electronics
1021 Howard Avenue
San Carlos, CA 94070
(415) 592-8097

JDR Microdevices
1101 S. Winchester Blvd.
San Jose, CA 95128

Marlin P. Jones & Assoc.
P.O. Box 12685-E
Lake Park, FL 33403
(305) 848-8236

John Meshna, Jr. Surplus Supplies
Box 62
E. Lynn, MA 01904
(617) 595-2275

MHz Electronics
2111 W. Camelback
Phoenix, AZ 85015
(602) 242-3037

M-M Electronics Sales
2300 1st Avenue
Seattle, WA 98121
(800) 426-0634

McGee Radio Co.
1901 McGee Street
Kansas City, MO 64108
(816) 842-5092

New-Tone Electronics International**
P. O. Box 1738
Bloomfield, NJ 07003
(800) 631-1250

Olson Electronics
2850 Gilchrist Road
Akron, OH 44305
(800) 321-2424

Poly-Paks
P. O. Box 942
S. Lynnfield, MA 01940

Quest Electronics
P. O. Box 4430C
Santa Clara, CA 95054
(408) 988-1640

Radiokit
Box 411
Greenville, NH 03048
(603) 878-1033

Ramsey Electronics
2575 Baird Road
Penfield, NY 14526
(716) 586-3950

Semiconductors Surplus
2822 N. 32nd Street, Unit 1
Phoenix, AZ 85008
(602) 956-9423

Solid State Sales
P. O. Box 74A
Somerville, MA 02143
(617) 547-7053

Surplus Electronics Corp.
7294 N. W. 54th Street
Miami, FL 33166
(305) 887-8228

notes:
(1) *No minimum order or handling charge. There may be postage charges, however.
(2) **Specializes in Japanese semiconductors.
(3) Most of the firms listed will accept major charge cards, such as Master Charge or Visa, on telephone orders. A larger minimum order size may be required, however.
(4) The "800-series" numbers listed are toll-free.

parts substitution

This discussion leads to the question of substituting components. It's especially important when it comes to buying by mail, since it's inconvenient, time-consuming, and expensive to return wrong-choice components — not to mention the frustration involved. It's a fact that most small parts that aren't right usually end up in the junkbox, since it's normally not worth the effort to return them — and what's in the junkbox is seldom what's needed for a given project.

over-rated components

Generally speaking, over-rated parts can be used in electronic projects. For example, a 1-watt carbon resistor can be used instead of a ½-watt carbon resistor of the same resistance. A 100-volt, 0.01 microfarad Mylar capacitor can be used in place of a lesser-rated one, such as a 25-volt, 0.01 microfarad Mylar, assuming that the tolerance range (usually ± 10 or 20 per cent) is maintained and that the larger component will physically fit its allotted space. Both resistors and capacitors can be connected in parallel or series to yield new values. And what about those confusing decimal equivalents? **Table 2** shows popular electronic metric conversions you'll need. Get them right when shopping by mail!

Be careful when substituting components with over-rated ones when the device is supposed to perform a *specific function* at a certain value of voltage or current. In this case, a larger unit would not do the job. Zeners and other voltage- or current-regulating devices would fall into this category.

active components

As for active components, similar guidelines hold, as long as the substitute has equivalent parameters. For example, a transistor that has a maximum collector current (I_C) of 600 mA can be used as a substitute for one having a maximum I_C of 400 mA, providing that other specifications are comparable — such as power dissipation, current gain, maximum collector voltage and frequency.

literature

It pays to have a set of semiconductor reference books to enable quick substitution decisions. With so many construction projects stated in terms of widely-available Radio Shack component types, it's good to have on hand the *Archer Semiconductor Reference Handbook*. This book is a guide to Radio Shack's semiconductors and it's also a useful cross-reference and substitution guide for over 100,000 devices.*

Pin connections and detailed data are provided for ICs, diodes, SCRs, LEDs, and other semiconductors.

Other references are ARRL's *Electronics Data Book* and *Radio Amateur's Handbook*, and Bill Orr's Editors and Engineers *Radio Handbook*, as well as various Sams and TAB substitution handbooks and specifications manuals. Manufacturers' reference books and data sheets are needed if you're really into electronic construction.

The Allied Electronics catalog and engineering reference book is another candidate for your bookshelf.†

table 2. Electronic unit conversions. The following table lists the various multiples and submultiples of fundamental units (such as the farad, henry, watt, etc.). These may be indicated by the following prefixes, abbreviations and conversion multipliers:

prefix	abbreviation	multiplier
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico ("micro-micro")	p	10^{-12}

note:
Perhaps the most use for this table will be found in working with capacitor values. Typically, values are stated in terms of microfarads or picofarads ("micro-microfarads"). The latter is one-millionth the former, so an appropriate decimal conversion is required.

For example, to convert the value of a capacitor with a stated capacitance of 0.001 microfarad to picofarads (sometimes called "micro-microfarads"), multiply by 10^6 or 1,000,000. The equivalent value is 1000 pF.

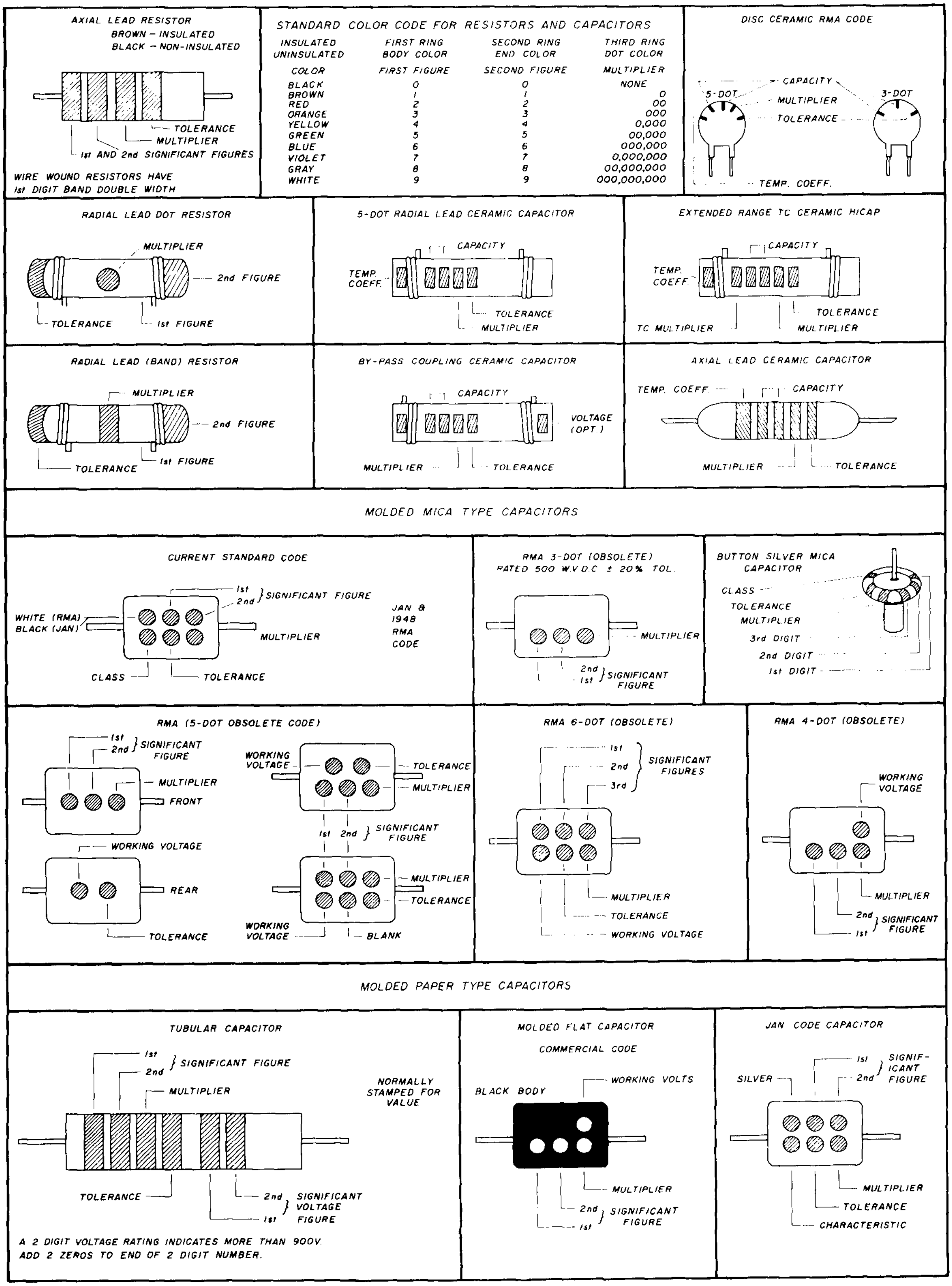
If the equipment designer or article author has pointed out critical components, don't change them! Otherwise, making intelligent substitutions for the exact parts specified is all right. Hams are supposed to be experimenters!

mail-order buying tips

Buying electronic parts and components by mail is no more difficult than buying anything else this way: you write out your order, enclose a check, money order, or charge-card number, and mail it in. In anywhere from a few days upwards, you receive the parts.

*Radio Shack, 1400 One Tandy Center, Fort Worth, Texas 76102.

†Allied Electronics, 401 East 8th St., Fort Worth, Texas 76102.



STANDARD COLOR CODE FOR RESISTORS AND CAPACITORS

INSULATED / UNINSULATED	FIRST RING / BODY COLOR	SECOND RING / END COLOR	THIRD RING / DOT COLOR
COLOR	FIRST FIGURE	SECOND FIGURE	MULTIPLIER
BLACK	0	0	NONE
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

Most resistors are prominently color-coded for easy identification. This chart should help dispel any confusion as to color-coding schemes.

PC-board-mounted components are usually bargain-priced since it's difficult to economically remove and reuse them. IC desoldering kit shown here has special tools for removal of in-line ICs, "TO" packages, transistors, and also includes a special device that melts and straightens bent tabs and leads to facilitate removal of delicate components, such as diodes (*photo courtesy Ungar Div. Eldon Industries, Inc.*).

A few pointers regarding direct-mail buying are in order. In setting up your list, have a copy of the dealer's latest catalog or flyer at hand, and use one of his order blanks to place you order. Use his part numbers, especially if they are different from, or in addition to, the generic part numbers. Accuracy in stating what you want is paramount!

Be sure to carefully check your arithmetic in pricing the order, and observe minimum-order, postage, handling, and sales-tax requirements. Failure to do so can result in embarrassment and delay. Enclosing a little extra to allow for small price changes or increased postal or UPS charges isn't a bad idea and saves later correspondence. Most firms will refund unused amounts to the penny. For very small orders, ordinary *first class mail* (not parcel post) is quick and inexpensive.

substitutions

If you will accept substitutions in filling your order, so state and indicate the range of acceptable choices, without requiring the order-filler to go through a logic tree to figure out just what is okay with you. State specific "kill" instructions, such as "fill within 10 days or cancel order" or "ship in-stock items and cancel balance of order," or the like. If uncertain as to an item's availability, a phone call or postcard will allow you to check on the stock. If you have questions or correspondence that don't pertain to the order, *place them on a separate sheet of paper to expedite handling*.

consumer protection

There are some important mail-order consumer protections. Since 1975, direct-mail firms have to fill orders within 30 days or offer a refund. If the company can't fill the order within 30 days, or within the time frame promised, you must be sent a return postcard allowing cancellation and offering a refund. There are some exceptions — such as when buying

Industrial and military surplus, represented by this selection of meters and oil-filled capacitors, abounds in the flyers issued by direct-mail dealers. Savings over store prices can be astounding, but a bargain is a bargain only if it can be used. Stock up on the good deals if you like, but exercise care and good judgment in doing so (*W8FX photo*).

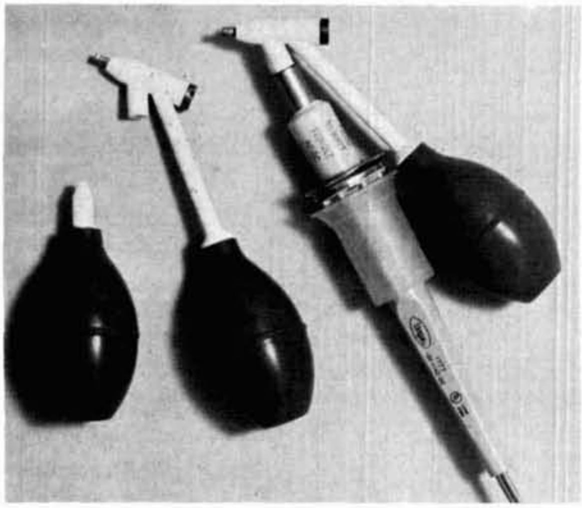
COD — but most merchandise is covered.

If you receive a "dud" part, or have a complaint, contact the company first for adjustment. Most want to please, but salespeople are human, parts do fail, and mistakes can occur. Give them a chance to "right" the situation before becoming aggressive in pursuing your grievance. If doing this doesn't yield satisfaction, you can, as an initial step, fill in a Consumer Service Card (PS Form 4314) at your post office. By completing and returning it, the Postal Service will look into the matter, dealing directly with the company. If fraud is suspected, it may refer the matter to postal inspectors.

What if all you have for the company is a post office box number? You can usually get the name and address of a principal by contacting the magazine that runs the firm's ads. It's also possible to obtain this information on commercial boxholders without charge from postal authorities. Contact your postmaster for help.

telephone orders

Worth noting is the fact that if you place your order over the phone, you do not have the same protection, since you didn't use the mail to place the order. Fraud is still fraud, of course, and fradulent use of the charge card may place the bad-boy firm in other kinds of trouble. Using over-the-phone charge cards is fine, in my opinion, for mail-ordering major items, but ordering large numbers of small components by phone can lead to confusion and mistakes in filling the order. This is especially true if it's a tape recorder that's taking your order.



Buying surplus, component-laden PC boards "just for parts" is fine, if it's recognized that delicate parts such as integrated circuits, transistors, and diodes may be damaged or rendered useless in their removal from the circuit board. Special desoldering tools are required to do the job right, as shown by this array of Ungar gear. Desoldering tool, similar to a regular soldering iron, allows one-hand operation; other hand is free to lift components. The desoldering bulb is shown in three configurations, as a separate attachment, installed on the desoldering tool, and as a separate unit for use with regular irons. Bulb removes solder by a vacuum action (*photo courtesy Ungar Div. of Eldon Industries, Inc.*).

Many direct-mail distributors frequent the hamfest circuit, operating sales tables side-by-side with the individual swapper. If you can't get what you need by mail-order, you may luck out at the next 'fest. Catalogs, flyers, parts specification sheets and bargain lists are always free for the asking. And, hamfests are great places to become familiar with the ins-and-outs of ham radio. Swap meets, technical forums, and dealer displays are staples at most (*photo taken at 1979 Columbus, Georgia Hamfest by W8FX*).

if problems occur

It pays to check out a firm in advance, especially before placing a substantial order. Most of the advertisers in the Amateur and electronics publications are reputable. It's a relatively small, specialized market, and laggards will eventually be driven from business if they offer less than prompt, reliable and honest service. However, if you *do* have problems, you can take several courses of action after trying to resolve matters with the company. You can contact the magazine that ran the company's ads; write state or local consumer agencies; call or write a "consumer action line," such as operated by many newspapers and radio/TV stations; contact the Better Business Bureau; write the state Attorney General; complain to industry or trade associations; or write to the federal Office of Consumer Affairs (Washington, D. C. 20506). You can also contact the Mail Order Action

Line, 6 E. 43rd St., New York, NY 10017, a consumer-assistance program organized by mail-order companies interested in preserving the industry's good name.

in summary

Here are some general mail-order buying guidelines that should contribute to successful results with *a minimum of headaches:*

1. Check out the company and its reputation. Have you seen their ads before? Is there a street address and phone number listed, or just a post office box? *Think* before mailing in your hard-earned dollars.

2. Understand the firm's return policy. Is there a money-back guarantee? What about a restocking charge?

3. Double-check your order before mailing or calling it in. Have you provided a street address? Many firms use UPS for delivery, and they usually need a street address not a post office box number.

4. Send a large-enough remittance. But enclosing a blank check to be filled in with the exact amount by the firm is risky. COD is okay, but these special charges add to the cost of the order. Never send cash. A money order or cashier's check will help speed delivery, as will ordering by charge card.

5. Allow sufficient time to get the merchandise. Realize that it may take a few weeks to clear your personal check, process your order, and actually get the parts to you. On "special deals," look for guaranteed delivery times (and prices) or the caveat, "quantities limited."

6. Always keep a copy or record of your order, showing the date you sent it in, what you ordered, and your check number.

7. Hold onto your charge-account records and cancelled checks. You may need these papers later on. Never send in the originals when inquiring about your order.

8. Many companies routinely issue small refunds in the form of credit slips. If you don't want them, say so in advance on your order form. However, you may want to accept the slips from those firms that allow the slips to be applied to your next order at more than face value, a sort of "consolation" for the out-of-stock problem.

buying in advance: does it pay?

The answer to this question is a crystal-clear "yes and no." A bargain isn't a bargain unless it can be used. The suppliers' catalogs and flyers are filled with bargains — parts by the bagful, manufacturers' seconds, unbranded and unlabeled components, surplus PC boards, and hundreds more — sometimes top-grade components for your next project at prices that are hard to beat, sometimes not. It's best to steer a middle course, taking advantage of quantity discounts and attractive parts "specials" on a highly selective basis, resisting the urge to squirrel-away and stockpile more than you could ever use.

Despite the bargain-filled flyers, direct-mail parts suppliers often have to backorder specific items to the intense displeasure of their customers — you and me. Thus, it's often not a bad idea to pad your order with limited quantities of widely-used chips, transistors and other parts for future use. Doing this is logical when you are trying to build up your order to minimum purchase levels, sometimes $10 or $15 or even more. Also, consider combining club construction project orders and those for friends. Quantity discounts may sometimes be brought into play. Grab-bag specials on assorted parts can help put your junkbox into first-class shape. Practically every mail-order outfit offers a variety of plastic bags full of diodes, capacitors, resistors, potentiometers, transistors, ICs, and other small components.

A few words of caution apply. Buying these goodies is of use only if you are building up a spare parts inventory, not to yield components for a specific project. Rarely will you come out with just what you need from a grab-bag. Carefully check the description of what's in the bag. For example, are the components assorted popular values, or are they all of one unusual (and possibly unusable) value? Are the leads cut too short, good for use in PC board wiring only? To what tolerance are the component values? And, are the components new, used, or seconds?

For the beginners, assortments of hardware, hookup wire, small switches, knobs, low-wattage carbon resistors, ceramic disc and polystyrene capacitors, high-capacitance, low-voltage electrolytic or tantalum capacitors, popular transistors and common ICs, carbon potentiometers, and small transformers are good for starters.

A $15 or $20 investment in plastic bag components, if the choices are made wisely, represents money well spent. Realize that there isn't much recourse for a bad selection. You take what you get and chalk up the results to experience. It's a good idea to check out plastic bag components for proper value, shorts, open circuits, and physical damage before using them in construction projects.

component identification

Most direct-mail firms carefully label and package components they ship so that you will have little problem in identifying the parts you receive. Generally speaking, ICs are labeled, transistors stenciled or mounted on labeled cardboard sheets, capacitors imprinted with their values, resistors and transformer leads color coded, and so on. Exceptions are diodes and some bulk-sale components, especially ICs, coils, and capacitors, which may not be labeled. These present real problems in component identification for all but the most knowledgeable experimenter. Special color codes exist for some diodes, however, and capacitor and coil values can be measured. But determining IC and transistor types can be sporty, to say the least. Buying surplus PC boards is risky, too. Identifying and safely removing the components is sometimes a real challenge. Most resistors and capacitors are prominently color-coded for easy identification.

Coding and values for other components, such as hookup wire, transformers, pilot lamps, and diodes can be found in the ARRL *Handbook* and the Editors and Engineers *Radio Handbook*, as well as in other radio-electronic reference books. Identifying the values of unknown/unmarked components, like capacitors, coils, and chokes is an art unto itself. However, ARRL's *LCF Lightning Calculator* provides the data needed to make many tricky identifications, when used in conjunction with a grid-dip oscillator or other rf source.

closing remarks

We've only scratched the surface. But you should have a good idea of the facts to consider when lining up parts for your next construction project.

Buying parts by mail-order can be a money-saving and interesting way to help complete your electronic projects. Provided you recognize the rules of the game, direct-mail buying can even be fun. Give it a try!

ham radio

did anyone hear Amelia?

For the last several years, Paul L. Briand, Jr., Professor of English at the State University of New York at Oswego, has been conducting research into the disappearance of Amelia Earhart in 1937. Amelia Earhart, the first woman to fly the Atlantic, was last heard from while crossing the Pacific on the final leg of an around-the-world flight. Any shortwave listeners who might have heard her transmissions in early July of 1937 (her call letters were KHAQQ) are asked to contact Dr. Briand, Department of English, SUNY College, Oswego, New York 13126 (telephone 315-343-0635).

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10-meter preamp for the FT-101E

Easy mods for improving the sensitivity of this popular radio — and others as well

This article does not provide construction details for a preamplifier; rather it describes how to install a preamplifier in an FT-101 transceiver. The preamp chosen by the author was described in the March, 1979, issue of *QST* by Doug DeMaw, W1FB. If you don't wish to use the referenced amplifier, others are available in kit form. Some examples are the Hal-Tronix HAL-PA-19 or the Hamtronics P-30. **Editor**

During a 1979 10-meter contest, my station was operated for the first time in the full-power, multi-operator category. My partners in this effort were KA1BMB, WA1YEC, and WB1GIF. Before the contest began, we felt that all was in readiness, having set up the amplifier and antenna in plenty of time (that afternoon). The first hint of trouble came about an hour into the test when we calculated our less-than-astonishing rate of 25 QSO's per hour. Maybe it's the band? The second hint was the phone calls that started coming in, asking why we were calling CQ over the JAs, etc., who were *calling us*. One-way propagation?

The real problem, of course, turned out to be the rather poor 10-meter sensitivity of my FT-101E. After talking with other FT-101 owners, I found this to be a relatively common problem in an otherwise well-engineered transceiver.

design considerations

A preamplifier seemed to be the logical remedy for

By **Dave Malley, K1NYK,** 132 Lydall Street, Manchester, Connecticut 06040

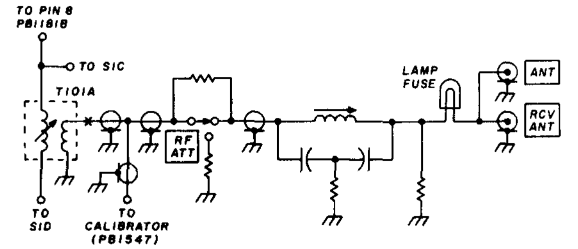


fig. 1. FT-101 circuit before adding preamp showing the location (X) selected for its installation.

the problem of poor sensitivity. Since I enjoy home-brewing, I decided to build the preamp and set about to find an existing design that met the following goals:

1. Stable (no self-oscillations)
2. 1-MHz bandwidth or better
3. Good gain (15-20 dB)
4. Inboard installation
5. No loss of resale value (no hole drilling)

The advantages of the design criteria are readily apparent. In a broad sense, the circuit should bring a weak signal up to a solid Q5 copy without retuning when switching between the phone and CW sub-bands. Retaining the resale value meant not drilling holes for cables or switches, as well as minimizing circuit mods to the transceiver. The internal installation requirement simplifies portable/mobile operation and keeps the station from being cluttered with yet another black box and its various wires. A method of switching the preamp into the circuit without using rf relays was also desired.

I reviewed several construction articles to become familiar with the circuit options before making a selection. The design I selected[1] was simple, and all the goals were met. This preamp also can be set up for 15 meters instead of 10 meters if two toroid windings are changed.

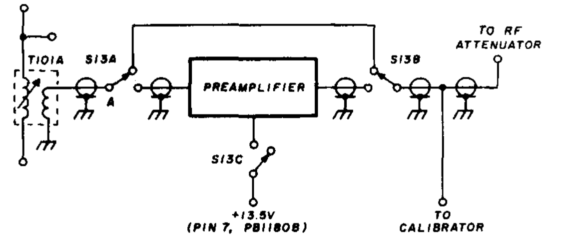


fig. 2. FT-101 circuit after modificaton showing added control switch and preamp module. Calibrator can be placed at point A, which may be more desirable (see text).

The contest was still on my mind, though, so I decided to stick with the 10-meter version. Construction is uncomplicated using a homemade circuit board, I found parts in my junkbox (oops, I mean my electronic inventory) — proving that no unusual components are needed. However, if all the parts are purchased, the bill will come to only around $8. This works out to about half a buck per decibel. If you're not inclined toward building this unit, a satisfactory commercial preamp can probably be found that will fit in the rig. Check the ads.

The first step should be to align both the receiver and transmitter 10-meter front-end sections. The FT-101 owner's manual covers this trimmer capacitor peaking procedure quite well. This procedure ensures maximum performance on 10, as would be expected.

As mentioned earlier, I hoped to avoid hold drilling and other mechanical (or major electronic) surgery. I wanted to be able to restore the transceiver to its original state.

After removing the bottom cover, I quickly found that the preamp board should be installed topside. The most space above the chassis is directly in front of the PA cage. As luck would have it, the 1.7 inch × 3.9 inch (43 × 99 mm) dimensions of my board allow it to fit vertically in this spot without interfering with the top cover. To avoid relays, which probably wouldn't fit inside the rig anyway, the preamp should be installed in the FT-101's receiver section.

A review of the circuit diagram showed that this could be done between the lamp fuse (rf overload protector) and T101A, (see **fig. 1**). The modified circuit diagram is shown in **fig. 2**. A 4PDT miniature toggle switch places the preamp into the circuit and simultaneously applies the 12-14 volts. Operation on all bands is not affected when the switch is off.

hardware and wiring details

A bracket was formed from a 3/4-inch-wide (19-mm) piece of 1/32-inch (1-mm) aluminum, which serves double duty by holding both the preamplifier circuit board and the miniature switch in position (**fig. 3**). The dimension marked with an asterisk should not be exceeded, or the top cover will not close properly.

Switch wiring is shown in **fig. 4**. RG-174 miniature coax was used for each rf run, and all coax braids must be grounded at each end. The circuit board and

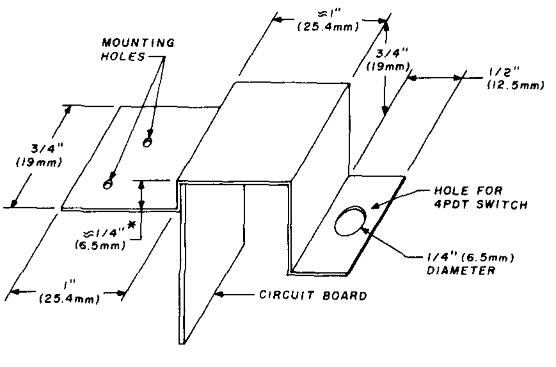


fig. 3. Sketch of the bracket used to mount preamp and switch assembly in the FT-101. The 1/4-inch (6.5-mm) dimension (asterisk) should not be exceeded (see text). Bracket attached to perforated PA cover, thus no holes need to be drilled.

the switch should be mounted on the bracket, then wired for greatest convenience. The cables that connect to the rig should also be soldered to the switch at this point. One or two short machine screws will ultimately secure the bracket assembly to an existing hole in the perforated PA cage cover. Make sure that these screws *do not* touch any components inside the PA compartment! This bracket arrangement provides very good mechanical stability.

The input/output lines from the preamp switches were passed around the driver tube socket and down through the opening beneath the heterodyne crystal oscillator board (PB1073), located in the right-front corner of the transceiver. Routing the coax cables around the tube socket is not necessary but gives enough slack to allow removing the board for adjustment or repair without unsoldering it.

The supply voltage wiring was routed from the switch through the opening under the VFO assembly and along to pin 7 of the mixer board socket (PB1180). I used a piece of scrap RG-174 for this cable, too, and pin 6 or 8 of the PB1180 socket can be used for grounding the braid. Passing the wiring between the chassis underside and the speaker plate gives the neatest appearance. Although each FT-101 circuit board has one or more 13.5-volt connections, the mixer socket seemed to offer the easiest access point.

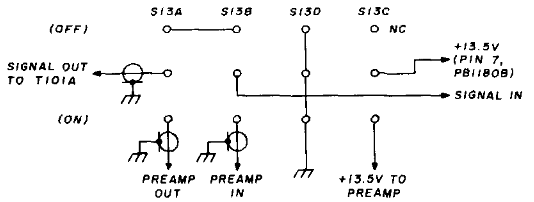


fig. 4. Schematic diagram of added control switch (S13) wiring. All coax braids are grounded at the switch and through S13d.

FT-101 circuit considerations

The simplest location for splicing the preamp into the FT-101 was right at the secondary of *T101A*, where the incoming signal is applied. The circuit board containing the front-end alignment trimmers must be temporarily moved aside to allow access to the T101A connections, which are between it and the underside of the chassis. Removing the wraparound cover also is convenient.

T101A has five terminals, with three of them on the transformer secondary. One secondary terminal is grounded, while another connects to the incoming signal and the crystal-calibrator signal. In my radio, the red wire carries the incoming signal, and the yellow wire goes to pin 16 of PB1547. It would be wise to check these wires in your radio with an ohmmeter to make sure that no production changes have occurred. The middle terminal is not connected to T101A and serves as a convenient tie point.

Remove the incoming and calibrator signal wires from their existing transformer terminal. Attach them and the preamp input to the T101A middle (dummy) terminal. Now connect the preamplifier output coax cable to the terminal that originally held the incoming and calibrator wires. Both preamp input/output coax shields are grounded at, or adjacent to, the transformer ground terminal. Note that the calibrator wire can remain in its original location. Once this work is finished, be sure to replace the circuit board containing the front-end alignment trimmers that was moved aside earlier.

alignment

Alignment of the preamp I selected involved peaking two trimmer capacitors on the preamp board. This condition is registered on the S-meter using a signal generator loosely coupled to the FT-101's antenna terminal. I aligned the preamp before the bracket assembly was attached to the PA compartment cover then later tweaked the caps after final assembly. (This step may not be necessary if the caps are properly peaked initially.)

It's important to couple the signal generator very loosely to the rig without developing AGC voltage (no S-meter reading). Using the calibrator signal was unsatisfactory because it was too strong and masked the correct adjustments. This resulted in *no* amplification of the weak signals. After all, making the weak signals stronger is the whole ball of wax! This unit works well and has no self-oscillations, body capacitive coupling, or other problems that can occur when LC circuits are not in resonance.

a final word

That completes the rig modifications, and the cabinet can be put back together. The photograph shows the circuit board and switch assembly installed beside the PA compartment. When the preamp is switched off, the receiver should work normally on all bands as before. My unit pushes a barely audible station to an S5-S8. While the no-signal noise is also amplified, this noise does not register on the S-meter, which indicates an overall increase in the signal-to-noise ratio. I found a minor secondary advantage of this modification with the rf-gain pot. Previously, a signal would disappear altogether when the rf gain was set below about 6. This pot now provides variable attenuation throughout its entire range when the preamplifier is turned on.

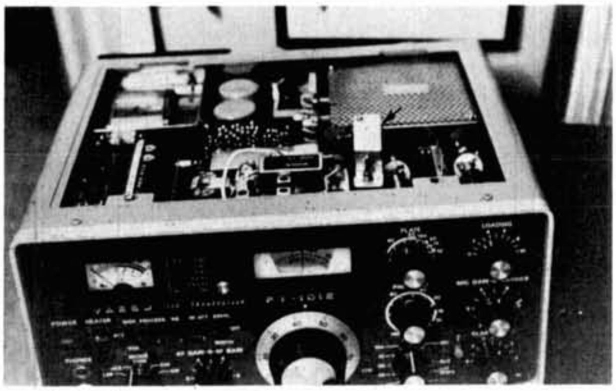


fig. 5. Photo of the preamp and switch assembled inside the FT-101 (arrows). Routing of the miniature coax cables is not critical and uses existing pass-through holes in the chassis.

While the mods discussed in this article are directed toward the FT-101, the same philosophies should apply to many other transceivers and receivers as well. This mod is quite effective. Having it integrated into the transceiver's circuitry certainly helps keep the station more orderly. Looking to the future, I expect this unit will be most beneficial as 10-meter propagation declines.

reference

1. Doug DeMaw, W1FB, JFET "Soup" for Tired Receivers, *QST*, March, 1979, page 19.

ham radio

A survey of antenna tuners — how QST and Lew McCoy, W1ICP, pioneered the "Transmatch"

ham radio TECHNIQUES

Bill Orr, W6SAI

Society seems to go through a progression of fads. Senior citizens well remember when miniature golf courses, "Amos 'n' Andy," and the snood were all the rage in the thirties and forties. Most of us can name some post-war fads: the hula hoop, tail fins on autos, and hot tubs.

Amateur Radio, being in some ways a mirror of society, also has its fads. Old timers remember from pre-war times the Astatic D-104 microphone, the RME-69 receiver, preselectors, and the Johnson-Q antenna. In vogue today are keyboards and RTTY,quad antennas, speech processors, SWR meters, baluns, and antenna tuners. Time will tell which of these technological developments will be of the greatest benefit to Radio Amateurs.

This brings me in a roundabout way to the subject of this column: antenna tuners. If you look in the various ham magazines, you'll see a bunch of advertisements featuring antenna tuners. Everybody has gotten in on the act! You can even buy an antenna tuner to match the decor of your equipment. Obviously, you've got to have an antenna tuner to be a part of the action.

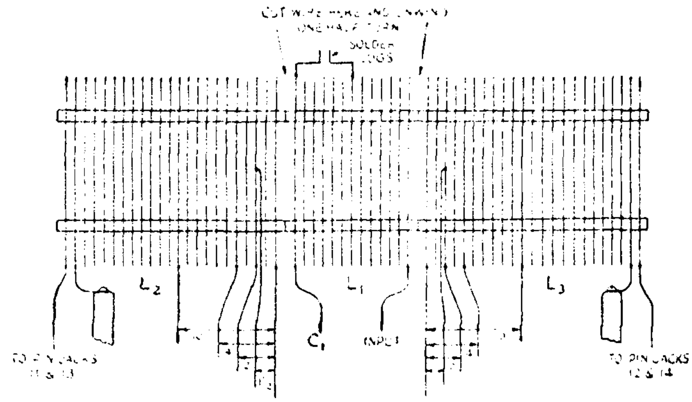
antenna tuner? what's that?

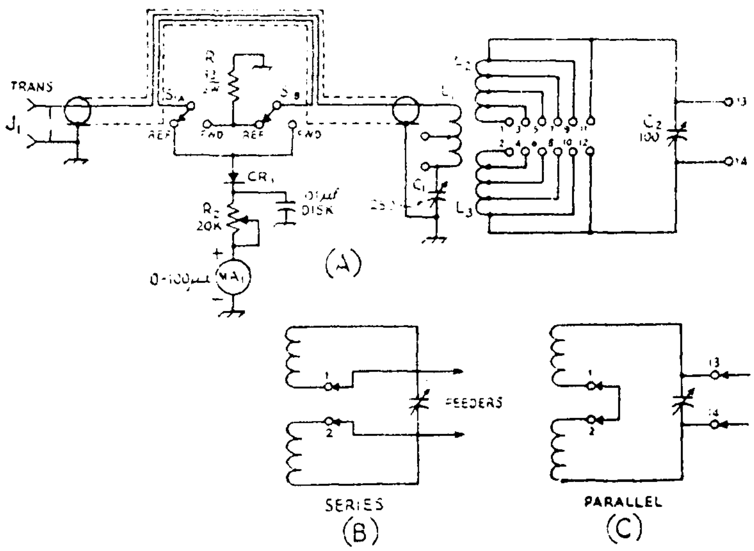
The term *antenna tuner*, as By Goodman, W1DX, once pointed out, is a misnomer. *It doesn't tune the antenna*. Rather, it's a matching device that translates the electrical characteristics of the antenna system into values more compatible with the communications equipment attached to the antenna.

Back in the days of open-wire feedlines and simple antennas, the antenna tuner was a resonant circuit coupled to the transmitter. A few copper alligator clips on the tuner coils permitted the operator to make loading adjustments to his taste. He didn't worry about the standing wave ratio (SWR) on the feedline — these magic initials were unknown to most Amateurs.

The SWR meter. With the availability of good, inexpensive coaxial cable after World War II, the switch-over from open-wire lines was inevitable. At about that time, Amateur Radio was introduced to the SWR meter. And the Federal Communications Commission introduced the Novice license, which brought a large number of new Amateurs on the air.

The influx of new, inexperienced hams on 80 and 40 meters brought a blizzard of problems for the FCC and Amateur Radio. The beginner's transmitter was unsophisticated and, more often that not, a prolific generator of strong harmonic signals. Moreover Amateur Radio as a whole was plagued with serious television interference (TVI) problems. Many





(A) Circuit diagram of the antenna coupler and s.w.r. bridge. (B) Series tuning. (C) Parallel tuning.

C_1—250-$\mu\mu$f. variable capacitor (Hammarlund MC-250-M).
C_2—100-$\mu\mu$f. variable capacitor (Hammarlund MC-100-SX).
CR_1—1N34A germanium diode.
J_1—Coaxial chassis receptacle, SO-239.
L_1, L_2, L_3—See Fig. 2 and text.
MA_1—0-100 microammeter, or other range, depending on sensitivity required.
R_1—33 ohms, ½-watt carbon resistor.
R_2—20,000-ohm potentiometer.
S_1—D.p.d.t. "tone control" switch (Centralab 1462).

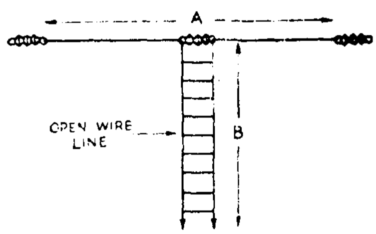
fig. 1. The antenna-tuner design that started it all. Shown in the March, 1959, issue of *QST*, this design brought the antenna tuner out of the dark ages. It incorporated a simple SWR bridge made from a length of coaxial line and a link-coupled circuit that could be adjusted for either series or parallel tuning of an open-wire transmission line. The air-wound coil is about 2 inches in diameter, 10 turns per inch. (Drawings from *QST*, March, 1959.)

Tuning Information

Parallel	*Series*
Connect feeders to 13 and 14, jumper 1 and 2	Connect feeders to 1 and 2

Short following terminals with jumpers

3.5 Mc.	——	——
7.0 Mc.	11 and 9 —	12 and 10
14.0 Mc.	11 and 7 —	12 and 8
21.0 Mc.	11 and 5 —	12 and 6
28.0 Mc.	11 and 3 —	12 and 4



The length *A* should be more than a quarter wavelength at the lowest operating frequency. When you determine the length of A to half the distance, add a sufficient length of feed line (B) to equal a quarter wavelength or multiple thereof. For example, let's assume you can put up an antenna 80 feet long and you plan to operate on the 3.7-Mc. Novice band as the lowest frequency. From the formula

$$\frac{246}{3.7} = 66.5 \text{ feet}$$

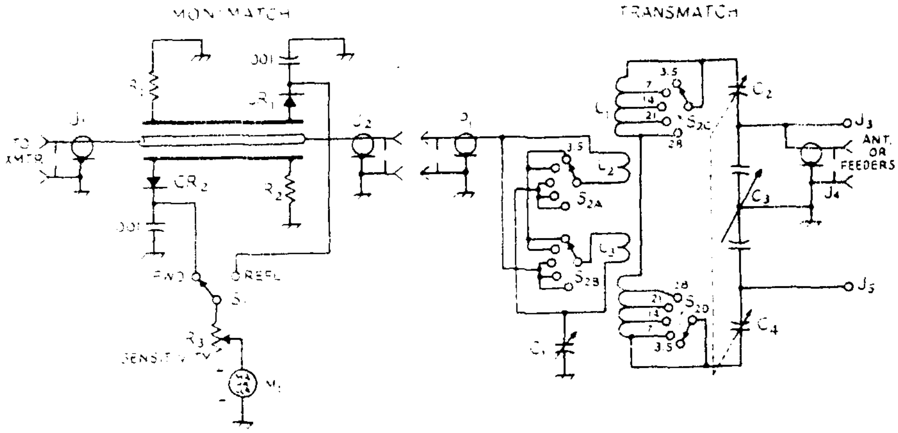
$$66.5 - 40 = 26.5 \text{ feet}$$

the feeder length, or

$$2 \times 66.5 = 133$$

$$133 - 40 = 93 \text{ feet.}$$

This can be carried out for greater feeder lengths, depending on the requirements of the installation.



Circuit diagram of the transmatch and Monimatch.

C_1—250-μμf. variable, 0.045-inch spacing for high power (Johnson 250E20); 0.025-inch spacing for low power (Hammarlund MC-250-M).

C_2, C_4—100-μμf. variable, 0.125-inch spacing for high power (Johnson 100E45); 0.025-inch spacing for low power (Hammarlund MC-100-M).

C_3—100-μμf.-per-section, dual variable, 0.125-inch spacing for high power (Johnson 100ED45); 0.025-inch spacing for low power (Hammarlund MCD-100-M).

CR_1, CR_2—1N34A germanium diodes.

J_1, J_2, J_3—Chassis-type coax receptacles, type SO-239

J_4, J_5—Feed-through insulators.

L_1, L_2, L_3—See Fig. 2 and text.

M_1—0–1 ma. or less; see text.

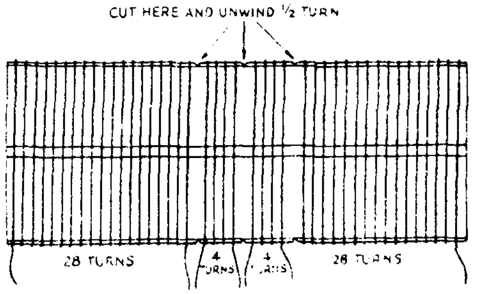
P_1—Coax plug, type PL-259.

R_1, R_2—For 50-ohm bridge, 150 ohms, ½-watt composition; for 70-ohm bridge, 100 ohms, ½-watt composition.

R_3—20,000-ohm control, linear taper.

S_1—Rotary, 1 pole, 2 positions (Centralab type 1460).

S_2—Ceramic rotary, 4 poles, 5 positions, 1 pole per section, 4 sections (Centralab index type P-122 with type "T" or "X" sections).



This drawing shows how to make the coil assembly. Not shown are the taps needed for changing bands. The tap points listed below all are counted from the outside ends of the coil.

7 Mc.—12 turns.
14 Mc.—23 turns.
21 Mc.—25 turns.
28 Mc.—26 turns.
The coil stock in 3 inches in diam., No. 14, 8 turns per inch

fig. 2. ***The 1961 version of the Transmatch.*** **The SWR bridge is shown at left. The coils are tapped, and a rotary switch is used to select the proper inductance. Note that a coaxial plug (J4) has been added to the output terminations of the tuned circuit. Only one-half of the tuner circuit is used for the coaxial connection. (Drawings from *QST*, November, 1961.)**

Amateurs thought that perhaps the old-fashioned antenna tuner might solve these problems. How could the old-design tuner be adapted from open-wire line to coaxial line?

The antenna tuner and SWR bridge circuit. Several solutions to this problem were introduced during the 1950s, but the most popular and effective tuner was that developed by Lew McCoy, W1ICP, the Novice Editor and Technical Assistant for *QST* magazine. An early version of Lew's device is shown in **fig. 1**. This tuner adapts a medium-power transmitter having a 50-ohm coaxial antenna output to a center-fed, all-band antenna. A simple SWR meter is incorporated into the tuner. Small copper clips make connections to the tuner coil as the band is changed. This is a practical all-band (80- through-10-meter) antenna and tuner, and I recommend it to any Amateur looking for a versatile, simple, and inexpensive antenna system. For more details, refer to the March, 1959, issue of *QST*, pages 11-15.

Later, in the November, 1961 *QST* Lew showed a high-power (500-watt) version of his tuner — a deluxe model having a wider adjustment range — and he called it a Transmatch. Again, it was designed to match a 50-ohm coaxial antenna output to an antenna having a balanced feed system. But he also added a coaxial output plug to the Transmatch to match to a 50-ohm transmission system. In this manner, the Transmatch could be used as a highly selective circuit in a 50-ohm coaxial system that would greatly attenuate the harmonics of the transmitter. The circuit is shown in **fig. 2**.

By 1966 the impetus had switched to harmonic suppression on 50-ohm transmission lines; so the October, 1966, issue of *QST* featured a simplified McCoy Transmatch that eliminated the SWR meter and emphasized single-ended output (**fig. 3**).

In 1967 an entirely different approach to an "antenna tuner" was described by Lance Johnson, K1MET. He built a simplified, single-ended tuner based upon a T-section network that provided an unbalanced-to-balanced match for a 50-ohm transmission system (**fig. 4**). This compact and simple Transmatch is an excellent solution to some of today's problems with solid-state rigs: it will reduce the SWR on an antenna system to near unity, so that the transmitter does not suffer reduced power output caused by operation into a mismatched load.

the "Line Flattener"

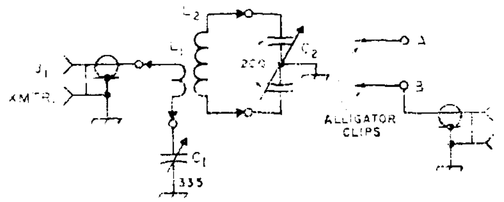
This circuit has shown up in Radio Amateur literature numerous times since its first introduction by K1MET (then an ARRL Lab Assistant). Previously, it had been in wide commercial use but somehow had never filtered into ham literature. In addition to providing a good match, the T section (**fig. 4**) provided up to 20 dB attenuation for transmitter harmonics falling into the TV channels. An extremely practical circuit, this low-cost device is recommended to today's Amateurs who have solid-state transmitters and who wish to achieve easy and efficient antenna matching with a minimum of fuss.

By now the name Transmatch was slipping into the public domain, and almost every "antenna tuner" was called a Transmatch. (Too bad, Lew. You've suffered the fate and fame of Kodak™ and Xerox™!)

A simplified Line Flattener for a triband beam (10-15-20 meters) can be built. Capacitor C1 is reduced to 250 pF, capacitor C2 is removed, and the end of coil L2 is connected directly to receptacle J2 (**fig. 4**). Then, coils L1 and L2 are reduced to nine turns each. Readers with a good memory will recall that I described a compact, 100-watt version of the Line Flattener in my antenna column in *CQ*, April, 1979. A somewhat similar device was also described by W6EBY in the September, 1978, issue of *ham radio* (page 22).

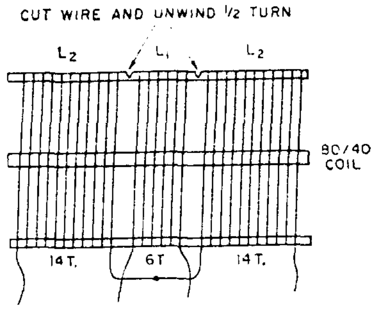
back to the Transmatch

By 1961 the antenna tuner had taken an interesting turn, and an article describing the "50-Ohmer" by Lew McCoy appeared in the July, 1961, issue of *QST* (**fig. 5**). This device was a form of Line Flattener designed to be used with a coaxial system to reduce the SWR on the



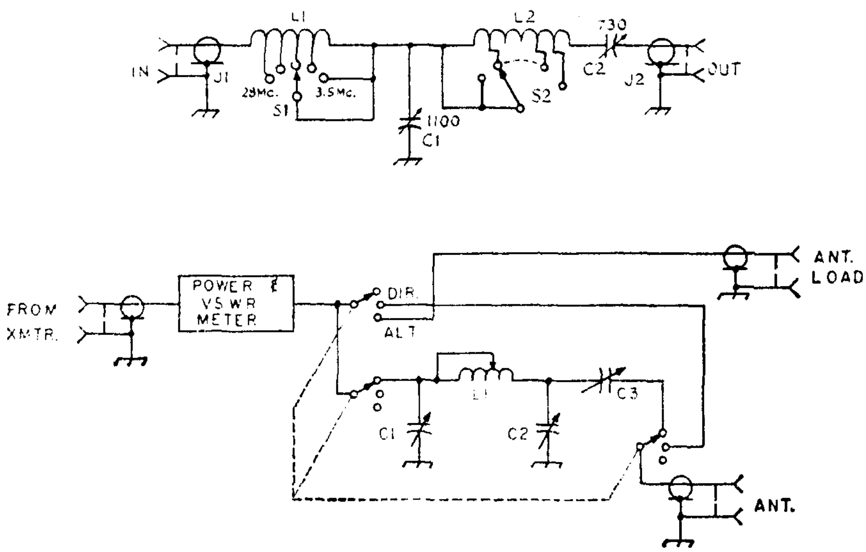
Circuit diagram of the transmatch. Balanced feeders should be attached to A and B.

C_1—335 pf. variable (Millen 19335 or equivalent).
C_2—200 pf. dual variable, 0.077-inch air gap for 1 k.w. (Millen 16200), 0.022-inch air gap for 150 watts and less (Millen 28200).
J_1, J_2—Coax chassis fitting, SO-239.
L_1, L_2—See Fig. 3 and text.



Details for making the 80/40-meter coil. The 20-meter coil consists of 2 turns for L_1 and 6 turns for L_2 (3 turns on either side of L_1). Details for the 15/10-meter coil are given in the text. The coils are mounted on Millen type 40305 plugs and the socket is Millen type 41305. Coil stock is Polyphase PIC type 1778, 3-inch diameter, 6 turns per inch, No. 12 solid wire.

fig. 3. The tuned-circuit antenna-matching device reduced to the simplest form. The SWR meter is eliminated, but provision for 50-ohm coaxial output is included. (Drawings from October, 1966, *QST*.)



Circuit of the 300-watt transmatch. Capacitances are in pf. For simplicity, only a few of the taps on L_2 are shown.

C_1—365-pf. variable, 3-section, receiving t.r.f. type (Miller 2113 or equivalent).
C_2—365-pf. variable, 2-section, receiving t.r.f. type (Miller 2112 or equivalent).
J_1, J_2—Coax chassis fitting, SO-239.
L_1—13 turns No. 14, 1¾-inch diam., 8 turns per inch, tapped at 3, 5, 9, 11 and 12 turns from J_1 end (Polycoil 1764 or equivalent).
L_2—21 turns same coil stock as L_1, tapped every other turn.
S_1—Ceramic rotary, 1 section, 1 pole, 2–6 positions (Centralab PA 2003 or equivalent).
S_2—Ceramic rotary, 1 section, 1 pole, 2–11 positions (Centralab P-270 index & YD section or equivalent).

fig. 4. The 1966 Transmatch (top). This is a T-section network that provides a match within a 50-ohm transmission line system. The configuration is well suited to today's solid-state equipment. Tuner is designed to cover 160 through 10 meters. A pi-network circuit, below, is used in the Drake MN-4 matching network. (*Drawings from QST, October, 1967.*)

transmission line. It used a "band-switching adjustable transformer" capable of handling SWR values as high as 5 to 1. Of interest to the circuit connoisseur is the use of a split-stator tuning capacitor with network input attached to the floating rotor.

This shunt provided a capacitive short circuit to ground for the transmitter harmonics and gave protection up to 20 dB for harmonics falling into the TV channels — a slightly different version of the K1MET design.

the Ultimate Transmatch

In July, 1970, W1ICP came up with the Ultimate Transmatch in his "Beginner and Novice" column of *QST*. This circuit was a sophisticated version of the 50-Ohmer, adapted for either coaxial lines or balanced lines. A 1-to-4 ferrite balun was used to achieve balanced output (**fig. 6**). This Transmatch combined simplicity and flexibility, requiring only one split-stator capacitor, one single-section capacitor, and one variable inductor. Many of the antenna couplers sold today employ this circuit or variations of it. The output termination for the balanced configuration is 200 ohms when the input to the Transmatch is 50 ohms.

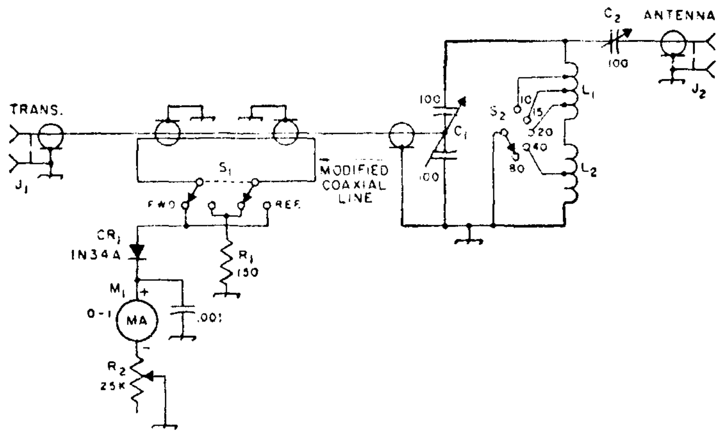
The use of a ferrite balun, however, should be approached with caution. Most balanced lines are other than 200 ohms (300 ohms for TV ribbon line, and 450-600 ohms for open-wire transmission line). Ferrite baluns don't like to work into a mismatch because of core saturation. The result of this misuse is increased harmonic radiation and the chance of balun flashover at medium power levels. An air-core balun at this point is recommended.

the SPC Transmatch

Shown in the 1981 *ARRL Handbook* is the SPC Transmatch (SPC standing for series-parallel-capacitance) — another offspring of the long series of antenna matching units pioneered by W1ICP and others. A simplified schematic of the *ARRL Handbook* version is shown in **fig. 7**. This unit was developed by Doug DeMaw, W1FB. It provides a wide range of matching and gets around the ferrite-core balun problem by substituting an air-core device.

which antenna tuner to build or buy?

So much for the background of the Transmatch, now firmly established as part of the history of Amateur Radio. Much information is available for the interested Amateur who



Circuit diagram of the 50-Ohmer. Decimal values of capacitances are in uf., others are in $\mu\mu$f.

C1—100-$\mu\mu$f.-per-section, split stator (Hammarlund HFBD-100-C).
C2—100-$\mu\mu$f. variable (Hammarlund MC-100-SX or Johnson 100 FD 20H).
CR1—1N34A germanium diode.
J1, J2—Coax chassis terminal, SO-239.
L1—9¾ turns No. 14, 1¾-inch diam., 4 turns per inch (B & W Miniductor 3021, Illumitronic Air Dux 1404T). 14-Mc. tap 2½ turns from junction of L1L2; 21-Mc. tap 7½ turns from junction of L1L2; 28-Mc. tap 7½ turns from junction of L1L2.
L2—28 turns No. 14, 1¾-inch diam., 8 turns per inch (B & W Miniductor 3022, Illumitronic Air Dux 1408T). 7-Mc. tap 5 turns from the junction of L1L2.
M1—0-1 milliammeter.
R1—150 ohms, ½ watt.
R2—25,000-ohm control, linear taper.
S1—2-pole, 2-position switch (Centralab 1462).
S2—Ceramic rotary, one section, one pole, 5 positions (Centralab type 2501).

fig. 5. The 50-Ohmer circuit of 1961 is the forerunner of today's Transmatch. The split-stator capacitor C1 provides good rejection of the transmitter harmonics and provides TVI protection when it is properly adjusted. Note that high-impedance output for two-wire transmission line has been dropped. (*Drawing from July, 1961 QST.*)

wants to buy or build a Transmatch. As to the question, "Which antenna tuner should I build or buy?," the first answer is, Don't use an antenna tuner unless you really need it. Too many Amateurs are swept away by antenna tuner fever when they could just as well get along without one.*

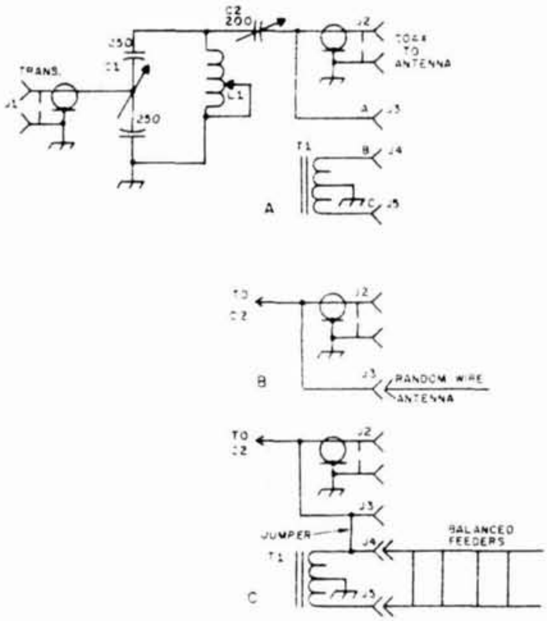
Where the Transmatch really shines is in conjunction with a solid-state transmitter and, say, a triband antenna. The tribander provides various terminating impedances as operation is conducted across the bands, and sometimes the solid-state transmitters encounter loading problems, especially at the band edges. The Transmatch will transform the odd-ball impedance at the station end of the transmission line into 50 ohms, which is what you would want for a good match to the transmitter.

The transmitter employing vacuum tubes and a pi-network output circuit is considerably more tolerant of a high SWR antenna load, and in most cases a Transmatch is not required to match a 50-ohm line to the transmitter, with one exception: 80 meters. The great majority of 80-meter ham antennas cannot work across the whole band without exhibiting a high value of SWR at one end of the band or the other. And here is where a Transmatch is worthwhile. Even though the antenna may be operated "off tune" and may exhibit a high SWR on the feedline, the Transmatch can provide a satisfactory load for the transmitter.

Which model Transmatch to build or buy? I'm not going to get into a dispute over that. My Transmatch needs are modest, so I have a haywire version of the T-section device shown in **fig. 4**. In fact, I have two of them. One is built up very pretty in a low-profile case, complete with SWR meter and all bells and whistles. The other one is built upon a small sheet of plywood, and the components are interconnected with flexible leads and copper-plated battery clips. It is very flexible and I can rearrange the circuit at a moment's notice to fit the need at hand.

If I were buying a Transmatch I would want to look inside the pretty case and examine the innards. Is a good quality ceramic switch used? Do the capacitors have sufficient plate spacing for the power level indicated? Are all rf connections well made — solid and firm? Is there sufficient air space around the inductor so that the metal cabinet is not inductively coupled to the coil, producing an unwanted shorted turn in the metal of the box? Sometimes a

*However the antenna matching unit does attenuate harmonics. **Editor**



Circuit diagram of the Ultimate Transmatch.
C1 – Split-stator variable, 250 pF per section; see text. For low-power version, E.F. Johnson type 16250; or similar, for high-power version, Millen type 16250, or similar.
C2 – 200-pF variable, for low power, E.F. Johnson type 167-12 or similar, for high power, Millen type 16520, .171-inch spacing, 16520A, .077-inch spacing, or similar.
J1, J2 – Coax chassis fitting, type SO-239.
J3,J4,J5 – Feed through insulators.
L1 – Roller inductor, see text. If 160-meter operation is desired, total inductance should be 28 uH, E.F. Johnson type 229-203; otherwise, 18 uH is adequate, E.F. Johnson type 229-202.
T1 – 1-to-4 balun; see text for details, cores are Amidon type T-200-2.

fig. 6. The Ultimate Transmatch of 1970. The split-stator circuit is used, and a ferrite-core balun has been added for balanced feeders. (*Drawing from QST, July, 1970, page 24.*)

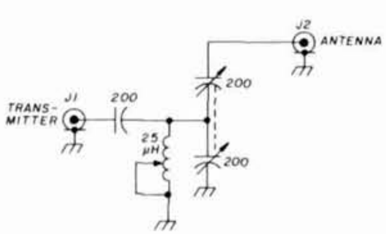


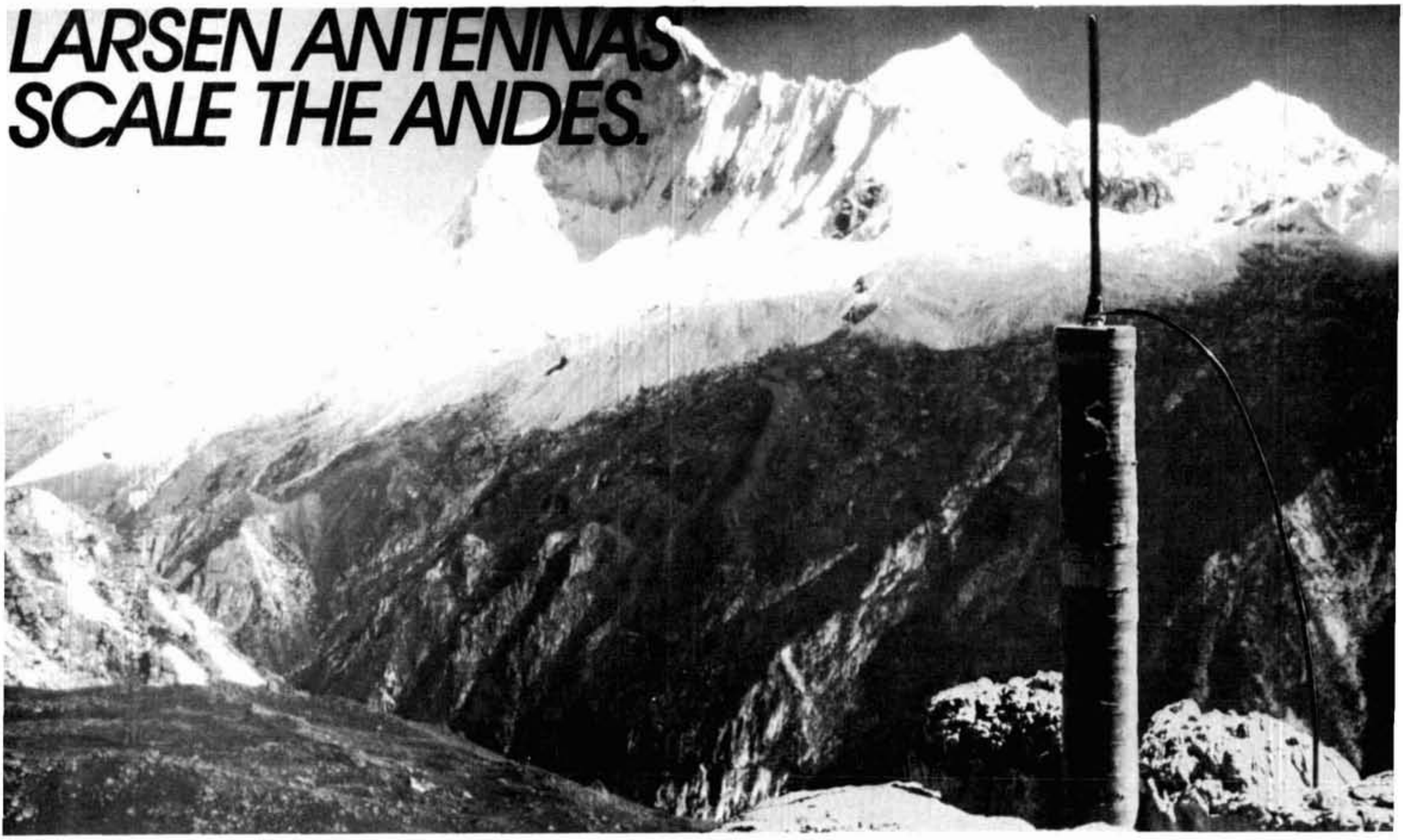
fig. 7. The SPC Transmatch shown in the 1981 *ARRL Handbook* is merely the Transmatch of W1ICP hooked up backwards! For balanced lines, an air-core balun is attached to antenna receptacle J2.

photograph of the interior of the tuner will give you these answers.

Note: A few months ago I offered readers of this magazine a reprint of my series of articles entitled "Design Considerations for Linear Amplifiers." This brochure has been reprinted and is again available. If you wish a copy, I'll be happy to send one to you for two 18-cent stamps (overseas readers send four IRCs). Write to me at EIMAC, 301 Industrial Way, San Carlos, California 94070 U.S.A.

ham radio

LARSEN ANTENNAS SCALE THE ANDES.



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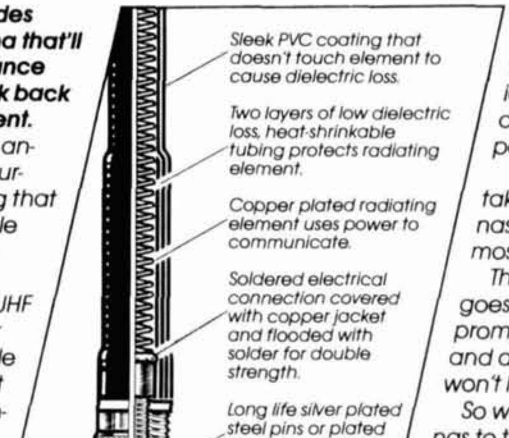

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an audio amplifier
for your handheld transceiver

Build this convenience accessory and avoid freeway trauma

Today's handheld transceivers are marvelous little radios. A long list of optional accessories makes it possible to tailor them to many applications. However, most don't have sufficient audio output to be used in a car. It's not much fun to drive while trying to hold the radio and its speaker/microphone to your ear. So a simple audio amplifier, with sufficient output to be heard over any amount of road noise, is a useful accessory. Let's build one.

The audio amplifier is mounted inside the speaker enclosure using a metal stand-off post. The power and audio leads are secured with a plastic cable clamp.

the circuit

In **fig. 1** an LM383 IC (U1) does all the work. It contains a preamplifier, power amplifier, and circuitry to protect against overheating, short circuits, and voltage spikes from an automotive electrical system. It operates from a 13.5-volt supply and can provide up to 5 watts of audio output. It delivers a gain of 100, about 40 dB.

Looking at **fig. 1**, R1 provides a load for the audio section of the handheld. (Some of the components used in the circuit prevent 2-meter energy from getting into the amplifier.) RFC1, C7, and C2 filter the input line, and RFC2 and C6 decouple the speaker lead.

The LM373 is a stable, well-behaved amplifier. R2 and R3 form a resistive divider, which provides negative feedback to pin 2 through C8. A key to stability is C4, which must be a metalized-film capacitor, with short leads, connected from pin 4 to pin 3 of U1. Other types of capacitors *should not* be substituted. Components used in the amplifier, except for the ferrite beads, are available from many local electronic-equipment suppliers. Ferrite beads are sold through mail order (check the ads).

By Douglas A. Blakeslee, N1RM, 4 Maple Lane, Brookfield, Connecticut 06804

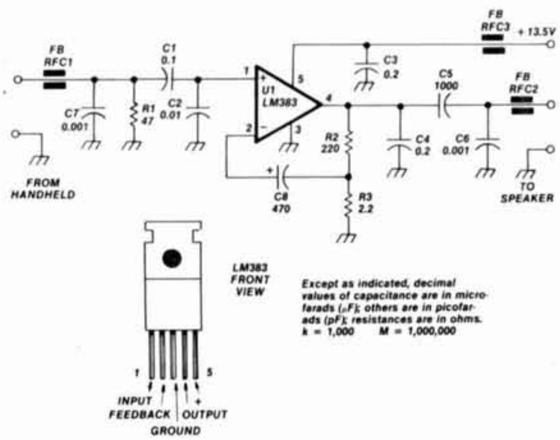

fig. 1. Schematic diagram of the audio amplifier. All capacitors are ceramic except C2, C3, and C4 (metalized film type) and those with polarity indicated, which are electrolytics. RFC1-RFC3 inclusive are jumbo ferrite-bead, VHF type, or three small VHF beads slipped over a short piece of hookup wire. U1 is a National Semiconductor audio-amplifier IC.

construction

The amplifier can be built using point-to-point wiring on a piece of perf board, on a universal circuit board, or on a homemade board, as shown in **fig. 2**. Whatever type of board you choose, follow the general component layout of **fig. 3**. If you use an etched circuit board, touch up the copper portion with some fine steel wool to remove any oxidation. Mount the components a few at a time, and bend the leads slightly to hold them in place. Solder all connections. Then inspect all solder joints to ensure they are bright and shiny. If a joint is dull and matted with solder, reheat it until the solder flows.

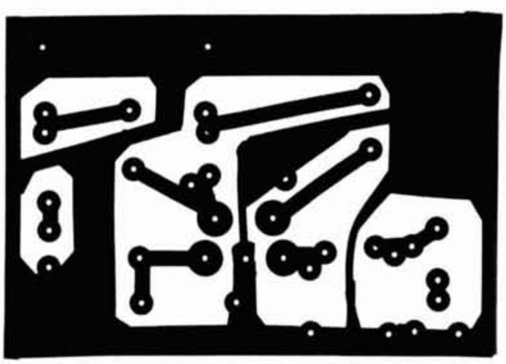

fig. 2. PC-board foil pattern for the audio amplifier.

To produce loud audio, a speaker must move air. Thus, a 2-inch diameter speaker isn't much good. A 4-inch diameter speaker is adequate, and 5- or 6-inch speakers are even better. I chose a 5-inch diameter speaker with housing, sold as an add-on rear-seat extension speaker. I mounted the audio amplifier inside the speaker housing (photo). If you use one of the extension speakers sold for CB radios and there is not enough room inside the speaker enclosure for the circuit, use a small aluminum box to house the amplifier.

power

The nominal 13.5 Vdc from an automotive electrical system is just what's needed for the audio amplifier. However, it's also desirable to power the handheld from the car electrical system, as rechargeable batteries are insufficient for long trips. Powering your handheld may not be so simple. Read your instruction book carefully. My FT-207 manual cautioned that the voltage applied be limited to 12 volts or below.

Inspection of the circuit diagram showed two dc input paths: one for needle-pin connections in a holder/power supply, and the other a jack for the battery charger. The circuit has one diode in series with the pin contacts and two diodes between the battery-charger jack and the set. (Silicon diodes typically have a voltage drop of 0.6 volt.)

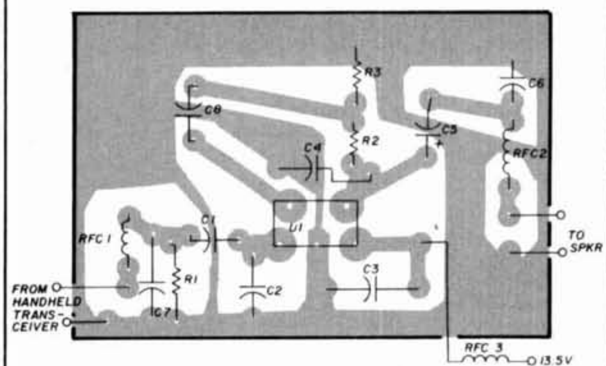

fig. 3. Parts placement diagram.

Automotive electrical systems are noisy electrically and often have high-voltage spikes called transients. The lead-acid storage batteries used in cars have a nominal voltage of 12.6. Fully charged, the batteries will show a potential of approximately 13.5 volts. The battery-charging system delivers 14 volts or more. Transients of up to 300 volts are produced during normal operation of the car. This is not the sort of power source to be directly connected to a handheld radio designed to operate from a mild-mannered nicad battery!

I chose to use the charger input jack to power my radio. With a maximum of 14.5 volts from the car, the power circuit of **fig. 4** was used. The two diodes inside the FT-207 provided a 1.2-volt voltage drop. I used two additional diodes in series with the power lead, so that the maximum voltage applied to the radio would be 12.1 volts. I included a 15-volt zener diode to clip any voltage transients. Also, I used a capacitor to reduce the noise from the automotive electrical system. (In some installations, a more extensive filter may be needed to eliminate alternator whine.)

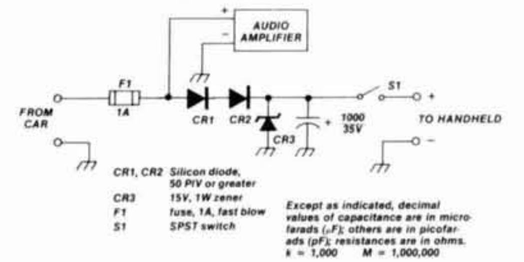

fig. 4. Schematic diagram of the power circuit.

installation

Installation details can be changed to suit individual requirements. My original goal was to use the radio for hamming while on family trips. I built the circuit of **fig. 4** into the speaker on a solder-lug strip. The power cord is equipped with a cigarette-lighter plug for instant installation.

Two short cords with miniature phone jacks connect to the radio, one for power and one for audio. S1 of **fig. 4** ensures that power is off until the power cord to the radio is in place. (It's impossible to insert or remove a "hot" phone plug without hitting ground simultaneously, which results in an impressive flash and a blown fuse!)

If you want a semi-permanent installation, the speaker and amplifier can be mounted under the dash or at any other convenient spot. I place my radio beside me on the car seat when traveling and use the remote microphone. Volume and squelch controls are handy, and the band-search feature is useful for finding repeaters when in unfamiliar areas. Best of all, when I arrive at my destination, the radio can be disconnected in seconds and clipped to my belt.

ham radio

Printed-circuit techniques,
solid-state devices,
and some old-time technology —
a project for
the first-time builder

field-strength meter
for the high-frequency Amateur bands

Here's a project for the first-time builder — a band-switching field-strength meter. It's a neat accessory for your station that indicates the relative field strength of a signal. Actually, it's a small, band-switched receiver covering the Amateur 80, 40, 20, 15 and 10 meter bands. In this unit the speaker or headphones have been replaced by a meter that indicates the relative field strength. The receiver is a very basic unit, but it's sensitive enough for critical antenna adjustment and tuning. It's battery powered, allowing you to work at some distance

By Ken Powell, WB6AFT, 6949 Lenwood Way, San Jose, California 95120

from the antenna. And it's sensitive enough so that a short whip antenna, as used on 2-meter portables, will serve as a pickup or receiving antenna.

The field-strength meter is constructed on a single printed circuit (PC) board. Component count is low, overall cost is minimal, and the highest voltage encountered is only 3 volts. The field-strength meter has a minimum number of controls: a push-button bandswitch, an rf-level meter, and a sensitivity control that keeps the instrument within reasonable bounds as you get your antenna and transmitter really humming!

The complete unit is about 5 inches wide, 6 inches deep, and 3 inches high (13 × 15 × 8 cm). It could be squeezed down a bit smaller; but, in the interest of making construction a pleasure rather than a chore, the package was kept on the roomy side. Component values are not overly critical, and no special tools or equipment are required for construction or adjustment.

circuit

The description of the field-strength meter makes it sound a bit more complex than it really is. A glance at the schematic (**fig. 1**) shows the simplicity of the circuit. Band switching sounds complex because we tend to think of large rotary switches and the like; but in this case, band switching is handled by a simple push-button switch mounted on the PC board. This eliminates a lot of wiring and the chance for errors. This type of switch is a real boon to the builder.

The circuit is actually a crystal set, much like those used by the pioneers of early wireless. The antenna is connected to the primary of the rf coil, L1; the secondary of this coil is tapped to provide resonance on each of the high-frequency bands covered by the field-strength meter.

The push-button bandswitch, S1, selects the desired tap on the secondary winding of the coil, L1, and shunts the secondary tap with the required capacitance to provide resonance at each switch position. To make parts procurement easy, the same variable capacitor is used on each band and is shunted by a fixed capacitor where required (see **fig. 1**). This provides a trimmer for setting each band and eliminates the need for a front-panel tuning control.

The voltage developed across L1 is applied to the detector, CR1, a germanium diode. This rectified voltage is filtered by capacitor C10 and applied to the base of Q1. This general-purpose germanium NPN transistor is an amplifier. It allows the use of a low-cost meter movement as an output indicator. (The alternative is a more sensitive meter, which is more expensive and more subject to damage.) The meter is shunted by sensitivity control R1, which allows a selected portion of Q1's collector current to bypass the meter movement. This enables you to maintain the meter needle within a usable portion of the meter scale as varying signals are applied to the antenna terminal. The overall collector current of transistor Q1 is limited by resistor R2. The power OFF/ON switch, S2, is coupled to the sensitivity control. The wiring is such that the full clockwise rotation of the control yields maximum sensitivity.

Power for the field-strength meter is supplied by two AA cells mounted on the PC board. Current consumption of the unit is low: battery life should approximate the shelf life of the batteries. Trimmer capacitors C1 through C5 provide individual tuning for each of the bands, and once the unit is adjusted, it's not likely that any drift will be encountered.

construction

Construction of the field-strength meter is really tailored for the first-time builder, and the parts cost, even in today's wild economy, is low. Components aren't especially sensitive to rough handling, and the package is not crammed or difficult to assemble. Radio-frequency circuits are often difficult to duplicate, but printed-circuit construction and standard coil stock take care of that nicely.

Standard hand tools and a drill are all that are required for construction. The aluminum of the case is very soft, and woodworking tools handle it well. A bit of filing is required to get the rectangular holes for the band switch and meter movement, but it's really not much of a task.

let's get started

The first step in the construction of the field-strength meter is to obtain the components shown in **table 1**. The PC board should be etched and drilled in accordance with the foil layout depicted in **fig. 2**. If you don't have the facilities for fabricating the PC board, an etched and drilled board, complete with the bandswitch assembly installed, is available. The source for this board is shown in **table 1**.

To start construction, mount the bandswitch and solder it in place on the PC board. Next, mount the four spacers on the foil side of the PC board. These spacers elevate the board above the base of the cabinet.

Now, before mounting any other components on the PC board, take the time to work out the mechanical details of the PC board in relation to the cabinet. If you use the same case I did and want to have the same general layout on the front panel, see the layout in the photos of the completed unit.

The front panel will require five rectangular holes for the switch assembly, a rectangular hole for the meter, and a round hole for the sensitivity control.

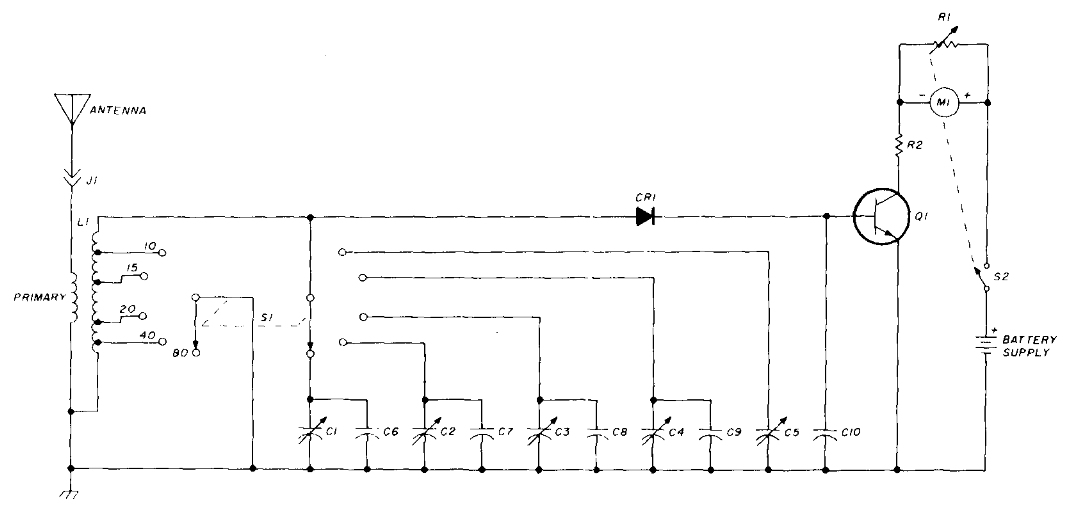

fig. 1. Schematic diagram of the bandswitching field-strength meter. Circuit is kept simple by using simple pushbutton switch mounted directly on the PC board.

The rear panel will require holes for the UHF connector used for the antenna.

After making the cutouts in the case, the PC board can be placed into the case, and the clearance for the push buttons can be checked. If things seem to fit well, mark and drill the four holes in the base for mounting the PC board and the rubber feet furnished with the case. When you're satisfied with the mechanical details, you can go on to complete the assembly of the board.

mounting small parts

The PC-board-mounted components, with the exception of rf coil L1, can now be mounted and soldered in place on the board as shown in **fig. 3**. When mounting components try to develop the habit of installing like components in the same direction so all values can be read from one side or edge of the PC board. In this case, all capacitors would be installed in the same direction. This is a good practice for all your projects and can make service and checkout easier.

Install the four wires that leave the board, using stranded wire to reduce the chance of wire breakage. Leave these leads about 6 inches (15 mm) long and trim them during the final stages of wiring. Color-coded wire is good for this purpose, and if you use color codes, note them on the schematic for reference. The PC board can now be set aside and work can be started on rf coil L1.

the rf coil

Before starting work on L1, study the drawing shown in **fig. 4**. Develop a fairly good idea in your mind of how the coil is to be formulated, as it is a very easy thing to get confused. Initially, the coil stock is 3 inches (76 mm) long and contains 48 turns held in place by four plastic formers.

Starting at the left end of the coil, as shown in **fig. 4**, count off four complete turns then go about one-third of a turn further, just past the second former, and cut the wire. Fold this wire back so it leaves the coil stock parallel to the lead at the start of the coil. This forms the four-turn primary of L1. The remaining end of the wire just cut will be the lead wire for the secondary and is peeled from the coil stock until it is parallel with the primary coil leads. This will leave a single-turn space between primary and secondary windings of L1. From this initial point on the secondary, count off 31 turns and again cut the wire about one-third way around the coil form. Fold this wire back parallel with the other coil leads. Remove the remaining coil stock and you should have a four-turn primary and a 31-turn secondary.

Now to put a few taps on the secondary. Using nail polish or other marking device, put a small mark at the fourth, seventh, ninth, and eighteenth turns of the secondary. These marks should be placed at the former, and the taps will be soldered just past the marks in the direction of the coil winding.

Scrape the coil plating lightly with a sharp hobby knife where each tap will be placed. This will make soldering the taps easier. Tin each of these spots lightly with your iron before soldering the taps in place. Form the four tap wires from resistor leads or solid wire that is well tinned. Don't try to use wire left

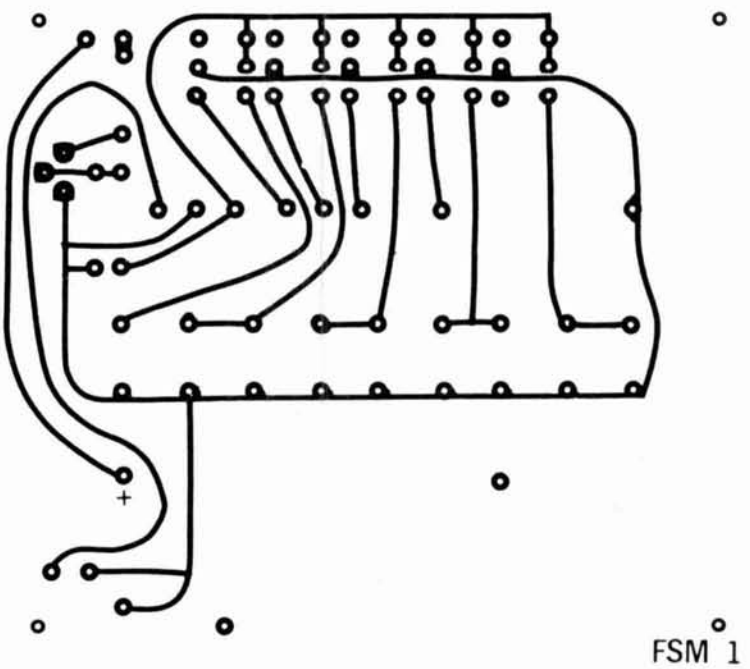

fig. 2. PC board, foil side, for the field-strength meter.

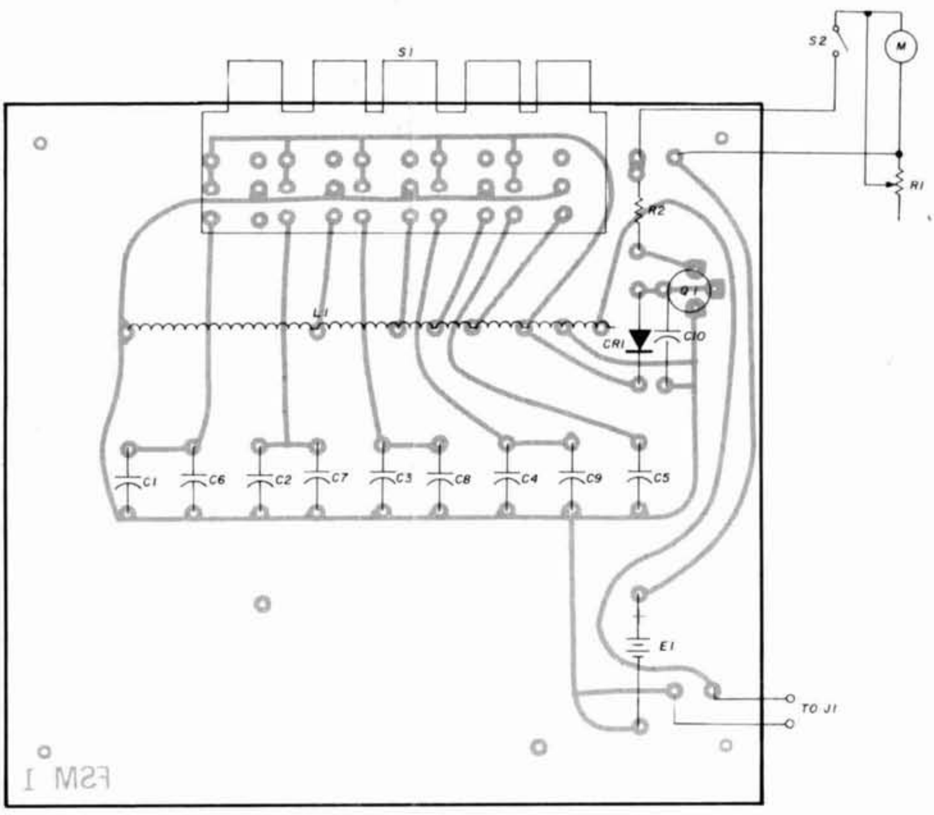

fig. 3. Component layout and associated wiring viewed from component side of PC board.

table 1. Parts list for the field strength meter.

component	description	part number	source*
C1 through C5	5 to 30 pF ceramic trimmer	E.F. Johnson 275-0430-005	CS
C6	150 pF ceramic cap	Sprague 5GA-T15	CS
C7	68 pF ceramic cap	Sprague 5GA-Q68	CS
C8	22 pF ceramic cap	Sprague 5GA-Q22	CS
C9	10 pF ceramic cap	Sprague 5GA-Q10	CS
C10	0.001-μF	Sprague 5GA-D10	CS
CR1	1N34A diode	276-1123	RS
E1	1.5 V "AA" cells (2X)	23-552	RS
E1 Holder	for 2 "AA" cells	12A2016-0	GM
J1	UHF jack, SO-239	278-201	RS
L1	1" × 16 turns/inch	B&W 3015	QE
M1	1 mA meter	Calectro D1-905	CS
Q1	transistor, germanium	276-2002	RS
R1	5 k pot, linear taper	271-1714	RS
R2	270-ohm, 1/2 W resistor	271-016	RS
S1	switch, 5-position pushbutton	18A1731-9	GM
S2	switch for R1	271-1740	RS
case	5-1/4" × 3" × 6"	270-253	RS
knob	0.750" diameter × 1/4" shaft	274-415	RS
spacers	No. 6 screw spacers	64-3024	RS
PC board	with S1 installed	FSM1	JO

CS: Circuit Specialists
1344 N. Scottsdale Road
Tempe, AR 85281
Tel. 800-528-1417

GM: Gravois Merchandisers, Inc.
715 Armour Road
No. Kansas City, MO 64116
Tel. 800-821-3686

QE: Quement Electronics
1000 S. Bascom Avenue
San Jose, CA 95128
Tel. 408-998-5900

JO: Jim Oswald
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PC board with S1
installed $9.75 postpaid
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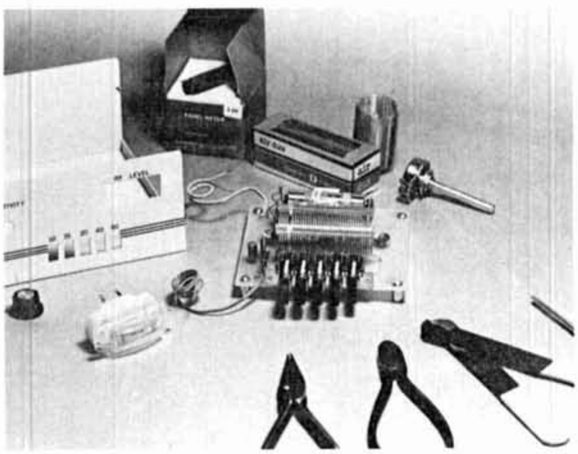
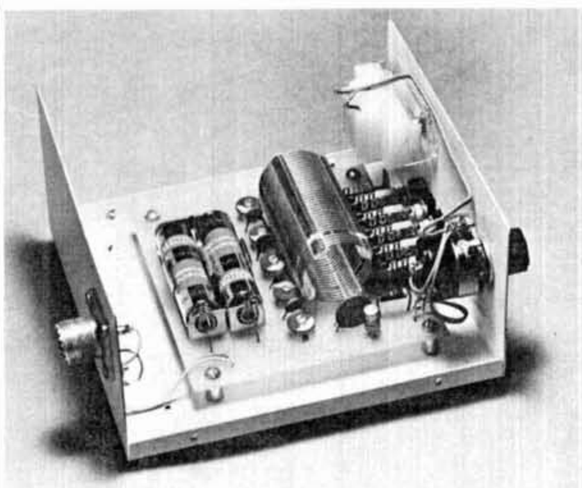
RS: Radio Shack
Local stores



The field-strength meter ready for final assembly. PC-board construction and the use of pushbutton switches make a clean layout and an attractive package. Mounting screws for the meter are avoided by mounting the meter with epoxy cement.



Inside the field-strength meter showing, from left, the battery pack; rf tuned circuit consisting of L1 and C1 through C10; meter, and sensitivity control. Note that component layout pretty much follows the schematic diagram.

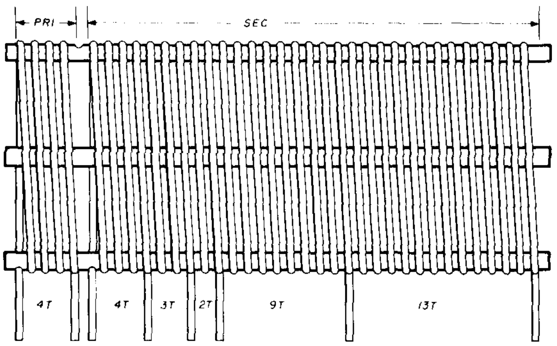


fig. 4. Details of rf-coil construction from standard coil stock.

over from the coil stock, as this is often difficult to solder in place.

Solder the four taps in place as shown in **fig. 4**. This operation is a bit tricky. Should you splash some excess solder on the coil form, it will lift off using solder wick or even a pipe cleaner.

After all the taps are in place, the coil leads can be trimmed to size and the coil can be mounted and soldered to the PC board. Don't get the tap leads too hot during this process or they may pop off the coil!

final details

Now that the PC board is complete, the mechanical details can be finished on the case. If desired, the case can be sanded with 320 or finer paper and a coat or two of your favorite color can be applied. I usually do this, as I invariably scuff up the front panel when making the required cutout.

After the paint is thoroughly dry, the rub-on lettering can be applied. This type of lettering and a few racing stripes can give your home projects a commercial look. A coat of clear lacquer will protect the lettering and level out the paint on the panel.

After all's dry, the PC board can be installed in the case and the sensitivity control, meter, and antenna jack mounted. The meter described in **table 1** has two small mounting holes. However, rather than use these, I mounted the meter with a couple of drops of epoxy cement between the front panel and the mounting tabs. This eliminated the mounting screws in the front panel and makes for a clean package.

The remaining wiring can be completed as shown in **fig. 3**, and the control knob can be installed on the sensitivity control. Give the unit a quick once-over against the schematic and drawings, then install the two AA cells, observing proper polarity. You are just about ready for the smoke test.

Turn the field-strength meter to **ON** and advance the sensitivity control slowly. As you advance clockwise, the meter will move slightly off the zero position in a positive direction. This is normal and indicates that all is well so far. Should the meter move slightly in the negative direction, the meter leads are reversed and must be transposed to correct the problem.

adjustment

The field-strength meter can be tuned with a signal source such as a signal generator, grid-dip meter, or your transmitter. If you use your transmitter, be sure to couple it to a dummy load so you don't radiate signals that will bother other Amateurs. In the absence of a dummy load, turn your transmitter output down and pick a time when the band is dead. Remember to listen on frequency before transmitting and keep each transmission short, ten seconds or less, and identify each transmission as a test transmission.

Choose your favorite frequency on the 80-meter band, and with the field-strength meter in the 80 position, inject a signal from the generator or use a pickup antenna for off-the-air or grid-dip signal source.

Adjust trimmer capacitor C1 for a maximum meter reading. Next, repeat this procedure with your signal source and the field-strength meter set for the 40-meter band. Trimmer capacitor C2 will provide adjustment for this band. Repeat this procedure for the 20-meter band, using C3 for adjustment. Capacitor C4 is for 15 meters, and C5 will be the trimmer for the 10-meter band. This completes the adjustment of the field-strength meter. The cover can be installed and you can sit back and admire your handiwork!

a final word

While the field-strength meter isn't a technological breakthrough or a state-of-the-art device by today's standards, it's a good project for getting started in the fascinating field of home brew. It will help you gain the skills necessary to go on to bigger, better, and more interesting projects. Most first-time builders will be able to complete the project during a weekend once the parts have been procured. And keep in mind that if you do have any problems or areas that are confusing you, ask one of your Amateur buddies for a bit of help. You will both enjoy the project!

The next project? Well, I hope to put an SWR meter together soon, and when we're armed with the field-strength meter *and* an SWR meter, there won't be a tune-up problem we can't handle. So do a good job on the field-strength meter and watch for the SWR meter soon.

ham radio

super beep circuit
for repeaters

Here's a circuit
for your repeater
that features an inhibit
and selectable wait function

A beep signal in your repeater, if used properly, could be an asset; otherwise it's nothing more than another piece of trivial hardware. The super beep circuit, described here, was designed to provide the following:

1. An inhibit function against fluttering signals, as from mobile stations.

2. A selectable wait function to allow breakers to start a conversation before the beep signal is activated.

3. An adjustable duration of two independent audio oscillators, which generate a mellow and pleasant sound.

4. A high-level audio output to drive most repeater circuits.

The super beep circuit was designed for the Upper-Valley Amateur Radio Club repeater (Dayton, Ohio) using a VHF Engineering COR board. Input to the beep circuit, **fig. 1**, is obtained from the PTT point on the COR board. Output from the beep circuit feeds the audio input to the repeater's transmitter.

The super beep circuit uses standard TTL and CMOS logic, operating from a 5-volt supply. As shown in **fig. 1**, the circuit consists of an inhibit one-shot, a wait one-shot, and the two triggered audio oscillators. A buffer amplifier isolates and drives the repeater's audio input.

inhibit function

The inhibit function of the circuit is provided by U1, a 555 timer used as a monostable, which is made retriggerable by connecting a diode (CR1) between pins 6 and 2 (**fig. 2**). When the squelch from the repeater is broken, the PTT signal on the COR board, normally at logic 1, is forced to a logic 0. This action makes U1 pin 2 a logic 1. So long as the repeater's COR board keeps the PTT signal low, the output of U1 will stay high, and no timing function will be permitted since CR1 will not allow the timing capacitor to charge.

By Al Torres, KP4AQI, 4850 Hollywreath Court, Dayton, Ohio 45424

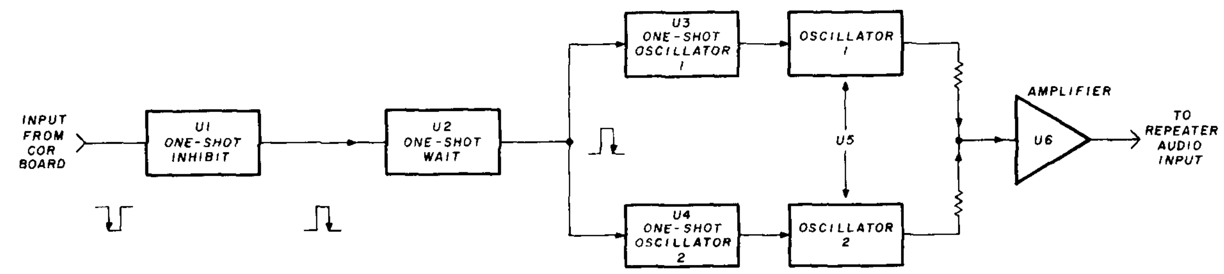


fig. 1. Block diagram of the super beep circuit, which uses standard TTL and CMOS logic. Two triggered oscillators provide the beep tone.

If the COR signal momentarily switches states (as during mobile flutter), the timing cycle of U1 is initiated. This timing cycle was designed to keep U1 pin 3 at logic 1 for 0.75 second after the COR signal changes state. If the COR signal recovers before 0.75 second, U1 pin 3 will not change state, and the timing cycle is aborted (see **fig. 3**). Keep in mind that the wait one-shot is activated only on transitions that go from high to low.

wait function

This function is implemented by using a 74121 (U2, **fig. 2**) as a monostable. The time duration of this one-shot is determined by:

$$T_D = K_d R_T C_T \left(1 + \frac{0.7}{R_T}\right) \qquad (1)$$

where:

T_D = time duration (seconds)

K_d = constant supplied by manufacturer (ND)

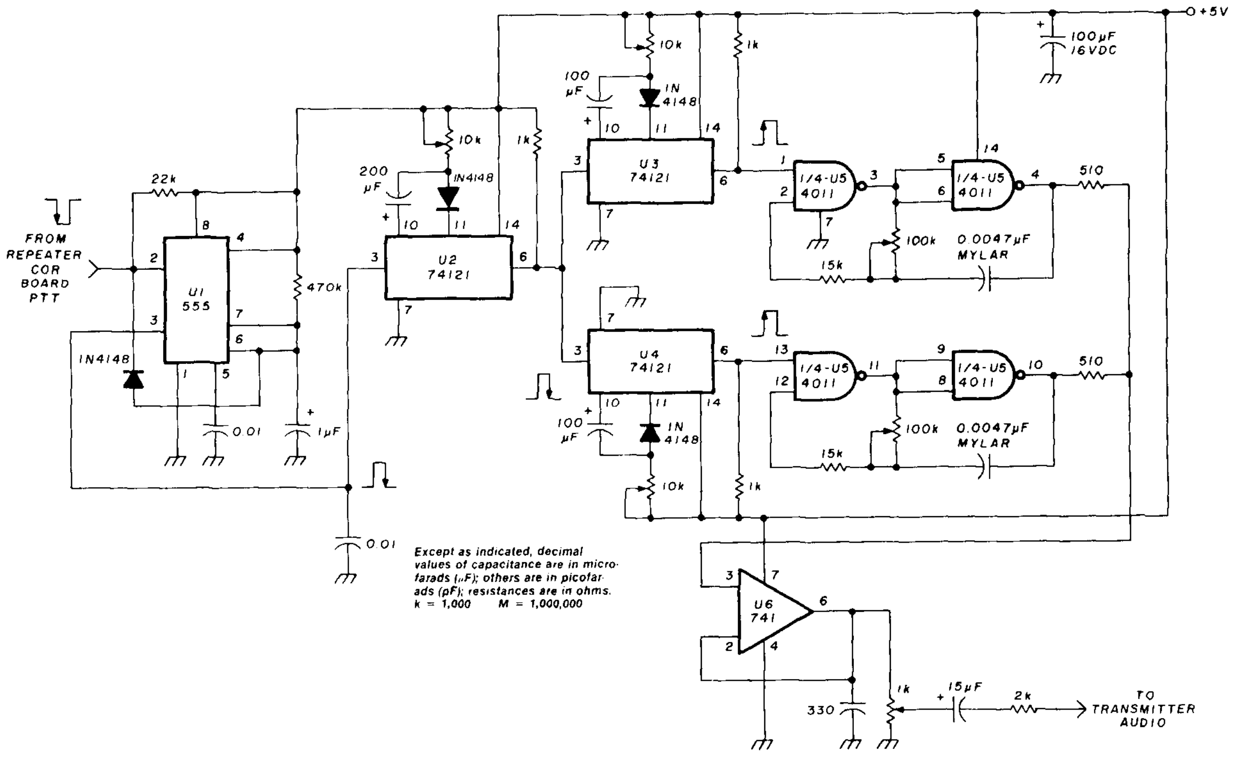


fig. 2. Schematic diagram of the super beep circuit.

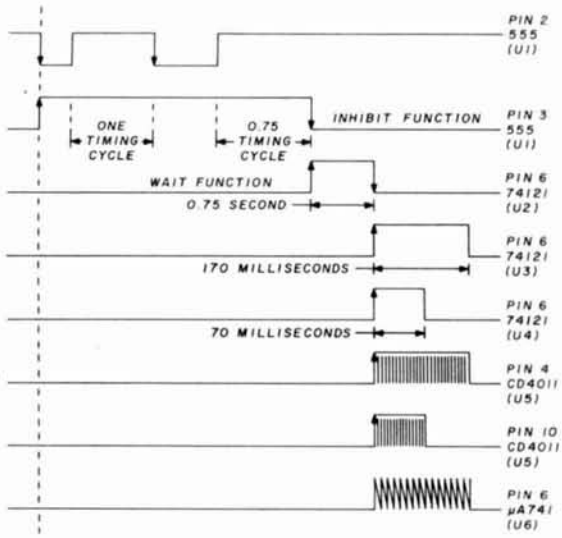


fig. 3. Super beep circuit timing diagram.

C_T = capacitance (farads)
R_T = resistance (ohms)

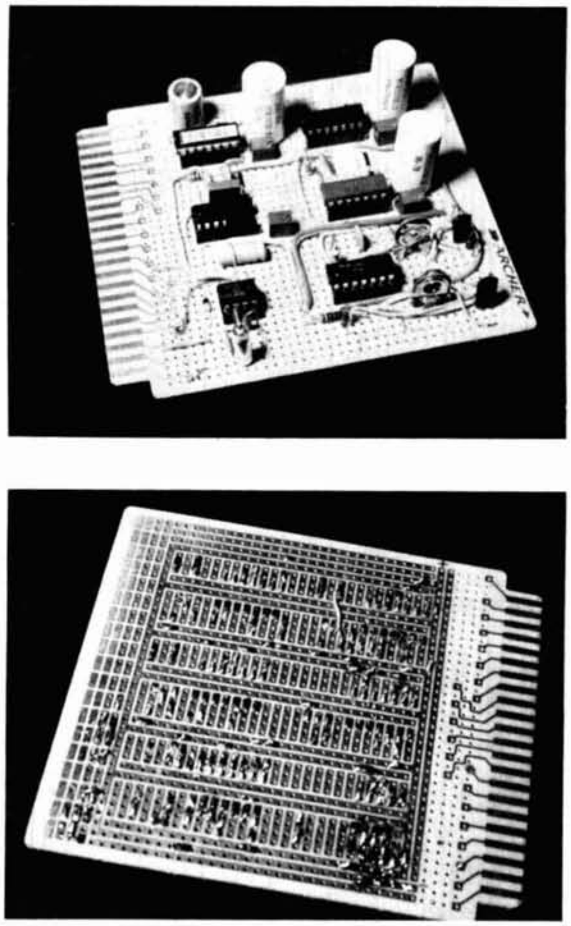
With the values shown, the one shot can be adjusted from more than 100 milliseconds to more than 2 seconds. In practice, I found that 0.75 second was optimum; such time duration, in addition to the 0.75 second from the inhibit circuit (a total of 1.5 seconds), is enough time for someone to break in between transmissions and before the beep signal is activated.

oscillators

The oscillators use CMOS logic (U5, a CD4011) and operate in the gated mode. When the input to the first gate is at logic 0 no audio is generated. Using this concept, the oscillators are fired for a fixed-time duration; control for such time duration is accomplished by two one-shots (U3 and U4). By making U3's duration longer than that of U4, a pleasant, mellow sound is generated.

The pitch of each oscillator is controlled by a 100k pot, which can be adjusted to satisfy your taste. After careful experimentation with our system, we made U3's duration approximately 170 milliseconds and U4's just 70 milliseconds. Results showed that a ratio of 3:1 creates the most pleasant sound. The audio is then coupled to the repeater through two 510-ohm resistors to a unity-gain voltage follower (U6), a μA741 op amp. Audio level is controlled by a 1k pot.

The input impedance of this voltage follower is such that no loading occurs at the CMOS audio oscillators. Audio range, with the components used, is adjustable from 1000 Hz to 10 kHz.



Super beep circuit was constructed on a Radio Shack edge-card board.

construction

The super beep circuit was built on a Radio Shack two-voltage-source edge-card board (RS 276-154), which mates to a 22-pin dual edge-card socket (RS 276-1551). The ICs were mounted in DIP sockets, which were soldered to the board.

Nothing is critical about the circuit. The unit operates from 5.0 Vdc, which is available on most popular repeaters. Current drain is not significant.

When adjusting the audio level, make sure that you provide enough audio to deviate your repeater 4-4.5 kHz; any greater amount will become bothersome to the operators and to adjacent repeaters.

ham radio

Here's a Concept You Haven't Seen In Amateur Radio For A Long Time— Low Price.

New TEN-TEC Argosy $549

The right design — for all the right reasons. In setting forth design parameters for ARGOSY, Ten-Tec engineers pursued the goal of giving amateurs a rig with the right features at a price that stops the amateur radio price spiral.

The result is a unique new transceiver with selectable power levels (convertible from 10 watts to 100 watts at the flick of a switch), a rig with the right bands (80 through 10 meters including the new 30 meter band), a rig with the right operational features plus the right options, and the right price for today's economy—just $549.

Low power or high power, ARGOSY has it. Now you can enjoy the sport and challenge of QRPp operating, and, when you need it, the power to stand up to the crowds in QRM and poor band conditions. Just flip a switch to move from true QRPp power with the correct bias voltages to a full 100 watt input.

New analog readout design. Fast, easy, reliable, and efficient. The modern new readout on the ARGOSY is a mechanical design that instantly gives you all significant figures of any frequency. Right down to five figures (± 2 kHz). The band switch indicates the first two figures (MHz), the linear scale with lighted red bar-pointer indicates the third figure (hundreds) and the tuning knob skirt gives you the fourth and fifth figures (tens and units). Easy. And efficient—so battery operation is easily achieved.

The right receiver features. ***Sensitivity*** of 0.3 μV for 10 dB S+N/N. ***Selectivity:*** the standard 4-pole crystal filter has 2.5 kHz bandwidth and a 2.7:1 shape factor at 6/50 dB. Other cw and ssb filters are available as options, see below. I-f frequency is 9 MHz, i-f rejection 60 dB. ***Offset tuning*** is ± 3 kHz with a detent zero position in the center. ***Built-in notch filter*** has a better than 50 dB rejection notch, tunable from 200 Hz to 3.5 kHz. An optional noise blanker of the i-f type has 50 dB blanking range. ***Built-in speaker*** is powered by low-distortion audio (less than 2% THD)

The right transmitter features. ***Frequency coverage*** from 80 through 10 meters, including the new 30 meter band, in nine 500 kHz segments (four segments for 10 meters), with approximately 40 kHz VFO overrun on each band edge. ***Convertible power:*** 100 or 10 watts input with 100% duty cycle for up to 20 minutes on all bands. ***3-function meter*** shows forward peak power on transmit, SWR, and received signal strength. ***PTT*** on ssb, ***full break-in*** on cw. PIN diode antenna switch. ***Built-in cw sidetone*** with variable pitch and volume. ***ALC control*** on "high" power only where needed, with LED indicator. ***Automatic*** normal sideband selection plus reverse. ***Normal 12-14V dc*** operation plus ac operation with optional power supply.

The right styling, the right size. Easy-to-use controls, fast-action push buttons, all located on raised front panel sections. New meter with lighted, easy-to-read scales. Rigid steel chassis, molded front panel with matching aluminum top, bottom and back. Stainless steel tilt-up bail. And it's only 4" high by 9½" wide by 12" deep (bail not extended) to go anywhere, fit anywhere at home, in the field, car, plane or boat.

The right accessories—all front-panel switchable. Model 220 2.4 kHz 8-pole ssb filter $55; Model 218 1.8 kHz 8 pole ssb filter $55; Model 217 500 Hz cw filter $55; Model 219 250 Hz cw filter $55; Model 224 Audio cw filter $34; Model 223 Noise blanker $34; Model 226 internal Calibrator $39; Model 1125 Dc circuit breaker $15; Model 225 117/230V ac power supply $129; Model 222 mobile mount, $25; Model 1126 linear switching kit, $15.

Model 525 ARGOSY —— $549.

Make the right choice, ARGOSY—for the right reasons ***and*** low price. See your TEN-TEC dealer or write.

TEN-TEC, INC.
SEVIERVILLE, TENNESSEE 37862

Questions and Answers

Entries must be by letter or post card *only. No telephone requests will be accepted. All entries will be acknowledged when received. Those judged to be most informative to the most Amateurs will be published. Questions must relate to Amateur Radio.*

Readers are invited to send a card with the question they feel is most useful that appears in each issue. Each month's winner will receive a prize. We will give a prize for the most popular question of the year. In the case of two or more questions on the same subject, the one arriving the earliest will be used.

I notice that pattern plots for beam antennas show the beamwidth at the 3-dB down points. Why is this figure used rather than, say, the 4- or 5-dB down point? — Sylvester McCutheon.

The 3-dB down point for antenna beamwidth measurements is a convenient reference point. The beamwidth is the angular distance between the directions at which the received or transmitted power is 0.707 times its maximum value, also called the half-power point.

I've moved a number of times in the last couple of years. The way I understand the FCC regulations is that if I move I have to notify the FCC — unless it is a temporary move. But what amount of time is considered temporary? — David Carrington, WL7ACD.

The FCC rules pertaining to addresses of licensees are contained in Sections 97.43 and 97.44. Basically, these rules state that you must furnish the FCC with an address in the United States where they can reach you with correspondence and documents (pink tickets, for example). Furthermore, every Amateur Radio station shall have one land location, the address of which appears on the station license, and at least one control point. Unless advised otherwise, the Commission will use the address contained in your most recent application to contact you.

After reading an article in which negative resistance was mentioned, I have wondered just what this term means. — Ted Brice.

Some devices have a property that exhibits a characteristic opposite to Ohm's law for positive resistance. This property, called negative resistance, is characterized by a decrease in voltage drop across the device as current through it is increased, or vice versa. Alternatively, a decrease in current through the device will occur as voltage across the device is increased, or vice versa.

A tunnel diode is an example of a device that exhibits negative resistance. The characteristic curve of the tunnel diode, which shows forward current as a function of forward voltage, contains an area where the diode's current decreases with increased voltage. This, of course, is opposite to the behavior of a regular resistor, which permits a greater current to flow as the voltage increases. The reverse condition occurs in the diode over this range of voltages; thus it is said to have negative resistance. With suitable external circuits added, it can be used as an oscillator or amplifier.

My TH6DXX antenna is on a 105-foot tower, and a 2300-MHz TV down converter is on the same tower at the 45-foot level. When I run about 800 watts input on 15 meters, the television screen goes blank and the down converter is inoperative. I have no interference problem with the down converter disconnected. The interference does not occur when operating on any other Amateur high-frequency band. Is the problem caused by overload on the down converter, and if so, why only on 15 meters? — Jim Brown, N4DDS.

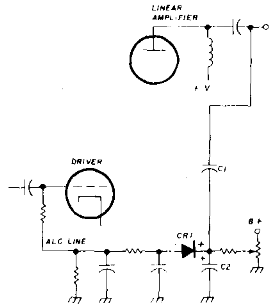
The transmission line from your converter to the TV set might be some length that is resonant at 21 MHz. So even if you disconnect the converter and don't remove the feedline, the latter will act like a beautiful antenna. Try putting a shorted quarter-wave stub (at 21 MHz) at the input to the TV set. The problem should then disappear.

What is the best location for a multiband vertical antenna — on the ground, on the roof, or on top of a mast? — Richard L. Beaty, KA5DDG.

The antenna should be mounted as high above ground and as far from surrounding objects as possible. In any case, a good ground system is important for a vertical antenna to work efficiently. Most vertical-antenna ground systems consist of radial wires arranged around the base of the antenna. It is not absolutely necessary that the radials form the spokes of a wheel; they can be run in almost any convenient manner. Installing radials on a mast-mounted vertical is more difficult than if the antenna is ground mounted, of course. However, you can use the radials as guy wires and slope them downward at an angle of, say, 45 degrees from the horizontal. This arrangement will make the antenna's feedpoint impedance closer to that of 50-ohm coax than if the wires were run horizontally.

Would you discuss ALC in some detail? I can't find anything on the subject in any authoritative source, including ARRL publications or my manual for my Yaesu FT-101. — Harold F. Keenan, WA1FJR.

ALC is an acronym for both *Automatic Level Control* and *Automatic Load Control*. The former is used with speech amplifiers in the radio-broadcast service. In the Amateur-Radio Service, the latter term describes a form of compressor, or automatic variable-gain amplifier, which is used in SSB transmitters. Automatic load control keeps SSB transmitter gain at the highest usable level without exceeding the peak-power capability of the power amplifier — a sort of insurance policy.



In the simplified circuit shown, which is used with zero-biased triodes, the power-amplifier tube draws grid current over a certain portion of each excitation cycle. C1 and C2 divide the rf voltage in the amplifier plate circuit. The rf voltage produced across C2 is rectified by CR1, which is connected so that its dc output voltage is negative. This negative dc voltage is applied to the control grid of a remote-cutoff tube in the driver to reduce the gain of the driver stage on signal peaks.

Other circuit elements provide appropriate attack and release time constants and bias. The overall effect of ALC is to keep the rf output relatively constant and at a level below the point where the amplifier is overdriven by widely varying audio input.

ham radio

Top-Notch.

VBT, notch, IF shift, wide dynamic range

TS-830S

Now most Amateurs can afford a high-performance SSB/CW transceiver with every conceivable operating feature built in for 160 through 10 meters (including the three new bands). The TS-830S combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF. Its optional VFO-230 remote digital VFO provides five memories.

TS-830S FEATURES:

- **160-10 meters, including three new bands**
  Covers all Amateur bands from 1.8 to 29.7 MHz (LSB, USB, and CW), including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz.
- **Wide receiver dynamic range**
  Junction FETs (with optimum IMD characteristics and low noise figure) in the balanced mixer, a MOSFET RF amplifier operating at low level for improved dynamic range (high amplification level not needed because of low noise in mixer), dual resonator for each band, and advanced overall receiver design result in excellent dynamic range.
- **Variable bandwidth tuning (VBT)**
  Continuously varies the IF filter passband width to reduce interference. VBT and IF shift can be controlled independently for optimum interference rejection in any condition.
- **IF notch filter**
  Tunable high-Q active circuit in 455-kHz second IF, for sharp, deep notch characteristics.
- **IF shift**
  Shifts IF passband toward higher or lower frequencies (away from interfering signals) while tuned receiver frequency remains unchanged.
- **6146B final with RF NFB**
  Two 6146B's in the final amplifier provide 220 W PEP (SSB)/180 W DC (CW) input on all bands. RF negative feedback provides optimum IMD characteristics for high-quality transmission.
- **Built-in digital display**
  Six-digit large fluorescent tube display, backed up by an analog dial. Reads actual receive and transmit frequency on all modes and all bands. Display Hold (DH) switch.
- **Adjustable noise-blanker level**
  Built-in noise blanker eliminates pulse- type (such as ignition) noise. Front-panel threshold level control.
- **Various IF filter options**
  Either a 500-Hz (YK-88C) or 270-Hz (YK-88CN) CW filter may be installed in the 8.83-MHz first IF, and a very sharp 500-Hz (YG-455C) or 250-Hz (YG-455CN) CW filter is available for the 455-kHz second IF.
- **More flexibility with optional digital VFO**
  VFO-230 operates in 20-Hz steps and includes five memories. Also allows split-frequency operation. Built-in digital display. Covers about 100 kHz above and below each 500-kHz band.
- **Built-in RF speech processor**
  For added audio punch and increased talk power in DX pileups.
- **RIT/XIT**
  Receiver incremental tuning (RIT) shifts only the receiver frequency, to tune in stations slightly off frequency. Transmitter incremental tuning (XIT) shifts only the transmitter frequency.
- **SSB monitor circuit**
  Monitors IF stage while transmitting, to determine audio quality and effect of speech processor.

More information on the TS-830S is available from all authorized dealers of Trio-Kenwood Communications, Inc., 1111 West Walnut Street, Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Matching accessories for fixed-station operation:
- SP-230 external speaker with selectable audio filters
- VFO-230 external digital VFO with 20-Hz steps, five memories, digital display
- AT-230 antenna tuner/ SWR and power meter
- MC-50 desk microphone
- HC-10 digital world clock
- YG-455C (500-Hz) and YG-455CN (250-Hz) CW filters for 455-kHz IF
- YK-88C (500-Hz) and YK-88CN (270-Hz) CW filters for 8.83-MHz IF

Other accessories not shown:
- TL-922A linear amplifier
- SM-220 Station Monitor
- PC-1 phone patch
- HS-5 and HS-4 headphones
- MC-30S and MC-35S noise-cancelling hand microphones

Specifications and prices are subject to change without notice or obligation.

Small wonder.

Processor, N/W switch, IF shift, DFC option

TS-130S/V

An incredibly compact, full-featured, all solid-state HF SSB/CW transceiver for both mobile and fixed operation. It covers 3.5 to 29.7 MHz (including the three new Amateur bands!) and is loaded with optimum operating features such as digital display, IF shift, speech processor, narrow/wide filter selection (on both SSB and CW), and optional DFC-230 digital frequency controller. The TS-130S runs high power and the TS-130V is a low-power version for QRP.

TS-130 SERIES FEATURES:

- **80-10 meters, including three new bands**
  Covers all Amateur bands from 3.5 to 29.7 MHz, including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz. VFO covers more than 50 kHz above and below each 500-kHz band.
- **Two power versions...easy operation**
  TS-130S runs 200 W PEP/160 W DC input on 180-15 meters and 160 W PEP/140 W DC on 12 and 10 meters. TS-130V runs 25 W PEP/20 W DC input on all bands. Solid-state, wideband final amplifier eliminates transmitter tuning, and receiver wideband RF amplifiers eliminate preselector peaking.
- **CW narrow/wide selection**
  "N-W" switch allows selection of wide and narrow bandwidths. Wide CW and SSB bandwidths are the same. Optional YK-88C (500 Hz) or YK-88CN (270 Hz) filter may be installed for narrow CW.
- **Built-in speech processor**
  Increases audio punch and average SSB output power, while suppressing sideband splatter.
- **SSB narrow selection**
  "N-W" switch allows selection of narrow SSB bandwidth to eliminate QRM, when optional YK-88SN (1.8 kHz) filter is installed. (CW filter may still be selected in CW mode.)
- **Sideband mode selected automatically**
  LSB is selected on 40 meters and below, and USB on 30 meters and above. SSB REVERSE position on MODE switch.
- **Built-in digital display**
  Six-digit green fluorescent tube display indicates actual operating frequency to 100 Hz. Also indicates external VFO or fixed-channel frequency, RIT shift, and CW transmit/receive shifts. Backed up by an analog subdial.
- **IF shift**
  Allows IF passband to be moved away from interfering signals and sideband splatter.
- **Built-in RF attenuator**
  For optimum rejection of intermodulation distortion.
- **Single-conversion PLL system**
  Improves stability as well as transmit and receive spurious characteristics.
- **Built-in VOX**
  For convenient SSB operation, as well as semibreak-in CW with sidetone.
- **Effective noise blanker**
  Eliminates pulse-type interference such as ignition noise.
- **Compact and lightweight**
  Measures only 3-3/4 inches high, 9-1/2 inches wide, and 11-9/16 inches deep, and weighs only 12.3 pounds.

Optional DFC-230 Digital Frequency Controller
Allows frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Includes four memories (handy for split-frequency operation) and digital display. Covers 100 kHz above and below each 500-kHz band. Very compact.

More information on the TS-130 Series is available from all authorized dealers of
Trio-Kenwood Communications, Inc.,
1111 West Walnut Street,
Compton, California 90220.

KENWOOD
...pacesetter in amateur radio

Matching accessories for fixed-station operation:

- PS-30 base-station power supply (remotely switchable on and off with TS-130S power switch).
- SP-120 external speaker
- VFO-120 remote VFO
- MC-50 50kΩ/500Ω desk microphone

Other accessories not shown:

- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters
- YK-88SN (1.8 kHz) narrow SSB filter
- AT-130 compact antenna tuner (80-10 m, including 3 new bands)
- MB-100 mobile mounting bracket
- MC-30S and MC-35S noise cancelling hand microphones
- PC-1 phone patch
- TL-922A linear amplifier
- HS-5 and HS-4 headphones
- HC-10 world digital clock
- PS-20 base-station power supply for TS-130V
- SP-40 compact mobile speaker
- VFO-230 digital VFO with five memories

Specifications and prices are subject to change without notice or obligation.

Garth Stonehocker, KØRYW

DX FORECASTER

last-minute predictions

Very good conditions on the lower-frequency bands are expected during the first few days, perhaps through the first week, of July, then another good period is expected during the third week of the month. The DX conditions for the higher-frequency bands should improve steadily until the third week. During this time the daylight hours into the evening will be favored. Some disturbance is expected for a day or two in the first week, again around the 15th, and possibly of longer duration near the 21st of the month.

events of the month

Geophysical events that may affect DX on various bands are plentiful this July. The moon comes on stage with a partial eclipse on the day it is full (July 17th). The eclipse begins at 0325 and ends at 0609 UT. It can be seen from Africa except in the northeast; southwestern Europe; Antarctica; South America; North America except the northwest; the east Pacific; and New Zealand. The maximum obscurity of moon diameter is 0.55. Lunar perigee is on the 27th.

The sun is the big performer, with a total eclipse on the 31st beginning at 0111 and ending at 0620 UT, with a maximum duration of two minutes, two seconds. The path of totality begins on the Arabian Peninsula then extends across the southern Black Sea, northern Caspian Sea, into the USSR and China border, across Japan and Hawaii, and into Alaska and Northern Canada. Near the path of totality radio propagation goes from day conditions (high-frequency ham bands) to night conditions (lower-frequency ham bands) and returns to daytime conditions in just a couple of hours.

When daytime conditions return after totality, look for DX from unusual locations, as extra ionized layers are usually formed, which change slowly in height from the E to F region. The extra layer will support only nighttime radio frequencies near totality, changing slowly to daytime frequencies at the end of the eclipse. It should be fun to try some of the frequencies for DX if your QTH is near the path of the eclipse. Hams have in years past participated in eclipse propagation experiments.

The Aquarid meteor shower starts about the 18th, peaks about the 28th, and lasts until about August 7th. The radio-echo rate at maximum is about 34 per hour.

more on sporadic E (Es) DX

Before the Es season gets further along, a few more observations come to mind about using Es propagation in DX hunting. The *DX Forecaster* for May, 1981, went into some geophysical aspects of Es production. This was to give DXers an idea of where and when to look for summer short skip. Some antenna design considerations, to be able to couple well into the E propagation mode, were mentioned.

To try to short skip into a DX location use the following antenna takeoff angles and bearings: the takeoff angle should be around 5 degrees to make a hop length of 900 miles (1500 km) to obtain maximum signal strength of about 60 dB above a microvolt. To obtain the highest probability of being able to use the Es when it occurs, a fairly wide beamwidth should be used. That is, a small beam is better than a rhombic, and a wide-angle beam is better than a narrow one. Another rule is to use the lowest high-frequency band commensurate with the higher daytime versus nighttime absorption of the signal and the static. In other words, in the daytime don't use the 10-meter band when 20 is available or use 40 meters at night when 80 meters is available (if the static is not very bad); 6-7 dB are available for this difference in Es frequency range.

band-by-band forecast

Ten meters should provide excellent daytime propagation, particularly north/south path DX to South America, Africa and Pacific areas. Expect conditions to peak during the afternoon hours. There will also be some good short-skip sporadic-E conditions on many days of the month to distances between 500 and 1500 miles (800-2400 km) or more.

Fifteen meters will provide good worldwide DX during the daylight and early evening hours on most days of the month. Expect conditions to peak during the late afternoon, with long- and short-skip signals.

Twenty meters will be open to some area of the world for the entire twenty-four hour period on most days of the month. The band should peak in all directions just after local sunrise, and again toward the east and south during late evening hours. During darkness, the band will peak toward the west, in an arc from southwest through northwest, that will take in Pacific areas.

Forty meters can often provide good DX from sunset, through darkness, until just after sunrise, despite the atmospheric noise levels (static) — provided you choose times when local thunderstorm-related static is at a minimum.

Eighty meters can sometimes provide openings to DX areas during darkness and at sunrise, but signals will be weak and static will be strong. For these DX conditions, coastal stations often have a better chance of working DX than do stations in the center of large land masses.

One-sixty meters is almost hopeless during the hours of darkness and during the daytime. Forget it!

ham radio

WESTERN USA

GMT	PDT	N (ASIA FAR EAST)	NE (EUROPE)	E (S. AFRICA)	SE (S. AMERICA)	S (ANTARCTICA)	SW (NEW ZEALAND)	W (OCEANIA AUSTRALIA)	NW (JAPAN)
0000	5:00	—	20	—	15*	15	10	10	20
0100	6:00	—	20	—	15	15	10	10	20
0200	7:00	—	20	—	15	20*	10	10	20
0300	8:00	15	20	—	15	20	10	10	15
0400	9:00	15	20	—	15	20	10	10	15
0500	10:00	15	20	20	15	20	15*	15	15
0600	11:00	15	20	20	15	20	15*	15	20*
0700	12:00	—	20	20	20	20	15	15	20
0800	1:00	20	20	20	20	20	15	15	20
0900	2:00	20	40	—	20	20	15	20	20
1000	3:00	20	40	—	20	20	15	20	20
1100	4:00	20	40	—	20	40	15	20	20
1200	5:00	20	—	—	20	40	20	20	20
1300	6:00	20	20	20	—	40	20	20	20
1400	7:00	20	20	20	—	40	20	20	—
1500	8:00	20	20	20	—	—	40	20	—
1600	9:00	20	20	15	—	—	40	20	—
1700	10:00	15	20	15	—	—	—	20	—
1800	11:00	15	20	15	15*	—	—	40	15
1900	12:00	15	—	15	10	—	15*	40	15
2000	1:00	15	—	15	10	15	15*	—	15
2100	2:00	—	15	—	15*	15	10	—	15
2200	3:00	—	15	—	15*	15	10	10	15
2300	4:00	—	15	—	15*	15	10	10	15

MID USA

GMT	MDT	CDT	N (ASIA FAR EAST)	NE (EUROPE)	E (S. AFRICA)	SE (S. AMERICA)	S (ANTARCTICA)	SW (NEW ZEALAND)	W (OCEANIA AUSTRALIA)	NW (JAPAN)
0000	6:00	7:00	—	20	—	15	15	10	15	—
0100	7:00	8:00	15	20	—	15	15	10	15	15
0200	8:00	9:00	15	20	—	15	20	15*	15	15
0300	9:00	10:00	15	20	—	15	20	15*	15	15
0400	10:00	11:00	15	20	40	15	40*	15*	15	20*
0500	11:00	12:00	20	20	40	15	40*	15	15	20
0600	12:00	1:00	20	20	20	20	40*	15	15	20
0700	1:00	2:00	20	20	20	20	20	15	20*	20
0800	2:00	3:00	20	—	20	40*	20	15	20	20
0900	3:00	4:00	20	—	40*	40*	20	15	20	20
1000	4:00	5:00	—	—	—	40*	20	20*	20	20
1100	5:00	6:00	—	20	—	40*	20	20	20	40
1200	6:00	7:00	—	20	—	20	—	20	20	40
1300	7:00	8:00	20	20	—	20	—	20	20	20
1400	8:00	9:00	20	20	20	20	—	40*	20	20
1500	9:00	10:00	20	—	15	15	—	40	20	20
1600	10:00	11:00	20	—	15	15	—	40	20	20
1700	11:00	12:00	20	—	15	15	—	—	40*	20
1800	12:00	1:00	20	—	15	10	—	—	40	20
1900	1:00	2:00	20	—	15	10	—	—	—	20
2000	2:00	3:00	15	15	15	10	20*	15	15	15
2100	3:00	4:00	20*	15	20	10	15	10	15*	20*
2200	4:00	5:00	—	15	20	10	15	10	10	15
2300	5:00	6:00	—	20	—	10	15	10	15*	15

EASTERN USA

GMT	EDT	N (ASIA FAR EAST)	NE (EUROPE)	E (S. AFRICA)	SE (CARIBBEAN S. AMERICA)	S (ANTARCTICA)	SW (NEW ZEALAND)	W (OCEANIA AUSTRALIA)	NW (JAPAN)
0000	8:00	15	20*	—	15	20	15	15	15
0100	9:00	15	20	—	15	20	15	15	20*
0200	10:00	15	20	40*	15	20	15	15	20*
0300	11:00	15	40*	40	15	20	15	15	20
0400	12:00	20	40*	40	20*	20	15	15	20
0500	1:00	20	20	40	20*	40*	15	15	20
0600	2:00	20	20	40*	20	40*	20	20*	20
0700	3:00	20	20	—	20	40*	20	20	—
0800	4:00	—	40	—	20	20	20	20	—
0900	5:00	—	40	20	20	20	20	20	—
1000	6:00	—	20	20	20	20	20	20	—
1100	7:00	20	20	20	20	20	20	20	—
1200	8:00	20	20	20*	20	—	20	20	20
1300	9:00	20	20	15	20	—	20	20	20
1400	10:00	20	15	15	15	—	20	20	20
1500	11:00	20	15	15	15	—	—	20	20
1600	12:00	—	15	15	10	—	—	20	20
1700	1:00	—	15	15	10	—	—	20	—
1800	2:00	—	15	15	10	20	15	—	—
1900	3:00	15	15	15	10	20	15	—	—
2000	4:00	15	15	20*	10	20	15*	—	20
2100	5:00	15	15	20	15	20	15*	15*	15
2200	6:00	20*	15	20	15	20	15	15	15
2300	7:00	15	20*	20	15	20	15	15	15

JULY

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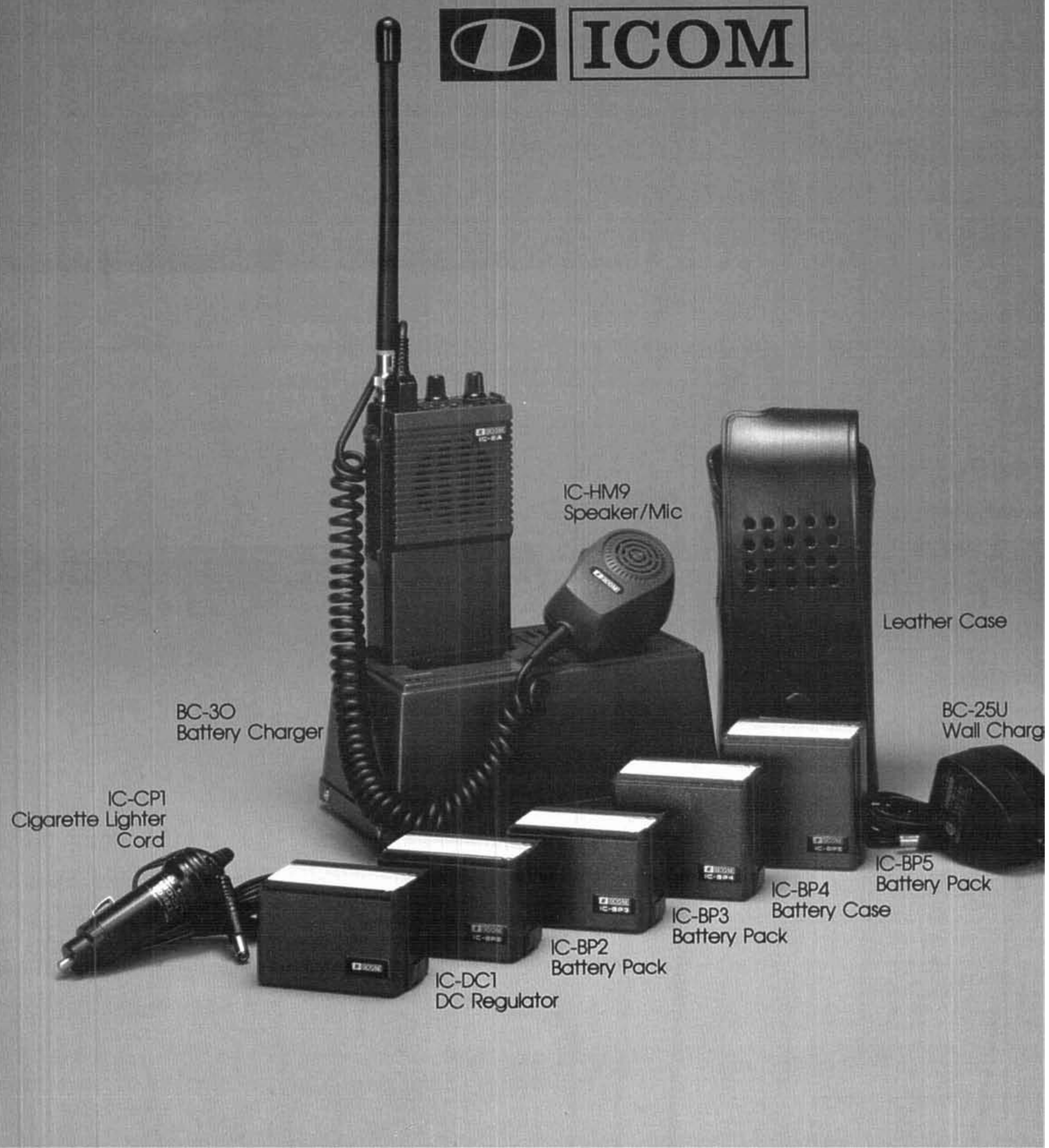

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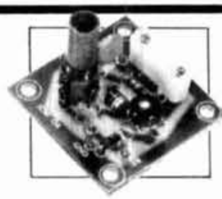

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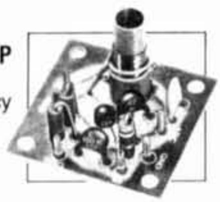

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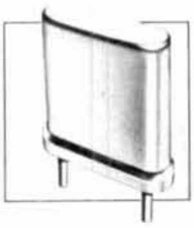

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More Details? CHECK—OFF Page 106

a new look at the W8JK antenna

This old standby provides interesting possibilities for the new bands

The W8JK antenna or "flat-top beam" was adapted for Amateur use and described in *QST* in 1938[1] by John D. Kraus, W8JK. This antenna was widely used for several years but has now been largely superseded by the Yagi, which has higher gain for a given size.

In 1970, 32 years after his original *QST* article, W8JK described a 5-band rotary beam antenna with several modes of operation.[2] In mode 1, having the highest gain, the antenna consists of a pair of vertical W8JK antennas stacked horizontally. Whether by design or chance, the same issue of *QST* contains a description of a device called "The Ultimate Transmatch,"[3] which is a considerable aid in making the basic W8JK an attractive antenna.

In this article the W8JK antenna is compared to the widely-used 3-element Yagi, and it will be shown that, despite its lower theoretical gain, the W8JK is in several respects the better antenna.

the W8JK antenna

The basic W8JK antenna is shown in **fig. 1**. It consists of two closely spaced dipoles fed 180 degrees out of phase. The original W8JK article refers to this as a single-section antenna if the dipole length, L, is a half wavelength and as a two-section antenna if L is a full wavelength. In fact, the antenna operates well and with no abrupt change in properties over a frequency range such that L varies from less than a half wavelength to more than a full wavelength, so that this distinction appears unnecessary. In the original article and elsewhere[4] more complicated varieties of the antenna, and end-fed as well as center-fed versions, are discussed. However, only the basic antenna is dealt with here.

Operation of the W8JK antenna is as follows: the individual dipoles tend to radiate as they would in isolation; that is, with no radiation off the ends and maximum radiation at right angles to each dipole. However, because of the out-of-phase feed to the dipoles, radiation cancels in the upward and downward directions. The cancelled radiation is not lost but appears elsewhere, primarily in both directions along a line joining the centers of the two dipoles.

Antenna gain depends on both element length L and spacing d, but neither is critical. If a lossless antenna is assumed, very close spacing should produce the highest theoretical gain, but such spacing also results in very low radiation resistance, and conductor losses cannot then be neglected. In practice, spacings of about one-eighth wavelength seem to be opti-

By **Frank Regier, OD5CG**, Department of Electrical Engineering, American University of Beirut, Beirut, Lebanon

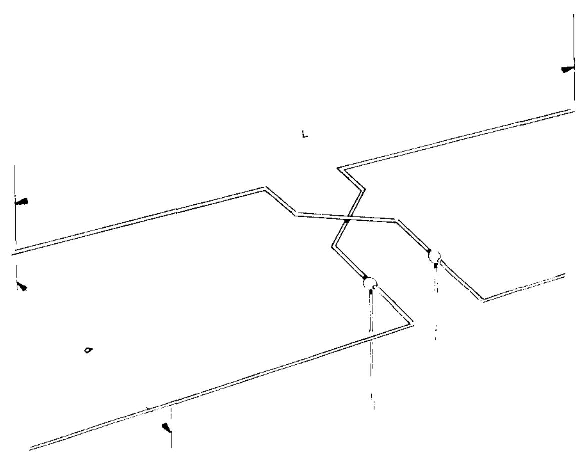

fig. 1. The basic W8JK antenna, consisting of two closely spaced dipoles fed out of phase.

mum. The spacing should not be reduced to much below this figure but can be increased to a quarter wavelength with very little reduction in gain.

Antenna length is subject to the same constraints as in the case of a simple dipole: length should not be reduced much below a half wavelength because of reduced radiation resistance, and gain increases with length up to a maximum at one and a quarter wavelengths.

The gain of a basic W8JK antenna with eighth-wavelength spacing and half-wavelength elements is about 4 dB in free space. This figure increases gradually to about 6 dB at twice the design frequency, and to a maximum of about 7 dB at 2.5 times the design frequency.

the Yagi antenna

The familiar 3-element Yagi antenna is shown in **fig. 2**. This antenna is similar to the W8JK in that its gain results from the cancellation of radiation from the various elements in some directions and addition in others. It differs, however, in how power is applied to the various elements. In the W8JK antenna both elements are fed directly. In the Yagi only one element is fed directly, and the others behave simultaneously as receiving and transmitting antennas, receiving power from the driven element and re-radiating it with an amplitude and phase determined by the length of the element and its spacing from the driven element. This method of supplying power to the parasitic elements makes the Yagi easy to feed, but the critical dependence of the phase of radiated power on element length makes the Yagi a narrow-band antenna, operating as intended only near the design frequency. At frequencies far removed from resonance, the parasitic reflector and director receive and re-radiate little power, and the pattern of the antenna is not very different from that of the driven element alone.

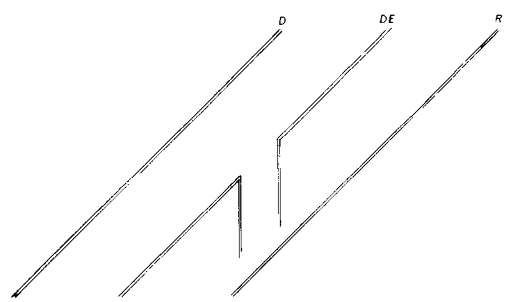

fig. 2. Three-element Yagi antenna. Energy from the driven element DE is picked up and reradiated by reflector R and director D.

Variations on the 3-element Yagi include: a) an increase in the number of directors, leading to improved forward gain (additional reflectors, being in a low-field region, would have little effect and are rarely used), b) interlacing elements for various frequency ranges, and c) the addition of traps in the various elements to cause resonance at several frequencies. This is a useful procedure but requires compromise spacing at the different frequencies.

a comparison

Although a 3-element Yagi has more gain in free space than the W8JK, there are at least three respects in which the latter is the better antenna. These are: noncritical construction, bandwidth, and operation at low elevation.

The noncritical nature of the W8JK results from the fact that, unlike the Yagi, it does not depend on resonance for its symmetry; and, provided symmetry is maintained, element length and spacing are relatively unimportant.

Its large bandwidth, too, results from the nonresonant nature of the W8JK antenna. This bandwidth is such that operation is possible over at least a 2.5:1 frequency range. Operation over such a range does require the use of an antenna tuner or transmatch and a tuned transmission line, since antenna impedance does change with frequency.

antenna height

We turn now to the question of operation at low elevation. It is a matter of great importance, and in fact the major point of this article, that the basic principle of operation of the W8JK antenna remains valid even at very low elevations, whereas under the same conditions the behavior of a Yagi degrades to that of

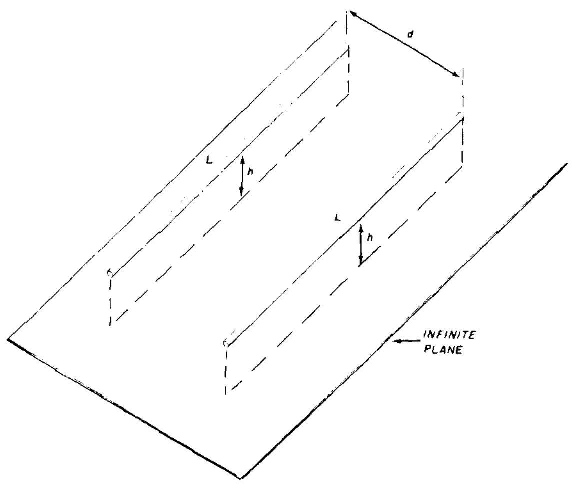

fig. 3. Basic W8JK antenna spaced at a height h above a ground plane. Although reflection from the ground plane takes place and the angle of radiation is raised, symmetry is retained, and the basic principle of operation — cancellation of radiation in the vertical direction — remains valid.

a simple dipole. This means that at low elevation the W8JK is a more effective antenna than the Yagi. To see why this is so, consider first the W8JK (see **fig. 3**). The presence of a nearby ground plane will affect the antenna impedance, but with a tuned feed line and a transmatch this is easily compensated.

The important point is that, because symmetry is not disturbed by the ground plane, the fundamental principle of operation — cancellation of radiation in the vertical direction — remains valid. Considering next the Yagi (see **fig. 4**), we find that the nearby ground plane will severely detune both director and reflector and interfere with their excitation by the driven element. These two parasitic elements therefore become ineffective, and performance degrades to that of a simple dipole near ground.

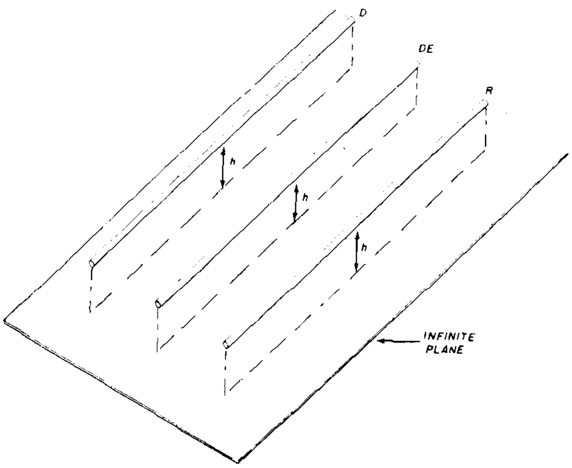

fig. 4. Three-element Yagi antenna at a height h above a ground plane. If h is small, director D and reflector R are detuned and improperly excited and are thus ineffective. The resultant radiation pattern is that of the driven element DE alone — a dipole above a ground plane.

It follows from the above argument that there must be some critical height below which the W8JK outperforms the Yagi, and it would be interesting to know what that height is. In principle it should, of course, be possible to calculate the characteristics of both the W8JK and the Yagi as functions of height above a perfect ground. But, particularly in the case of the Yagi, this presents difficulties, and an experimental approach seems preferable. I am not in a position to carry out the experimental work, but I have found a reference[5] that seems to contain the essential results. In this reference it is stated that a 20-meter antenna, essentially equivalent to a W8JK, at 38 feet (11.6 meters) gave results comparable to a 3-element Yagi at the same height. When 10-meter antennas were compared at the same height, the 3-element Yagi was found to be superior. This would seem to imply that at an elevation of about one wavelength, a 3-element Yagi outperforms a W8JK, but that at a half wavelength elevation, the two are about equal. This would mean that the critical height is about a half wavelength, and that below that height a W8JK can be expected to outperform a Yagi.

Fig. 5 (from reference 4) shows the W8JK vertical radiation pattern at a height of 1/2 wavelength.

conclusions and remarks

The W8JK antenna has a number of desirable characteristics and makes a particularly good antenna in situations where only a low height is possible. An elevation of a half wavelength seems to be about the critical height below which the W8JK provides higher gain than a 3-element Yagi. Thus a W8JK at 20 feet (6 meters) should be about comparable to a 3-element Yagi at the same height on 21 MHz, poorer at higher frequencies, and better at lower frequencies.

Although the W8JK exhibits gain over at least a 2.5:1 frequency range, the antenna has an impedance that is a function of frequency and should be fed by a transmatch and an open-wire line of some sort.

In addition to the 10-, 15-, and 20-meter bands, the new Amateur bands at 10, 18, and 24 MHz can be accommodated. For example, an antenna with a length $L = 40$ *feet* (12 meters) and a spacing $d = 11$ *feet* (3.4 meters) should provide good performance on the Amateur bands at 10, 14, 18, 21, 24, and 28 MHz. In addition it should provide much improved reception on the 12-, 15-, 18-, and 21-MHz shortwave broadcast bands, where most listeners make do with a random length of wire, or at best, a dipole. If operation below 14 MHz is not required, the spacing can be reduced to $d = 8$ *feet* (2.4 meters), and the length L can be anything from 24-40 feet (7.3-12.2 meters).

In closing I might mention that my own experience in feeding a 30-foot-long (9-meter) W8JK with 8-foot (2.4-meter) spacing by means of a 40-foot (12.2-meter) length of 300-ohm TV twinlead has been better than might be expected. There has been no breakdown with 1200 watts PEP input, and although losses are no doubt somewhat higher than those of an open-wire line, the use of twinlead is extremely convenient. The main disadvantage of the twinlead is that it is necessary to cease operation during rainstorms because the input impedance of the feed line becomes erratic.

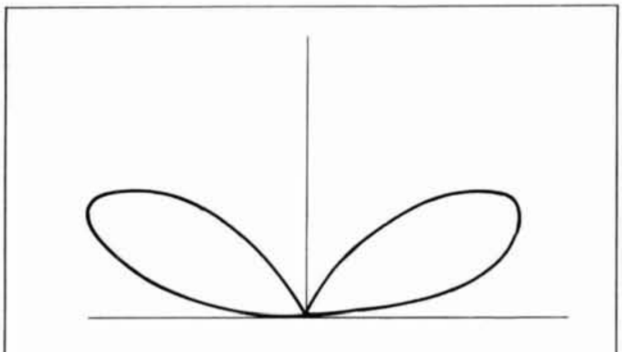

fig. 5. Vertical pattern of W8JK antenna at a height h of one-half wavelength. At other heights additional lobes may appear, but vertical radiation is always cancelled and radiation is at lower angles than from a dipole at the same height (from reference 4).

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Lawson, James L., W2PV, "Yagi Antenna Design," *ham radio*, January, 1980, page 22; February, 1980, page 18; June, 1980, page 32; July, 1980, page 18; September, 1980, page 37; October, 1980, page 29; November, 1980, page 22; December, 1980, page 30.

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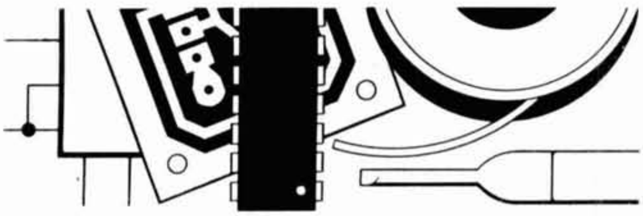


a 2-way ashtray for your car

Mounting a handheld transceiver (HT) in your car any place other than on the front seat can sometimes be a problem — particularly if you want to be able to remove it easily. I found a simple solution that works well for me, with only about one evening's work. My Toyota Corolla (like most cars) has an ashtray in a convenient and accessible location on the front dash. It suddenly seemed obvious (particularly as I no longer smoke) that this would be an ideal location for mounting my radio. The sketch in **fig. 1** is for a bracket to hold a Kenwood TR-2400, although the dimensions and design can be altered to suit any HT.

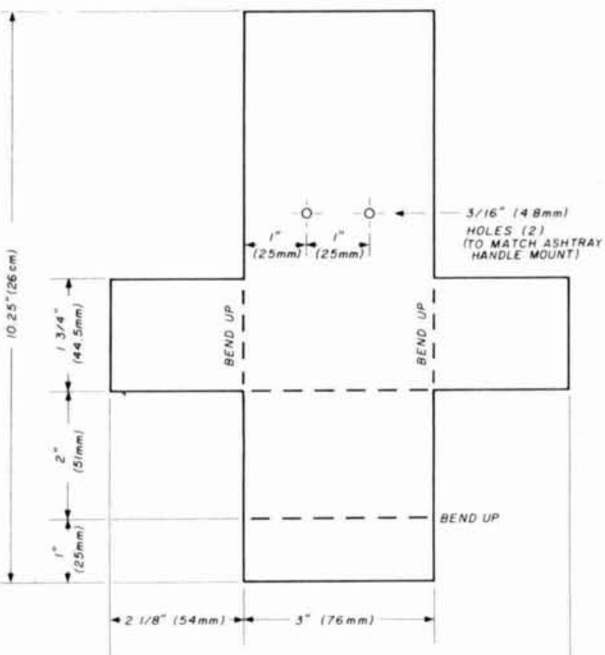
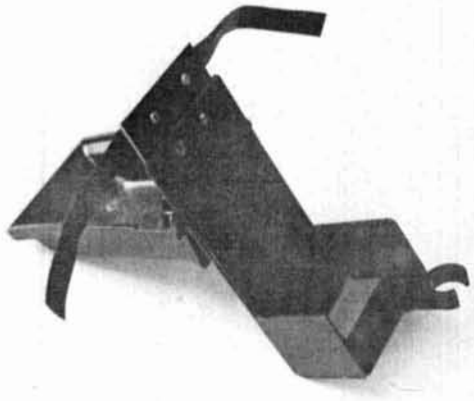


fig. 1. Ashtray bracket for mounting a handheld transceiver.

Handheld in ashtray mount makes a convenient mobile installation.

Radio and ashtray mount removed from car and resting on table.

By Herb Bresnick, KB2XM, 16 Creekside Drive, Honeoye Falls, New York 14472



Homebrew mounting bracket fastens to the front of automobile ashtray.

Since the tone pad is on the front of the radio, the bracket is cut higher on the sides and lower in the front to permit access.

The ashtray is removed from the dash by simply pulling it beyond the normal stop position. Some ashtrays require pressing a tab so they can be removed for emptying. The plastic pull is next unscrewed from the inside and removed, leaving a flat mounting surface. The same holes can be used for attaching the bracket.

After the bracket was bent, a coat of black enamel was applied and the inside lined with self-stick, felt contact-paper to protect the set from scratches. A small piece of foam on the bottom absorbs shocks while you're driving, further protecting your set. I used a strip of Velcro™ to hold the top part of the radio to the bracket, although a small leather strap would work as well.

One advantage of this mount is that it can be easily slid out for quick removal. It also functions as a simple stand on a table, and the ashtray even holds accessories (charger, earphone, and so on).

As a further refinement, I mounted a microphone holder on the lower front of the bracket and plugged an external microphone into the microphone jack, so that the entire radio doesn't have to be lifted out for talking. A low-impedance dynamic cassette microphone, with a series 0.5-μF capacitor was found to work fine with the TR-2400. The microphone is light and compact, and the plugs mate exactly with the radio jacks. I replaced the original cable with a coil cord for added convenience.

This was a fun project and has considerably improved the utility of my HT as a mobile rig. Incidentally, if you are a smoker, this is good incentive to quit smoking!

ham radio

7400

SN7400N	.25	SN7472N	.29	SN74156N	.79
SN7401N	.20	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.89
SN7403N	.25	SN7475N	.49	SN74161N	.89
SN7404N	.25	SN7476N	.35	SN74162N	.89
SN7405N	.29	SN7479N	5.00	SN74163N	.89
SN7406N	.35	SN7480N	.50	SN74164N	.89
SN7407N	.35	SN7482N	.99	SN74165N	.89
SN7408N	.29	SN7483N	.69	SN74166N	1.25
SN7409N	.29	SN7485N	.89	SN74167N	2.79
SN7410N	.25	SN7486N	.35	SN74170N	1.95
SN7411N	.29	SN7489N	1.75	SN74172N	4.95
SN7412N	.35	SN7490N	.49	SN74173N	1.39
SN7413N	.40	SN7491N	.59	SN74174N	.99
SN7414N	.69	SN7492N	.45	SN74175N	.89
SN7416N	.29	SN7493N	.45	SN74176N	.79
SN7417N	.29	SN7494N	.69	SN74177N	.79
SN7420N	.25	SN7495N	.69	SN74179N	1.49
SN7421N	.29	SN7496N	.69	SN74180N	.79
SN7422N	.45	SN7497N	3.00	SN74181N	2.25
SN7423N	.29	SN74100N	1.49	SN74182N	.79
SN7425N	.29	SN74107N	.35	SN74184N	2.49
SN7426N	.29	SN74109N	.39	SN74185N	2.49
SN7427N	.25	SN74116N	1.95	SN74190N	1.25
SN7428N	.49	SN74121N	.39	SN74191N	1.25
SN7430N	.25	SN74122N	.55	SN74192N	.89
SN7432N	.29	SN74123N	.59	SN74193N	.89
SN7437N	.25	SN74125N	.49	SN74194N	.89
SN7438N	.40	SN74126N	.49	SN74195N	.69
SN7439N	.25	SN74132N	.75	SN74196N	.89
SN7440N	.20	SN74136N	.75	SN74197N	.89
SN7441N	.89	SN74141N	.99	SN74198N	1.49
SN7442N	.59	SN74142N	3.25	SN74199N	1.49
SN7443N	1.10	SN74143N	3.49	SN74221N	1.25
SN7444N	1.10	SN74144N	3.49	SN74251N	.99
SN7445N	.89	SN74145N	.79	SN74276N	1.95
SN7446N	.79	SN74147N	1.95	SN74279N	.79
SN7447N	.69	SN74148N	1.29	SN74283N	1.49
SN7448N	.79	SN74150N	1.25	SN74284N	3.95
SN7450N	.20	SN74151N	.69	SN74285N	3.95
SN7451N	.20	SN74152N	.69	SN74365N	.69
SN7453N	.20	SN74153N	.79	SN74366N	.69
SN7454N	.20	SN74154N	1.25	SN74367N	.69
SN7459A	.25	SN74155N	.79	SN74368N	.69
SN7460N	.20			SN74390N	1.49
SN7470N	.29			SN74393N	1.49

74LS

74LS00	.29	74LS92	.75	74LS192	1.15
74LS01	.29	74LS93	.75	74LS193	1.15
74LS02	.29	74LS95	.99	74LS194	1.15
74LS03	.29	74LS96	1.15	74LS195	1.15
74LS04	.35	74LS107	.45	74LS197	1.19
74LS05	.35	74LS109	.45	74LS221	1.19
74LS08	.29	74LS112	.45	74LS240	1.95
74LS09	.35	74LS113	.49	74LS241	1.95
74LS10	.29	74LS114	.49	74LS242	1.95
74LS11	.75	74LS122	.89	74LS243	1.95
74LS12	.35	74LS123	1.25	74LS244	1.95
74LS13	.59	74LS125	.89	74LS245	2.95
74LS14	.99	74LS126	.55	74LS247	1.19
74LS15	.35	74LS132	.99	74LS248	1.19
74LS20	.29	74LS133	.89	74LS249	1.19
74LS21	.35	74LS136	.49	74LS251	1.49
74LS22	.35	74LS138	.89	74LS253	.99
74LS26	.35	74LS139	.89	74LS257	.89
74LS27	.35	74LS145	1.19	74LS258	.99
74LS28	.35	74LS151	.89	74LS260	.69
74LS30	.29	74LS153	.89	74LS266	.69
74LS32	.35	74LS154	1.75	74LS273	1.95
74LS33	.59	74LS155	1.19	74LS279	.75
74LS37	.45	74LS156	1.19	74LS283	1.09
74LS38	.49	74LS157	.89	74LS290	.99
74LS40	.35	74LS158	.99	74LS293	.99
74LS42	.89	74LS160	1.15	74LS298	1.25
74LS47	.89	74LS161	1.15	74LS352	1.29
74LS48	1.15	74LS162	1.15	74LS353	1.29
74LS49	1.15	74LS163	1.15	74LS365	.75
74LS51	.29	74LS164	1.15	74LS366	.75
74LS54	.29	74LS165	1.25	74LS367	.75
74LS55	.29	74LS168	1.19	74LS368	.75
74LS73	.45	74LS169	1.19	74LS373	1.95
74LS74	.45	74LS170	2.49	74LS374	1.95
74LS75	.59	74LS173	1.39	74LS375	.89
74LS76	.45	74LS174	.99	74LS386	.69
74LS78	.49	74LS175	.99	74LS393	2.49
74LS83	.89	74LS181	2.95	74LS399	2.49
74LS85	1.25	74LS190	1.25	74LS670	2.49
74LS86	.45	74LS191	1.25	81LS95	1.95
74LS90	.59			81LS97	1.95

74S

74S00	.50	74S124	2.49	74S243	3.25
74S02	.50	74S133	.55	74S244	3.25
74S03	.50	74S134	.69	74S251	1.45
74S04	.55	74S135	1.19	74S253	1.45
74S05	.55	74S136	1.75	74S257	1.35
74S08	.50	74S138	1.35	74S258	1.35
74S09	.50	74S139	1.35	74S260	.79
74S10	.50	74S140	1.15	74S280	2.95
74S11	.50	74S151	1.35	74S287	4.95
74S15	.50	74S153	1.35	74S288	4.95
74S20	.50	74S157	1.35	74S373	3.49
74S22	.50	74S158	1.35	74S374	3.49
74S30	.50	74S160	1.95	74S387	5.95
74S32	.55	74S174	1.59	74S471	19.95
74S38	.69	74S175	1.59	74S472	19.95
74S40	.55	74S188	4.95	74S473	19.95
74S51	.50	74S194	1.95	74S474	21.95
74S64	.50	74S195	1.95	74S475	21.95
74S65	.50	74S196	3.95	74S570	7.95
74S74	.79	74S240	2.95	74S571	7.95
74S86	.79	74S241	2.95	74S572	19.95
74S112	.79	74S242	3.25	74S573	19.95
74S113	.79			74S940	3.15
74S114	.79			74S941	3.15

CA—LINEAR

CA3010H	1.07	CA3060N	3.25	CA3089N	3.75
CA3011H	2.15	CA3080H	1.25	CA3096N	3.95
CA3023H	3.25	CA3081N	2.00	CA3130H	1.39
CA3035H	2.48	CA3082N	2.00	CA3140H	1.25
CA3039H	1.35	CA3083N	1.60	CA3160H	1.25
CA3046N	1.30	CA3086N	.85	CA3401N	.59
CA3059N	3.25			CA3600N	3.50

CD—CMOS

CD4000	.39	CD4041	1.49	CD 4098	2.49
CD4001	.39	CD4042	.99	CD4506	.75
CD4002	.39	CD4043	.89	CD4507	.99
CD4006	1.19	CD4044	.89	CD4508	3.95
CD4007	.25	CD4046	1.79	CD4510	1.39
CD4009	.49	CD4047	2.50	CD4511	1.29
CD4010	.49	CD4048	1.35	CD4512	1.49
CD4011	.39	CD4049	.49	CD4514	3.95
CD4012	.25	CD4050	.69	CD4515	2.95
CD4013	.49	CD4051	1.19	CD4516	1.49
CD4014	1.39	CD4052	1.19	CD4518	1.79
CD4015	1.19	CD4053	1.19	CD4519	.89
CD4016	.59	CD4056	2.95	CD4520	1.29
CD4017	1.19	CD4059	9.95	CD4526	1.79
CD4018	.99	CD4060	1.49	CD4528	1.79
CD4019	.49	CD4066	.79	CD4529	1.95
CD4020	1.19	CD4068	.39	CD4543	2.79
CD4021	1.39	CD4069	.45	CD4562	11.95
CD4022	1.19	CD4070	.55	CD4566	2.79
CD4023	.29	CD4071	.49	CD4583	2.49
CD4024	.79	CD4072	.49	CD4584	.75
CD4025	.23	CD4073	.39	CD4723	1.95
CD4026	2.95	CD4075	.39	CD4724	1.95
CD4027	.69	CD4076	1.39	MC14409	14.95
CD4028	.89	CD4078	.55	MC14410	14.95
CD4029	1.49	CD4081	.39	MC14411	14.95
CD4030	.49	CD4082	.39	MC14412	11.95
CD4034	3.49	CD4093	.99	MC14419	4.95
CD4035	.99			MC14433	13.95
CD4040	1.49			MC14538	2.49
				MC14541	1.95

A P PRODUCTS

DIP JUMPERS

- Mate with Standard IC Sockets
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- Integral Molded On Strain Relief
- Line-By-Line Probeability

Dip Jumpers are used for jumpering within a PC Board; interconnecting between PC Boards, backplanes and mother boards, and interfacing input/output signals.

Part Number	No. of contacts	Description	Wire Length	Price
924112-12	14	single end	12"	$1.61
924112-24	14	single end	24	1.92
924112-36	14	single end	36	2.33
924106-12	14	double end	12"	2.81
924106-24	14	double end	24	3.02
924106-36	14	double end	36	3.43
[illegible]	16	single end	12"	[illegible]
[illegible]	16	single end	24	[illegible]
[illegible]	16	single end	36	[illegible]
[illegible]	16	double end	12"	[illegible]
[illegible]	16	double end	24	[illegible]
[illegible]	16	double end	36	[illegible]
924122-12	24	single end	12"	2.80
924122-24	24	single end	24	3.30
924122-36	24	single end	36	4.00
924126-12	24	double end	12	4.50
924126-24	24	double end	24	5.20
924126-36	24	double end	36	5.90
924132-12	40	single end	12"	4.35
924132-24	40	single end	24	5.52
924132-36	40	single end	36	6.11

DISCRETE LEDS

XC556R	.200"	red	5/$1	MV50	.085"	red	6/$1	XC111R	.190"	red	5/$1
XC556G	.200"	green	4/$1	XC209R	.125"	red	5/$1	XC111G	.190"	green	4/$1
XC556Y	.200"	yellow	4/$1	XC209G	.125"	green	4/$1	XC111Y	.190"	yellow	4/$1
XC556C	.200"	clear	4/$1	XC209Y	.125"	yellow	4/$1	XC111C	.190"	clear	4/$1
XC22R	.200"	red	5/$1	XC526R	.185"	red	5/$1				
XC22G	.200"	green	4/$1	XC526G	.185"	green	4/$1				
XC22Y	.200"	yellow	4/$1	XC526Y	.185"	yellow	4/$1				
MV10B	.170"	red	4/$1	XC526C	.185"	clear	4/$1				

XC556 RED LED, METAL MTG. HDW. 2-4" LEADS.
RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode   C.C. — Common Cathode

Type	Polarity	Ht	Price	Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95	DLG507	C.A.—green	.500	1.25
MAN 2	5x7 D.M.—red	.300	4.95	DL704	C.C.—red	.300	1.25
MAN 3	C.C.—red	.125	.25	DL707	C.A.—red	.300	1.25
MAN 52	C.A.—green	.300	1.25	DL728	C.C.—red	.500	1.49
MAN 54	C.C.—green	.300	1.25	DL741	C.A.—red	.600	1.25
MAN 71	C.A.—red	.300	.75	DL746	C.A.—red ± 1	.630	1.49
MAN 72	C.A.—red	.300	.75	DL747	C.A.—red	.600	1.49
MAN 74	C.C.—red	.300	1.25	DL750	C.C.—red	.600	1.49
MAN 82	C.A.—yellow	.300	.49	DLO847	C.A.—orange	.800	1.49
MAN 84	C.C.—yellow	.300	.99	DLO850	C.C.—orange	.800	1.49
MAN 3620	C.A.—orange	.300	.49	DL33B	C.C.—red	.110	.35
MAN 3630	C.A.—orange ± 1	.300	.99	FND358	C.C. ± 1	.357	.99
MAN 3640	C.C.—orange	.300	.99	FND359	C.C.	.357	.75
MAN 4610	C.A.—orange	.400	.99	FND503	C.C. (FND500)	.500	.99
MAN 6610	C.A.—orange—DD	.560	.99	FND507	C.A. (FND510)	.500	.99
MAN 6630	C.A.—orange ± 1	.560	.99	HDSP-3401	C.A.—red	.800	1.50
MAN 6640	C.C.—orange—DD	.560	.99	HDSP-3403	C.C.—red	.800	1.50
MAN 6650	C.C.—orange ± 1	.560	.99	5082-7751	C.A., R.H.D.—red	.430	1.25
MAN 6660	C.A.—orange	.560	.99	5082-7760	C.C., R.H.D.—red	.430	1.75
MAN 6710	C.A.—red—DD	.560	.99	5082-7300	4x7 sgl. dig. RHD	.600	22.00
MAN 6750	C.C.—red ± 1	.560	.99	5082-7302	4x7 sgl. dig. LHD	.600	22.00
MAN 6780	C.C.—red	.560	.99	5082-7304	Overnge. char. (±1)	.600	19.95
DLO304	C.C.—orange	.300	1.25	4N28	Photo Xsistor Opto-Isol.		.99
DLO307	C.A.—orange	.300	1.25	LIT-1	Photo Xsistor Opto-Isol.		.69
DLG500	C.C.—green	.500	1.25	MOC3010	Optically Isol. Triac Driver		1.25

SOCKETS / RECEPTACLES

Test TEXTOOL Sockets

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- G.F. PSF Plastic Body
- For testing IC's

Receptacles:
- Nickel Boron Plating
- G.F. PSF Plastic Body
- Wire Wrap Contacts

Part No.	Pins	Price	Part No.	Pins	Price
214-3339	14 pin	5.95	222-3343	22 pin	9.95
216-3340	16 pin	6.49	224-3344	24 pin	9.75
218-3341	18 pin	7.95	228-3345	28 pin	11.95
220-3342	20 pin	8.95	240-3346	40 pin	12.95

Part No.	Pins	Price	Part No.	Pins	Price
214-3592	14 pin	9.75	222-3596	22 pin	12.95
216-3593	16 pin	9.95	224-3597	24 pin	12.75
218-3594	18 pin	10.95	228-3598	28 pin	13.95
220-3595	20 pin	11.95	240-3599	40 pin	15.95

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

		Values		
ASST. 1	5 ea.	10 Ohm 12 Ohm 15 Ohm 18 Ohm 22 Ohm 27 Ohm 33 Ohm 39 Ohm 47 Ohm 56 Ohm	50 pcs.	$1.95
ASST. 2	5 ea.	68 Ohm 82 Ohm 100 Ohm 120 Ohm 150 Ohm 180 Ohm 220 Ohm 270 Ohm 330 Ohm 390 Ohm	50 pcs.	$1.95
ASST. 3	5 ea.	470 Ohm 560 Ohm 680 Ohm 820 Ohm 1K 1.2K 1.5K 1.8K 2.2K 2.7K	50 pcs.	$1.95
ASST. 4	5 ea.	3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	50 pcs.	$1.95
ASST. 5	5 ea.	22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	50 pcs.	$1.95
ASST. 6	5 ea.	150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	50 pcs.	$1.95
ASST. 7	5 ea.	1M 1.2M 1.5M 1.8M 2.2M 2.7M 3.3M 3.9M 4.7M 5.6M	50 pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)		$10.95 ea.

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INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	22.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	28.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	9.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	11.10
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.50
8212CPA	Volt Ref/Indicator	2.50

74C

74C00	.39	74C106	.75	74C195	1.59
74C02	.39	74C107	1.89	74C221	1.95
74C04	.29	74C151	2.95	74C240	2.25
74C08	.39	74C154	3.95	74C244	2.25
74C10	.39	74C157	2.25	74C373	2.49
74C14	.75	74C160	1.69	74C374	2.59
74C20	.39	74C161	1.60	74C901	.89
74C30	.39	74C162	1.49	74C903	1.15
74C42	1.39	74C163	1.69	74C911	10.95
74C48	1.95	74C164	1.59	74C912	10.95
74C73	.79	74C173	1.39	74C915	1.69
74C74	.79	74C174	1.39	74C917	10.95
74C85	1.95	74C175	1.39	74C922	5.49
74C86	.99	74C192	1.69	74C923	5.75
74C89	6.95	74C193	1.69	74C925	7.50
74C90	1.29			74C926	7.50
74C93	1.29			80C95	.79
74C95	1.59			80C97	.79

LINEAR

LH0002CN	6.85	LM340T-5	1.25	LM702H	.79
LM10CLH	4.50	LM340T-12	1.25	LM703CN	.89
LM11CLH	4.75	LM340T-15	1.25	LM709N	.49
LH0070-OH	6.05	LM341P-5	.75	LM710N	.79
TL071CP	.79	LM341P-12	.75	LM711N	.79
TL072CP	1.39	LM341P-15	.75	LM723N	.69
TL074CN	2.49	LM342P-5	.69	LM733N/H	1.00
LH0082CD	35.80	LM342P-12	.69	LM739N	1.19
TL082CP	1.19	LM342P-15	.69	LM741CN	.35
TL084CN	2.19	LM348N	1.25	MC1741SCG	3.00
LH0094CD	36.80	LM350K	5.75	LM747N/H	.79
LM300H	.99	LF351N	.60	LM748N/H	.59
LM301CN/H	.35	LF353N	1.00	LM1014N	2.75
LM302H	1.95	LF355N	1.10	LM1310N	1.95
LM304H	1.95	LF356N	1.10	LM1458CN	.59
LM305H	.99	LM358N	1.00	LM1488N	1.25
LM307CN/H	.45	LM359N	1.79	LM1489N	1.25
LM308CN/H	1.00	LM370N	4.49	LM1496N	1.95
LM309H	1.95	LM373N	3.25	LM1556V	1.75
LM309K	1.25	LM377N	2.95	LM1800N	2.95
LM310CN	1.75	LM380N	1.25	LM1877N-9	3.25
LM311H/CN	.90	LM381N	1.95	LM1889N	3.20
LM312H	2.49	LM382N	1.79	LM1896N	1.75
LM317MP	1.15	LM384N	1.95	LM2002T	1.49
LM317T	1.75	LM386N-3	1.29	LM2877P	2.05
LM317K	3.95	LM387N	1.45	LM2878P	2.25
LM318CN/H	1.95	LM389N	1.35	LM2896P-1	2.25
LM319N	1.95	LM392N	.69	LM3189N	2.95
LM320K-5	1.35	LF398N	4.00	LM3900N	.69
LM320K-12	1.35	LM399H	5.00	LM3905CN	1.25
LM320K-15	1.35	TL494CN	4.49	LM3909N	1.15
LM320T-5	1.25	TL496CP	1.75	LM3914N	3.95
LM320T-12	1.25	NE510A	6.00	LM3915N	3.95
LM320T-15	1.25	NE529A	4.95	LM3916N	3.95
LM323K-5	5.95	NE531H	3.95	RC4136N	1.25
LM324N	.99	NE536H	6.00	RC4151NB	3.95
LM329DZ	.65	NE540H	6.00	RC4194TK	5.95
LM331N	3.95	NE544N	4.95	RC4195TK	5.49
LM334Z	1.30	NE550A	1.30	KB4428	4.25
LM335Z	1.40	NE555V	.39	KB4429	5.95
LM336Z	1.75	LM556N	.99	LM4500A	3.25
LM337T	1.95	NE564N	3.95	ICL8038B	4.95
LM337MP	1.15	LM565N	1.25	LM13080N	1.29
LM338K	6.95	LM566CN	1.95	LM13600N	1.49
LM339N	.99	LM567V	1.25	75138N	1.95
LM340K-5	1.35	NE570N	4.95	75450N	.89
LM340K-12	1.35			75451CN	.39
LM340K-15	1.35			75492	.89

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
10 pf	.08	.06	.05	.001µF	.08	.06	.05
22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

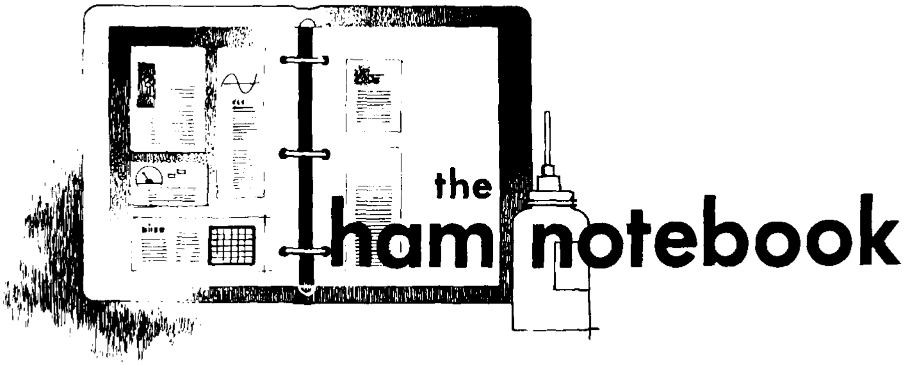
+20% DIPPED TANTALUMS (Solid) CAPACITORS

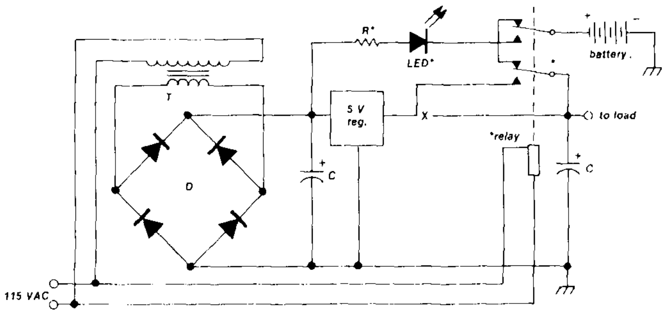
Value	1-9	10-99	100+	Value	1-9	10-99	100+
.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V	.79	.69	.55

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.45	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

More Details? CHECK—OFF Page 106





T	transformer 115/6.3V at 1 Amp	C	500 μF 25V electrolytic
R	current limit, 110 ohms	D	1N4001 diodes
Bat	*4.8V at 1.2 AH nicad*	Ry	*relay, 115Vac dpdt*
X	cut PC board foil here	*	additional parts

fig. 1.

battery backup for the K4EEU frequency standard

Because of frequent power failures in my area, I made the modifications shown in **fig. 1** to Bert Kelley's "Universal Frequency Standard," which was published in *ham radio*, for February, 1974.

When line power is on, it provides load power as well as charging current of near 50 mA as the battery approaches the discharged condition. However, because of the nonlinearity of the LED, current is reduced to below 10 mA trickle charge as the battery nears the fully charged state. It takes about 140 per cent of the battery rated ampere-hour (AH) capacity to fully charge a nicad at the normal rate. Typically it is AH/10 × 14 hours, or a trickle charge of AH/150 continuously, depending on the amount and duration of power failures.

As shown, the battery will provide backup power for about eight hours at the normal load rate of 150 mA. When fully charged, the battery reads near 5.5 volts but in minutes reduces to 5.2 volts when discharging. At this voltage the frequency standard runs about +5 Hz in 10^7. For about 80 per cent of the battery discharge cycle, the battery voltage is relatively stable near 4.8 volts, and the frequency standard runs near normal frequency. When the battery nears discharge (below 4.4 volts), the standard runs about −5 Hz in 10^7. However, when line power returns, the standard returns to normal in minutes instead of requiring days to regain normal frequency stability.

John R. True, N4BA

516F-2 low-voltage and bias modification

Owners of Collins 516F-2 power supplies who have changed from vacuum-tube rectifiers to solid-state devices should check the low-voltage supply potential. This supply is nominally given a 275-volt value under load and will rise to approximately 300 volts during standby. With the use of silicon rectifiers, an increase of 10 per cent in these values might be expected, but I found it (in two cases) to be closer to 20 per cent. This means the voltage during keydown would be 330 volts and during standby would rise to 360 volts. While this had no immediate detrimental effects, I felt that this condition isn't one that's in the best interests of equipment longevity!

Fortunately, the secondary of the low-voltage-supply transformer has a center tap lead separate from the high-voltage winding. Two parallel 600-ohm, 10-watt resistors were inserted between this lead and chassis ground (**fig. 2**). A terminal strip or insulated standoff was mounted near

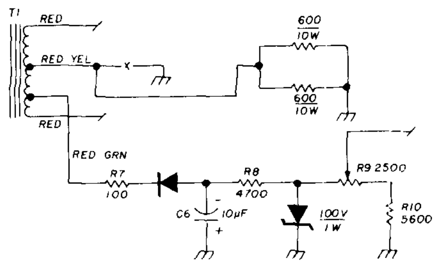


fig. 2.

the chassis side rail beneath the filter chokes. The center tap lead of the low-voltage secondary winding was lifted from its ground connection at the terminal strip close to the line cord entry and reconnected at the junction of the terminal strip and resistors. The resistors were placed along this side rail as well.

When I was done, I found the low voltage to be within a few volts of the recommended value. A check should be made of the paralleled combination of R-89/R-112 (32S-1) or R-140 (32S-3) since these resistors in the cathode circuit of the exciter's VOX relay tube run at their maximum power ratings, especially in the 32S-1; later model 32S-3s have a higher-power resistor here.

While working beneath the power-supply chassis, I added a 100-volt, 1-watt zener diode (HEP Z0438) between R8 and R9 junction. This device held the bias voltage to within a volt or so of its set value, whereas before this addition the bias wandered considerably with the changing transformer load during CW keying.

Paul K. Pagel, N1FB

trimming the dipole antenna

A formula for finding the length in feet of a halfwave wire to be used as a dipole antenna is 468/f (MHz). This is a good starting place but is usually not exactly correct.

To find the correct length the easy way, find the constant for your antenna location and height: this is a number near 468 and correct for your antenna.

Erect your dipole in its final position after determining the length by the above formula. Then find the frequency where the VSWR is lowest for this length. Multiply this frequency in MHz by the number of feet used. The number will be somewhere near 468. Now, recompute the length using this new constant instead of 468.

Example: You need a dipole with low VSWR at 7.2 MHz. The constant 468 divided by 7.2 is 65. Put up the dipole in its final position with 32.5 feet (9.9 meters) on each side. The lowest VSWR is at 7.15 MHz. Multiply $7.15 \times 65 = 464.75$. This is the constant you should have used; you have the antenna out there to prove it! This time use $464.75/7.2$. Answer: about 64.55 feet (19.7 meters). If you shorten the antenna by about 2-3/4 inches (70 mm) on each side, you will be on 7.2 MHz.

All this doesn't mean you're going to have zero reflected power at 7.2 MHz; it means your antenna will have the lowest VSWR at 7.2 MHz. Chances are small that you'll have the antenna in just the right place to present 50 ohms of resistive impedance to your feed line, and this is the reason for the small amount of reflected power remaining.

E.R. Lamprecht, W5NPD

radio interference to shortwave receivers

A troublesome source of interference to shortwave receivers is known as ITV. That's interference caused by the horizontal sweep oscillator in TV sets. It produces harmonics that cause hash every 15 kHz or so in your receiver. Cures for ITV have been described in numerous Amateur publications.

But what about other sources of interference to your receiver? An excellent description and some cures are found in reference 1, an article by the late Jim Fisk that appeared in an early issue of *ham radio*. Jim described causes of and cures for interference produced by TV receivers, electric-motor-powered appliances, fluorescent lights, power lines, neon signs, diathermy machines, furnace igniters, and TV boosters.

new interference sources

Now come some new interference sources. For example, I recently purchased an ion generator. That's a gadget that is supposed to produce a healthful environment by shooting out ionized particles. It also shoots out a lot of rf interference. It wasn't long before I heard a new noise in my receiver — and so did my neighbors. In fact, when I put a key into the power line to the ion generator, I was able to send spark signals (damped waves) all over the neighborhood. (I haven't figured out how to eliminate this source of interference, except by turning off the ion generator.)

Other sources of RFI (radio interference) are light dimmers and digital clocks. Some digital clocks have a small disk that rotates about once per second and produces a noise that can be heard some distance away in shortwave receivers.

Finding cures for this type of interference means working patiently with a sensitive monitoring device, locating the source, and then taking appropriate action with filters.

No one prohibits the sale of these interference-producing devices. They may crop up in your neighborhood any time. So if you hear a strange noise in your receiver, start looking at some of your new appliances. You might be surprised.

reference

1. Jim Fisk, W1DTY, "Radio-Frequency Interference," *ham radio*, December, 1970, page 12.

Ed Marriner, W6XM

ac-line switching precautions

A friend called me the other day and said that he'd used his equipment just before dinner and when he left the room, he turned "everything off." A few hours later my friend went into the radio room and smelled something burning. His linear-amplifier transformer had burned out!

"How could this have happened?" he asked. "I turned the switch off." It developed that my friend had a

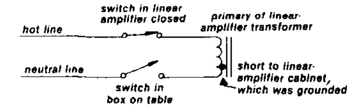


fig. 3.

heavy-duty cord running into a box on the operating table through a single-pole wall switch, since he had an ordinary two-wire plug on the end of the cord. It looked like he was breaking the *neutral* instead of the *hot* side of the ac line, since the linear amplifier was grounded. It wasn't too hard to understand that the transformer was still on the line. (See **fig. 3**).

Orville Gulseth, W5PGG

SEMICONDUCTORS SURPLUS

IC'S

Series 74S	
74S00	.59
74S02	.59
74S03	.59
74S04	.59
74S05	.59
74S08	.79
74S10	.59
74S11	.59
74S20	.59
74S22	.69
74S30	.59
74S37	.99
74S38	.99
74S40	.69
74S64	.89
74S65	.89
74S74	1.49
74S83	
74S86	1.69
74S112	1.39
74S114	1.39
74S124	3.75
74S133	.89
74S134	1.90
74S138	3.95
74S139	3.95
74S140	1.29
74S151	1.95
74S153	2.75
74S157	2.70
74S158	2.70
74S163	3.75
74S164	2.75
74S174	3.75
74S175	3.75
74S181	9.50
74S189	6.95
74S194	3.25
74S195	2.99
74S200	8.95
74S240	8.95
74S241	8.95
74S251	2.49
74S257	2.49
74S260	.99
74S280	3.95
74S283	
74S287	3.95
74S373	
74S374	
74S474	
Series 74	
7400	.39
7401	.27
7402	.27
7403	.27
7404	.27

7405	.28
7406	.28
7407	.28
7408	.31
7409	.28
7410	.27
7411	.34
7412	.34
7413	.44
7414	.90
7416	.34
7417	.34
7420	.27
7423	.34
7425	.34
7426	.34
	.34
7428	.34
7430	.28
7432	.34
7433	.34
7437	.34
7438	.34
7439	
7440	.29
7441	.99
7442	.99
7443	.99
7445	.99
7446	.99
7448	.84
7449	
7450	.28
7451	.28
7453	.28
7454	.28
7460	.44
7470	.39
7472	.42
7473	.41
7474	.42
7475	.42
7476	.42
7480	.64
7483	.60
7485	.70
7486	.44
7489	1.80
7490	.99
7491	.70
7492	.77
7493	.54
7494	.77
7495	.70
7496	.77
7497	.77
74100	1.04
74105	.37

74107	.58
74109	.37
74116	2.30
74120	2.00
74122	.64
74123	.64
74125	.49
74126	.62
74132	.74
74141	.74
74145	.67
74148	1.25
74150	1.04
74153	.72
74154	1.24
74155	.87
74157	.74
74158	1.70
74161	1.00
74163	.92
74164	1.02
74165	1.02
74166	1.25
74172	6.00
74173	.84
74174	.94
74175	.94
74177	.90
74180	.80
74181	1.80
74182	.80
74185	2.00
74186	10.00
74190	1.20
74191	1.20
74193	.90
74194	.90
74195	.90
74196	.90
74197	.90
74273	1.10
74279	.84
74283	2.20
74298	
74366	.73
74367	.84
74368	.84
Series 74LS	
74LS00	.40
74LS01	.33
74LS02	.33
74LS04	.44
74LS05	.33
74LS08	.44
74LS09	.43
74LS10	.33
74LS11	.44
74LS14	1.30

74LS20	.31
74LS21	.43
74LS27	.44
74LS30	.31
74LS32	.44
74LS37	.84
74LS38	.44
74LS42	.84
74LS49	1.43
74LS51	.31
74LS54	.40
74LS73	.50
74LS74	.64
74LS75	.73
74LS76	.50
74LS85	1.24
74LS86	.50
74LS90	.80
74LS93	.80
74LS95	.93
74LS96	1.03
74LS107	.50
74LS109	.50
74LS112	.64
74LS123	1.24
74LS125	.94
74LS132	.84
74LS138	.94
74LS139	.68
74LS145	1.30
74LS151	.84
74LS153	.84
74LS155	1.24
74LS156	1.04
74LS157	1.04
74LS158	.80
74LS160	1.03
74LS161	1.20
74LS163	1.03
74LS164	.94
74LS165	.94
74LS173	.94
74LS174	1.04
74LS175	1.04
74LS181	2.25
74LS191	1.20
74LS193	1.03
74LS194	1.20
74LS195	1.00
74LS196	.94
74LS197	.94
74LS221	1.54
74LS240	3.04
74LS244	3.00
74LS245	8.95
74LS251	1.84
74LS253	1.03
74LS257	1.03

74LS258	1.03
74LS259	3.00
74LS266	.64
74LS273	1.80
74LS282	
74LS283	1.15
74LS293	2.00
74LS298	1.34
74LS323	4.79
74LS353	1.70
74LS366	1.04
74LS367	1.04
74LS368	1.04
74LS373	2.80
74LS374	2.80
74LS378	1.33
74LS393	2.00
74LS670	2.34
4001	.34
4002	.34
4007	.34
4009	.64
4011	.34
4012	.34
4013	.54
4015	1.44
4017	1.24
4021	1.54
4023	.42
4024	.84
4025	.43
4027	.84
4028	1.04
4029	1.34
4030	.74
4040	1.34
4046	2.30
4049	.74
4050	.74
4052	1.15
4060	1.44
4069	.44
4081	.40
4093	1.04
7520L	1.35
75107	.84
75108	.84
75113	
75115	
75123	
75151	
75154	2.00
75350	
75368	
75369	
75427	
75451	2.10
75452	2.10
75454	2.10
75480	
75492	.93

MEMORY

2708	1K x 8 EPROM	3.00
2716/2516	2K x 8 5V single supply	7.50
2114/9114	1K x 4 Static	3.00
4027	4K x 1 Dynamic RAM	1.00
2117/4116	16K x 1 Dynamic RAM	3.00
2732-6	32K EPROM	39.95

C.P.U.'s ETC.

MC6800P	Microprocessor	9.99
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MC6845P	CRT Controller	25.00
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MC6852P	SSDA	5.00
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8080A	Microporcessor	5.00
Z80A	Microprocessor	10.99
Z80	Microprocessor	8.99
Z80A	PIO	9.99
Z80	SIO/O	22.50
Z80	SIO/I	22.50
8212	8 Bit input/output part	3.99
8251	Communication Interface	6.99
TR1602/AY5-1013	UART	6.99
TMS1000NL	Four Bit Microprocessor	4.99
PT1482B	PSAT	5.99
8257	DMA Controller	8.99
3341	64 x 4 FIFO	3.00
MM5316/F3817	Clock with alarm	5.99
8741		60.00
8748	8 Bit Microcomputer with programmable/erasable EPROM	60.00
MC1408L/6	6 Bit D/A	3.25
COM2502		9.99
COM2601		9.99

ZENER DIODES

Motorola - 500MW .54 ea.

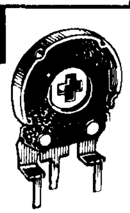
1N746A	1N755A	1N965B
1N747	1N756	1N966B
1N748A	1N756A	1N967B
1N750A	1N757A	1N968A
1N751A	1N758A	1N969B
1N752A	1N759A	1N972
1N753A	1N963B	1N978B
1N754A	1N964B	

NEW & USED BCD SWITCHES
3 switch with end plates
$8.99 New $6.95 Used

NEW GE OPTO COUPLERS
4N26 .69 ea. or 10/$5.00

MICRO-MINI WATCH CRYSTALS
32.768 Hz $3.00 each

TRIMPOTS



Thumb wheel type.
.39 each or 10/2.50
not sold mixed

100	20000	200	50000
150	25000	250	200K
		500	250K
		1000	500K
		1500	750K
		2000	2 megs
		2500	2.2 megs
		5000	3 megs
		10000	5 megs

SEMICONDUCTORS SURPLUS

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SEMICONDUCTORS SURPLUS

RELAYS

Meko #109P80060............ .99
5 VDC SPDT

Meko..................... .99
5 VDC SPST

AMF/P&B.................2.99
R10-E1-Y2-J1.0K - 8.5 MA
6 VDC DPDT

AMF/P&B.................2.69
R50-E2-Y1
12 VDC 210 ohms DPDT

AZ530-13-2...............2.69
12 VDC 45 ohms SPDT

Sigma #70RE62............4.95
12 VDC 3P6T

Omron MHE202PG..........2.99
VA - DC12 DPDT

AMF/P&B 4.99
KUMP11D18
12 VDC DPDT

Sigma 65F1A..............1.69
12 VDC SPDT

NAP Controls.............2.99
13 A 12D12 DPDT

Magnecraft 1.99
W104MX-2
250 ohms 12 VDC SPDT

P&B KH4695-1............2.99
120 VAC 2P4T

P&B GA-2290.............3.09
110 VDC 2P4T

P&B PR5DY...............3.99
25 A 12 VDC SPDT

P&B PR7AY...............5.99
25 A 115 VAC DPST

AMF/P&B.................4.99
PRD11AY0
24 VAC 25 A DPDT

MS188-901/188-212081-102
70 ohms SPST............1.69

ARCO CAPS

304	100-550pF	1.50	469	170-780pF	1.40
400	.9-7pF	1.00	4615	390-1400pF	2.02
402	1.5-20pF	1.00	404	8-60pF	1.00
420	1-12pF	1.00	405	10-80pF	1.00
423	7-100pF	1.00	422	4-40pF	1.00
426	37-250pF	1.01	424	16-150pF	1.00
464	25-280pF	1.00	427	55-300pF	1.00
465	50-380pF	1.39	462	5-80pF	1.50
467	110-580pF	1.03			

IC'S

MC4000P	5.09	MC4300F	10.00
MC4000L	7.30	MC4307F	10.99
MC4001P	9.60	MC4316F	13.55
MC4002P	4.96	MC4322F	10.40
MC4002L	7.30	MC4323F	13.87
MC4006P	5.99	MC4350F	20.89
MC4006L	8.33	MC4362F	7.75
MC4007L	8.43	MC1303L	1.00
MC4008P/74408P	4.24	MC1306	1.27
MC4012P/74412P	7.16	MC1311	
MC4012L	9.55	MC1330	2.50
MC4015P/74415P	5.81	MC1350	2.50
MC4015L/74415L	8.25	MC1351	1.43
MC4016P/74416P	6.89	MC1352	1.37
MC4017P/74417P	6.89	MC1358	2.50
MC4018P/74418P	6.89	MC1359	
MC4018L/74418L	10.05	MC1393	1.76
MC4019P/74419P	6.89	MC1408L6	2.75
MC4019L/74419L	10.05	MC1414L	1.83
MC4022P	5.41	MC1414P	1.29
MC4023P	7.79	MC1435L	
MC4024P	3.92	MC1436G	
MC4044P	3.92	MC1437	2.25
MC4050P/74450P	12.25	MC1439	3.57
MC4060P	5.32	MC1461	
MC4062P	3.43	MC1468L	5.33
MC4000F	8.87	MC1469R	5.65
MC4006F		MC1496P	2.50
MC4007F		MC1511G	
MC4008F		MC1535G	18.19
MC4060F/74460F		MC1539G	5.40
MC4062F		MC1550G	1.61
MC4300C	8.20	MC1552G	11.61
MC4306L	9.05	MC1558L	1.68
MC4307L	11.09	MC1560R	
MC4312L	10.67	MC1569RB2	10.49
MC4318L/MC54148L	11.40	MC1590G	6.99
MC4322L	8.61	MC1709CG	.97
MC4350L/MC54450L	17.16	MC1710G	1.79

IC'S

MC1711CL	1.03
MC1712CP	3.35
MC1723CP	.67
MC1733CL	1.35
MC1741G	1.50
MC14528B	2.04
MC14530BCP	1.22
LM101AH	
LM108AH	8.83
LM111H	8.73
LM139A	12.13
LM202H	
LM205	
LM211	4.43
LM258	2.15
LM270	
LM301AP/H	.69
LM304H	1.20
LM307N	.55
LM308H	2.99
LM310H	1.10
LM311V	.89
LM312H	2.70
LM319H	1.95
LM319N	1.25
LM324N	1.59
LM339N	.99
LM342N15	
LM348N	1.85
LF351	
LF355	1.31
LM358	.99
LM376	
LM377	
LM380	2.50
LM381	1.95

LM386	1.75
LM387	1.00
LM393	
NE527	
NE531T	2.95
NE540L	
NE555Y	.39
LM555H	
LM556CJ	1.42
LM565CH	1.75
LM567V	
LM/UA703	
LM709H	
LM711N	
LM715	
LM723CH	
LM741CN/Y	.56
LM741CH	1.01
LM747CT	
LM/F7470M	
LM748CN	
LM/UA749	
LM1310N	
LM1391N	
LM1458V	
LM1514J	
LM1889	
LM2901/SL61638	
LM3900/CA3401	.84
LM4250CH	1.84
CA3011	
CA3046	1.30
CA3085	
CA3086	1.04
CA3140	1.24
LM3146	2.00

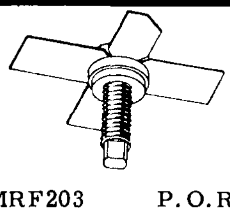
TUBES

6KD6	5.00
6LQ6/6JE6	6.00
6MJ6/6LQ6/6JE6C	6.00
6LF6/6MH6	5.00
12BY7A	4.00
2E26	4.69
4X150A	29.99
4CX250B	45.00
4CX250R	69.00
4CX300A	109.99
4CX350A/8321	100.00
4CX350F/J/8904	100.00
4CX1500B/8660	300.00
811A	20.00
6360	4.69
6939	7.99
6146	5.00
6146A	5.69
6146B/8298	7.95
6146W	12.00
6550A	8.00
8908	9.00
8950	9.00
4-400A	145.00
4-400C	145.00
572B/T160L	44.00
7289	9.95
3-1000Z	229.00
3-500Z	141.00

CRYSTAL FILTERS

EFCL455K13E	3.99
EFCL455K40B2	2.99
FX-07800L, 7.8 MHz	12.99
FHA103-4, 10.7 MHz	12.99

RF Transistors



MRF203	P.O.R.
MRF216	19.47
MRF221	8.73
MRF226	10.20
MRF227	2.13
MRF238	10.00

MRF240	14.62
MRF245	28.87
MRF247	28.87
MRF262	6.25
MRF314	12.20
MRF406	11.33
MRF412	20.65
MRF421	27.45
MRF422A	38.25
MRF422	38.25
MRF428	38.25
MRF428A	38.25

MRF426	8.87
MRF426A	8.87
MRF449	12.65
MRF449A	12.65
MRF450	11.00
MRF450A	11.77
MRF452	15.00
MRF453	13.72
MRF454A	21.83
MRF455	14.08
MRF455A	14.08
MRF474	3.00

MRF475	2.90
MRF476	2.25
MRF477	10.00
MRF485	3.00
MRF492	20.40
MRF502	.93
MRF604	2.00
MRF629	3.00
MRF648	26.87
MRF901	3.99
MRF902	9.41
MRF904	3.00

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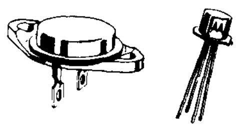
More Details? CHECK—OFF Page 106

SEMICONDUCTORS SURPLUS

RF Transistors

MRF911	4.29	MMCM2369	15.00	NEW MRF472
MRF5176	11.73	MMCM2484	15.25	12.5 VDC, 27 MHz
MRF8004	1.39	MMCM3960A	24.30	4 Watts output
BFR90	1.00	MWA120	7.80	10 dB gain
BFR91	1.25	MWA130	8.08	1.69 ea.
BFR96	1.50	MWA210	7.46	10/9.50
BFW92A	1.00	MWA220	8.08	100/69.00
BFW92	.79	MWA230	8.62	1000/480.00
MMCM918	14.30	MWA310	8.08	
MMCM2222	15.65			

Transistors



		2N3960JANTX	10.00	2N5645	10.00
		2N4072	1.60	2N5842	8.00
		2N4427	1.10	2N5849	20.00
		2N4429	7.00	2N5942	40.00
		2N4877	1.00	2N5946	14.00
		2N4959	2.00	2N5862	50.00
		2N4976	15.00	2N6080	7.00
2N2857JAN	2.50	2N5070	8.00	2N6081	10.00
2N2949	3.60	2N5071	15.00	2N6082	11.00
2N2947	15.00	2N5108	4.00	2N6083	13.00
2N2950	4.60	2N5109	1.50	2N6084	14.00
2N3375	8.00	2N5179	1.00	2N6095	11.00
2N3553	1.57	2N5583	4.00	2N6096	20.00
2N3818	5.00	2N5589	6.00	2N6097	28.00
2N3866	1.00	2N5590	8.00	2N6166	38.00
2N3866JAN	2.50	2N5591	11.00	2N6368	22.99
2N3866JANTX	4.00	2N5635	5.44	A210/MRF517	2.00
2N3925	10.00	2N5636	11.60	BLY38	5.00
2N3948	2.00	2N5637	20.00	40280/2N4427	1.10
2N3950	25.00	2N5641	5.00	40281/2N3920	7.00
2N3959	3.00	2N5643	14.00	40282/2N3927	10.48

CRYSTALS

$4.95 each

5.120	7.4825	9.565	10.150	11.155	11.905	17.315
7.3435	7.4865	9.575	10.160	11.275	11.955	17.355
7.4585	7.4925	9.585	10.170	11.700	12.000	17.365
7.4615	7.4985	10.000	10.180	11.705	12.050	37.600
7.4625	7.5015	10.010	10.240	11.730	12.100	37.650
7.4665	7.5025	10.020	10.245	11.750	16.965	37.700
7.4685	7.5065	10.030	10.595	11.755	17.015	37.750
7.4715	7.7985	10.040	10.605	11.800	17.065	37.800
7.4725	7.8025	10.0525	10.615	11.850	17.165	37.850
7.4765	9.545	10.130	10.625	11.855	17.215	37.900
7.4785	9.555	10.140	10.635	11.900	17.265	37.950
7.4815						38.000

CB type crystals

$4.95 each

51-T

T1	T15	T28
T2	T16	T29
T3	T17	T30
T4	T18	T31
T5	T19	T32
T6	T20	T33
T7	T21	T34
T8	T22	T35
T9	T23	T36
T10	T24	T37
T11	T25	T38
T12	T26	T39
T13	T27	T40
T14		

51-R

R1	R15	R28
R2	R16	R29
R3	R17	R30
R4	R18	R31
R5	R19	R32
R6	R20	R33
R7	R21	R34
R8	R22	R35
R9	R23	R36
R10	R24	R37
R11	R25	R38
R12	R26	R39
R13	R27	R40
R14		

Johnson AIR Variables

$1.00 each

T-3-5	1 to 5 pF
T-6-5	1.7 to 11 pF
T-9-5	2 to 15 pF
189-6-1	.1 to 10 pF
189-502-Y	1.3 to 6.7pF
189-503-105	1.4 to 9.2pF
189-504-5	1.5 to 11.6pF
189-505-5	1.7 to 14.1pF
189-505-107	1.7 to 14.1pF
189-506-103	1.8 to 16.7pF
189-507-105	2 to 19.3pF
189-508-5	2.1 to 22.9pF
189-509-5	2.4 to 24.5pF
545-043	1.8 to 11.4pF

Johnson AIR Variables

1/4 x 2 1/2" shaft
$2.50 each

193-10-6	2.2 to 34 pF
193-	1.5 to 27.5pF
193-	.6 to 6.4pF

$1.00 each

160-107-16	.5 to 12 pF
193-10-9	2.2 to 34 pF
193-10-104	2.2 to 34 pF
193-4-5	3 to 30 pF

TRANSFORMERS

#70169-2............. 4.99 each
26 VCT @ 1 Amp and
2.5 V @ 1 Amp

New GE model 6C-9 9 V Nicad Battery................... 3.69

New MCM Moving Coil Tach Generator
Model M100.......... 6.99 each

New Mallory Mini Sonalert
Model #SC-18. Works at 12 VDC
3500 Hz.............. 4.69 each

New T.V. Colorburst Crystals
3.579545...............99 each

WIDEBAND RF TRANSFORMERS

Tyep T16-1............6.50 each

	Insertion Loss
.3 to 120 MHz	3dB
.7 to 80 MHz	2dB
5 to 20 MHz	1dB

RF Power Device

MRF454 Same as MRF458
12.5 VDC, 3-30 MHz
80Watts output, 12dB gain
$17.95 ea.

CHOKES

.1-3 uH	2.99
VIV .15 .15 uH	2.99
VIV 150 150 uH	2.99
5-20 uH	1.69
Variable coil 10-80 uH	2.99
Transformer dual 2.8 uH	1.00
.47 uH	1.00 ea. or 10/7.50
.68 uH	1.00 ea. or 10/7.50
1 uH	1.00 ea. or 10/7.50
1.2 uH	1.00 ea. or 10/7.50
1.5 uH	1.00 ea. or 10/7.50
2.2 uH	1.00 ea. or 10/7.50
2.7 uH	1.00 ea. or 10/7.50
3.3 uH	1.00 ea. or 10/7.50
6.5 uH	1.00 ea. or 10/7.50
7.5 uH	1.00 ea. or 10/7.50
10 uH	1.00 ea. or 10/7.50
15 uH	1.00 ea. or 10/7.50
20 uH	1.00 ea. or 10/7.50
22 uH	1.00 ea. or 10/7.50
33 uH	1.00 ea. or 10/7.50
39 uH	1.00 ea. or 10/7.50
47 uH	1.00 ea. or 10/7.50
50 uH	2.99
56 uH	1.69
62 uH	1.00 ea. or 10/7.50
68 uH	1.00 ea. or 10/7.50
100 uH	2.99
120 uH	1.69
185 uH	1.00 ea. or 10/7.50
538 uH	1.00 ea. or 10/7.50
680 uH	1.00 ea. or 10/7.50
1000 uH	1.00 ea. or 10/7.50
1630 uH	1.50
.1 mH	2.99
.2 mH	2.99
.22 mH	2.99
.27 mH	2.99
.33 mH	2.99
.39 mH	2.99
.240 mH	2.99
1.2 mH	2.99
1.5 mH	2.99
1.65 mH	2.99
1.75 mH	2.99
1.9 mH	2.99
1 mH	1.69
1.88 mH	3.99
2 mH	2.99
2.4 mH	2.99
2.5 mH	1.00 ea. or 10/7.50
2.7 mH	2.99
3.0 mH	2.99
3.6 mH	2.99
4.3 mH	2.99

4.7 mH	2.99
5 mH	2.99
5.11 mH	2.99
6 mH	2.99
7.2 mH	2.99
8.25 mH	2.99
8.28 mH	2.99
8.6 mH	2.99
10 mH	2.99
12 mH	2.99
15 mH	2.99
17 mH	2.99
19.6 mH	2.99
20 mH	2.99
20.5 mH	2.99
22.6 mH	2.99
24 mH	2.99
27.4 mH	2.99
28.7 mH	2.99
29.9 mH	2.99
30 mH	2.99
36 mH	2.99
36.5 mH	2.99
40 mH	2.99
40.2 mH	2.99
43 mH	2.99
47 mH	2.99
50 mH	2.99
59 mH	2.99
60 mH	2.99
71.5 mH	2.99
78.7 mH	2.99
86 mH	2.99
100 mH	2.99
120 mH	2.99
150 mH	2.99
175 mH	2.99
200 mH	2.99
205 mH	2.99
237 mH	2.99
240 mH	2.99
300 mH	2.99
360 mH	2.99
390 mH	2.99
430 mH	2.99
500 mH	1.50
600 mH	2.99
1000 mH	2.99
1.5 Hy	2.99
2.0 Hy	2.99
2.5 Hy	2.99
3.0 Hy	2.99
5.0 Hy	2.99
10 Hy	2.99

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ASTRO-150A, the synthesized tranceiver for easy and safe tuning in the mobile environment. VRS for hands-off tuning; you set the rate and the microprocessor does the work. In addition, microphone up-down tuning allows tuning with one hand and eyes on the road. When off-road the microprocessor controlled sythesizer holds frequency, no matter how rough the going.
Emphasis has been placed on performance and human engineering. A leading editorial review stated, "The quality of construction is second to none. In fact the reviewer was reminded of a well-executed piece of expensive commercial or industrial test gear."
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Base Station Performance Tailored to the New Generation Small Cars.
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100MX
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IC-22U

ICOM VHF Mobile Performance at a Budget Price

Imagine IC-22S performance and simplicity . . . plus 800 channels . . .

Easy to Operate.

- Convenient pushbutton frequency selection
- Monitor repeater inputs at the flip of a switch
- Hi/Low power pushbutton selectible
- Touch Tone® available with optional HM8 microphone
- Convenient hookup points for sub-audible tone encoder or continuous tone controlled squelch system
- 5 KHz step (800 T/R channels standard)
- Covers the complete 144-147.995 MHz ham band

ICOM Performance.

- 5 helical resonators for outstanding selectivity
- Continuous duty rated 10 watt transmitter — rugged performance
- Excellent receiver sensitivity
- Patterned after ICOM's extremely successful and reliable IC-22S.
- APC circuit for protection of finals

Versatile.

- Easily set up for CAP/MARS use
- 8 pin mic connector
- 9 pin undedicated accessory socket
- Remotable frequency selection option
- Compact size [6.2 in (W) x 2.3 in (H) x 8.6 in (D)]

ICOM

2112 - 116th Avenue NE, Bellevue WA 98004
3331 Towerwood Dr., Suite 307, Dallas, TX 75234

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

One-Stop Component Center™

Jim-pak electronic components

This is a partial listing of over 500 items available from 500 authorized Jim-pak Distributors:

TTL

7400	2/.85	7490	.85
7402	2/.85	7493	.85
7404	2/.85	74100	2.25
7406	2/1.19	74109	2/1.19
7407	2/1.19	74121	.69
7408	2/.89	74123	.99
7410	2/.85	74150	1.95
7414	.99	74154	1.95
7417	2/1.10	74157	.99
7420	2/.85	74161	1.19
7447	1.19	74164	1.59
7474	.69	74174	1.59
7475	.79	74175	1.49
7476	.69	74192	1.19
7485	1.19	74193	1.19
7486	2/1.19	74367	.99
7489	2.99	74393	1.95

GRAB BAGS

GB100 Cer. Caps. (100)	2.95	GB123 Heat Sinks (30)	3.95
GB101 Mylar Caps. (60)	4.95	GB127 Transistors (100)	3.95
GB102 Electrolytics (60)	4.95	GB137 Chokes (50)	3.95
GB103 Tantalums (40)	4.95	GB139 Term. Strips (40)	3.95
GB108 TTL IC's (50)	4.95	GB140 Spcr/Stndff (150)	2.95
GB110 Asst. LEDs (100)	5.95	GB141 Washers (200)	2.95
GB113 Trimmers (30)	4.95	GB145 Lugs (100)	2.95
GB116 ¼w Resist. (200)	2.95	GB154 1&2w Resist. (100)	2.95
GB117 ½W Resist. (200)	2.95	GB162 7-Seg. Dsplys. (50)	5.95
GB120 Slide Switch (25)	3.95	GB173 3/8" Pots. (100)	5.95

LS Schottky

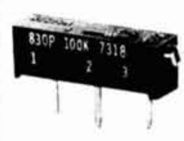
74LS00	.55	74LS109	.79
74LS02	.55	74LS123	1.95
74LS04	.69	74LS138	1.49
74LS08	.55	74LS139	1.49
74LS10	.55	74LS154	2.49
74LS14	1.09	74LS157	1.49
74LS30	.55	74LS161	1.79
74LS32	.69	74LS174	1.79
74LS38	.69	74LS175	1.79
74LS42	1.49	74LS192	1.89
74LS47	1.49	74LS193	1.89
74LS48	1.79	74LS221	1.95
74LS73	.79	74LS244	2.49
74LS74	.79	74LS245	3.49
74LS75	.99	74LS367	1.29
74LS85	1.95	74LS374	2.49
74LS90	1.09	81LS97	2.49

POTENTIOMETERS

2 Watt @ 70°C
7/8" Slotted Shaft
Linear Taper

1K 5K 10K
25K 50K 100K
1 Meg

CMU . . $2.95



3/4 Watt @ 70°C
15 Turn Pot.
Linear Taper

100Ω 500Ω 1K
5K 10K 50K
100K 500K 1Meg

830P . . $1.79

NEW! JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2"w x 5-1/16"L x 2"H

JE215 Adj. Dual Power Supply Kit (as shown) . . $24.95

(Picture not shown but similar in construction to above)
JE200 Reg. Power Supply Kit (5VDC, 1 amp) . . $14.95
JE205 Adapter Brd. (to JE200) ±5, ±9 & ±12V . . $12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp . . $19.95

SOCKETS

Low Profile		Wire Wrap	
8 pin LP	2/.59	14 pin WW tin	.75
14 pin LP	2/.69	14 pin WW gold	1.09
16 pin LP	2/.79	16 pin WW tin	.79
18 pin LP	2/.89	16 pin WW gold	1.19
20 pin LP	2/.99	24 pin WW gold	1.69
22 pin LP	2/1.09	40 pin WW gold	2.75
24 pin LP	.79	14 p. plug/cover	1.29
28 pin LP	.82	16 p. plug/cover	1.39
36 pin LP	.99	24 p. plug/cover	1.95
40 pin LP	1.19	Also, The Molex Line	

DIODES & TRANSISTORS

IN751	2/.59	2N2219A	2/1.19
IN757	2/.59	2N2222A	2/.89
IN1188	2.69	2N2907A	2/.89
IN3600	5/.99	2N3055	.99
IN4001	4/.59	2N3772	2.25
IN4004	4/.69	2N3904	2/.69
IN4007	4/.79	2N3906	2/.69
IN4148	10/.99	2N4401	2/.79
IN4733	2/.69	2N4403	2/.79
IN4734	2/.69	2N5129	2/.69
IN4735	2/.69	2N5139	2/.69
IN4742	2/.69	2N5210	2/.79
IN4744	2/.69	2N5951	2/1.29

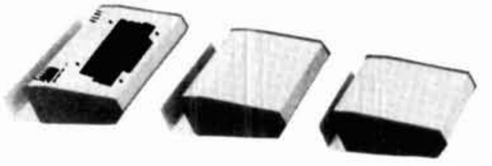
CMOS

4000	.69	4030	.79
4001	.69	4040	1.95
4002	.69	4044	1.39
4006	1.95	4046	2.49
4009	.89	4047	2.75
4010	.85	4049	.89
4011	.69	4050	.89
4013	.85	4051	1.95
4016	.85	4066	1.19
4017	1.49	4069	.79
4018	1.49	4070	.79
4020	2.19	4071	.79
4023	.49	4081	.69
4024	1.29	4093	1.19
4027	.89	4511	1.95

CAPACITORS

Dipped Tantalum		ELECTROLYTIC	
.1mfd @ 35V	2/.89	1mfd @ 50V	3/.69
.47mfd @ 35V	2/.89	4.7mfd @ 50V	2/.59
1mfd @ 35V	2/.89	10mfd @ 50V	2/.69
2.2mfd @ 25V	2/1.09	22mfd @ 50V	2/.79
3.3mfd @ 25V	2/1.19	47mfd @ 50V	2/.89
4.7mfd @ 25V	2/1.39	100mfd @ 50V	.59
10mfd @ 25V	1.19	220mfd @ 50V	.69
33mfd @ 25V	3.95	1000mfd @ 25V	1.19
100V MYLAR		2200mfd @ 16V	1.39
.001-.01mfd	4/.79	**50V CERAMIC**	
.022mfd	4/.89	10pf-.022mfd	4/.59
.047mfd	4/.99	.047mfd	4/.69
.1mfd	4/1.19	.1mfd	4/.79
.22mfd	4/1.29		

DESK TOP ENCLOSURES



DTE-8 (Pictured)	**$31.95**
DTE-11 (Pictured)	**34.95**
DTE-14	**36.95**
DTE-HK (Case for JE600)	**47.95**
DTE-AK (Case for JE610) (Pictured)	**52.95**

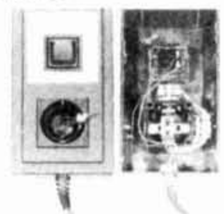
CONNECTORS

DB25P	D-Subminiature Plug	3.95
DB25S	D-Subminiature Socket	4.95
DB51226	Cover for DB25P/S	2.25
22/44SE	P.C. Edge	2.95
UG88/U	BNC Plug	2.19
UG89/U	BNC Jack	3.95
UG175/U	UHF Adapter	.59
SO239	UHF Panel Recp.	1.49
PL258	UHF Adapter	1.95
PL259	UHF Plug	1.95
UG260/U	BNC Plug	2.39
UG1094/U	BNC Bulkhead Recp.	1.49

MICROPROCESSORS

Z80A	CPU (4MHz)	14.95
MC6800	8 Bit MPU	14.95
8080A	CPU	6.95
8212	8 Bit I/O Port	3.95
8216	Bi-Directional Bus Driver	4.49
2513/2140	Character Generator	12.95
8T97	Tri-State Hex Buffer	2.25
AY-5-1013	30K Baud UART	6.95
AY-5-2376	88-Key Keyboard Encoder	13.95
2114-3	4K Static RAM (300ns)	6.95
MK4116	16K Dynamic RAM (250ns)	4.95
2708	8K EPROM	6.95
2716	16K EPROM (+5V)	10.95

JOYSTICKS



JS-100K	**100K Linear Taper Pots**	**$5.49**
JVC-40	**40K (2) Video Controller**	**5.95**

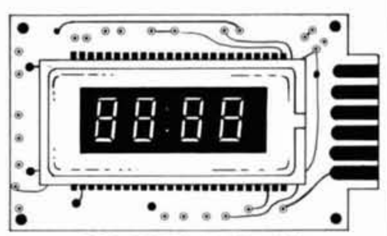
LINEAR

LM301N	.59	LM7805T	1.75
LM305H	1.39	LM7812T	1.75
LM307N	.75	LM7815T	1.75
LM308N	1.19	LM380N	1.49
LM309K	2.25	LM384N	2.49
LM310N	2.69	LM555N	.69
LM311N	1.49	LM556N	1.49
LM317T	2.29	LM565N	1.95
LM318N	2.95	LM566N	1.95
LM319N	2.95	LM567N	1.79
LM320K-5	2.25	LM723N	.79
LM7905T	1.75	LM741N	.65
LM7912T	1.75	LM1310N	2.95
LM7915T	1.75	LM1458N	.99
LM323K	5.95	LM1488N	1.59
LM324N	1.29	LM1489N	1.59
LM337T	2.29	LM1800N	4.49
LM339N	1.29	76477N	3.95

WALL TRANSFORMERS

AC250	**250mA 12VAC (117V/60Hz)**	**$3.95**
DV9200	**200mA 9VAC (117V/60Hz)**	**3.95**

12VDC AUTOMOTIVE/ INSTRUMENT CLOCK MODULE



.300 GREEN DISPLAY

MA1003 . . . . $19.95

More Details? CHECK—OFF Page 106

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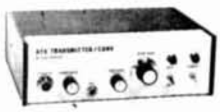

TC-1 Transmitter/Converter . . . . Plug in camera, ant., mic, and TV and you are on the air. Contains AC supply, T/R sw, 4 Modules below . . . . $ 399 ppd

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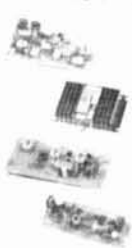

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ANTENNA BOOKS by Bill Orr, W6SAI

ALL ABOUT CUBICAL QUAD ANTENNAS

The cubical quad antenna is considered by many to be the best DX antenna because of its simple, lightweight design and high performance. In Bill Orr's latest edition of this well known book, you'll find quad designs for everything from the single element to the multi-element monster quad, plus a new, higher gain expanded quad (X-Q) design. There's a wealth of supplementary data on construction, feeding, tuning, and mounting quad antennas. It's the most comprehensive single edition on the cubical quad available. 112 pages. ©1977.

☐ **RP-CQ** — **Softbound $4.75**

THE RADIO AMATEUR ANTENNA HANDBOOK

by William I. Orr, W6SAI and Stuart Cowan, W2LX

If you are pondering what new antennas to put up, we recommend you read this very popular book. It contains lots of well illustrated construction projects for vertical, long wire, and HF/VHF beam antennas. But, you'll also get information not usually found in antenna books. There is an honest judgment of antenna gain figures, information on the best and worst antenna locations and heights, a long look at the quad vs. the yagi antenna, information on baluns and how to use them, and some new information on the increasingly popular Sloper and Delta Loop antennas. The text is based on proven data plus practical, on-the-air experience. We don't expect you'll agree with everything Orr and Cowan have to say, but we are convinced that **The Radio Amateur Antenna Handbook** will make a valuable and often consulted addition to any Ham's library. 190 pages. ©1978.

☐ **RP-AH** — **Softbound $6.95**

BEAM ANTENNA HANDBOOK

Here's recommended reading for anyone thinking about putting up a yagi beam this year. It answers a lot of commonly asked questions like: What is the best element spacing? Can different yagi antennas be stacked without losing performance? Do monoband beams outperform tribanders? Lots of construction projects, diagrams, and photos make reading a pleasurable and informative experience. 198 pages. ©1977.

☐ **RP-BA** — **Softbound $5.95**

Please add $1.00 to cover shipping and handling.

HAM RADIO'S BOOKSTORE
GREENVILLE, N. H. 03048

NEW products

New Product Report

Several years ago, in one of the April Fool's articles that appeared in *QST*, there was a design for a hydraulic antenna mast that retracted into the ground. As I remember the story, you had to drill a hole as deep as the mast was high. To raise or lower the mast you filled the hole with water. At least at that time it seemed like an April Fool's article.

Now, N-Pro, from Oregon City, Oregon, has designed and perfected an antenna mast that can be used in much the same fashion! Their design, however, goes way beyond the *QST* article and is rapidly finding a home in both ham and professional applications. TV stations, for example, are putting both cameras and antennas for their remote-site shots onto N-Pro masts. They find they're able to get better pictures from an elevated camera, and also improve their transmitted signals. The N-Pro K2 mast extends to 22 feet 2 inches, and can lift 150 pounds in just under two minutes. When retracted the mast is only 7 feet 6 inches long. The K2 is fabricated from four sections of 6061-T6 aluminum alloy. The pipe sections are splined to prevent antenna or camera rotation during elevation.

The K2 uses easy-to-find automotive automatic transmission fluid, rather than any of the more expensive hydraulic fluids. The hydraulic reservoir and pump can be conveniently located anywhere in the vehicle.

Hams will find the N-Pro masts of interest for mobile communications centers, VHF hilltopping installations, and for field day operations. For the ultimate in hidden antennas, you can even bury the mast as was done in the *QST* article. For more information, write N-Pro, 1022 Hazelwood Drive, Oregon City, Oregon 97045.

J. Craig Clark, N1ACH

Ten-Tec Argosy

Ten-Tec's new Argosy solid-state transceiver reverses the upward Amateur Radio price spiral with an Amateur net price of $549, hundreds of dollars lower than you would expect for a high performance transceiver. Dual power is a unique feature: a switch converts the Argosy from a 10-watt QRPp rig to a 100-watt SSB/CW transceiver.

The Argosy receiver features 80 through 10 meter coverage (including the new 30-meter band) with broadband design for instant band change without receiver "peaking"; typical sensitivity figure of 0.3 μV for 10 dB S + N/N; 2.5 kHz four-pole crystal filter (plus optional 1.8-kHz, 500-Hz and 250-Hz filters); 9-MHz i-f with 60 dB rejection; $\pm$3-kHz offset tuning with center "off" position; built-in 50 dB notch filter that's tunable from 200 Hz to 3.5 kHz; optional i-f type 50-dB noise blanker; and built-in speaker with low distortion audio.

The transmitter features tuning in nine 500-kHz segments (four segments for 10 meters) with approximately 40-kHz VFO overrun on each band edge; 100 percent duty cycle up to 20 minutes on all bands; three-function meter shows forward peak power or SWR on transmit and received signal strength; full break-in on CW plus PTT on SSB; built-in sidetone with adjustable tone and volume; ALC control on high power only, where needed; automatic sideband selection plus reverse; normal 12-14 Vdc operation plus ac operation with optional power supply.

Styling includes molded front panel, matching aluminum top, side and back panels. Size is 4 × 9½ × 12 inches, to fit and go anywhere. A full accessory line is available including filters, noise blanker, audio CW filter, and calibrator. Full details are available from Ten-Tec, Inc., Highway 411 East, Sevierville, Tennessee 37862.

book review: *The Art of Electronics*

Many books are submitted to us for review, but here's one that deserves special attention. It's a 716-page, hard-bound volume entitled *The Art of Electronics*, written by Paul Horowitz and Winfield Hill. The publisher: Cambridge University Press, 32 East 57 Street, New York, New York 10022. (It is also available in the United Kingdom for overseas readers.)

We like this book. It is written for the newcomer as well as the advanced electronics enthusiast. The book covers the design of modern electronic circuits, without mathematics, in an easy-to-understand manner. Just a few of the subjects:

- Current sources and current mirrors
- Single-supply operational-amplifier design
- Operational-amplifier frequency compensation
- Active filters (with tables and graphs)
- Voltage references and regulators, including constant-current supplies

The book is both novel in its approach and, in many ways, unique in the topics treated. Much emphasis is placed on tabular data and circuit examples, so that you can understand circuit behavior and the limitations imposed by available components. Standard topics are discussed, as well as the more specialized techniques needed for the design and construction of high-frequency and low-noise, high-precision circuits.

The book provides a well-balanced introduction to modern electronics

NEW products

and we recommend it for study. For more information, write Cambridge University Press, 32 East 57th Street, New York, New York 10022.

portable digital multimeter

A new, hand held, 3½-digit LCD DMM has just been introduced by EICO Electronic Instrument Co., priced at $89.95 including fitted carrying case. The EICO 274 measures ac and dc volts, dc current, and resistance in 21 ranges.

It is a precision-crafted unit that features single-chip LSI logic, and automatic decimal point and overload protection. And you get up to 200 hours' operation from a single 9-volt transistor battery. The automatic LO BAT indicator warns you of the last 20 percent of battery life. The large, LCD readouts allow easy viewing, and accuracy is better than 0.8 percent. Input impedance is 10 megohms. The EICO 274 comes complete with 9-volt battery, test probes, spare fuse, and carrying case.

For further information contact EICO Electronic Instrument Co., Inc., 108 New South Road, Hickville, New York 11801.

packaging and breadboarding materials

A twelve-page brochure from Vector Electronic Company describes 109 professional electronic packaging and breadboarding products that are available, over-the-counter, from electronics and personal-computer-component stores throughout the United States and Canada. Highlighted are microcomputer interface boards, Vector Plugbords™, motherboards, cases, tools, wiring terminals, and kits. A complete price list is included. Write to Vector Electronic Company, Inc., 12460 Gladstone Avenue, Sylmar, California 91342.

HAM CALENDAR July

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
W1AW Schedule **April 26-October 25, 1981** UTC Slow Code Practice MWF: 0200, 1300, 2300; TThSSn: 2000; S: 0200 Fast Code Practice MWF: 2000; TTh: 0200, 1300; TThSSn: 2300; S: 0200 CW Bulletins Dy: 0000, 0300, 2100; MTWThF: 1400 Code practice and CW bulletin frequencies: 1.835, 3.58, 7.08, 14.08, 21.08, 28.08, 50.08, 147.555 MHz.			**WEST COAST QUALIFYING RUN 1** **CANADA CONTEST** — 001 to 2359 UTC **1** **1**	**NIAGARA PENINSULA ARC** — CJ3VM will be operated by club members on 80-10 meters. Special QSL cards available via POB 692, St. Catharines ON L2R 6Y3 **2-7** **2**	**3**	**RAC ANNUAL FIRECRACKER HAMFEST** — Shellsville VFW picnic grounds Harrisburg PA **4** **HANNIBAL AMATEUR RADIO CLUB INC** — National Tom Sawyer Days — Clifford Ahrens Hannibal ARC, 2108 Orchard Ave, Hannibal MO 63401 **4-5** **VENEZUELAN SSB CONTEST** — Starts 0000 GMT Sat. Ends 2400 GMT Sun. **4-5*** **4**
5	**WEST COAST BULLETIN** — 8PM PST (0400UTC) 3540 KCS, A-1 22WPM **6** **6**	**AMSAT** Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) **AMSAT** Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) **AMSAT** Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) **7**	**W1AW QUALIFYING RUN 8** **INTERNATIONAL CONVENTION** — Independent County Hunters Net & Mobile Amateur Radio Awards Club — Jim Dixen ICHN MARAC, RR5 Box 576, Norwalk IA 50211 **8-11** **8**	**9**	**10**	**IARU RADIOSPORT CHAMPIONSHIP 11-12*** **BLACK RIVER ARC** — Special Event Station K18Z — on or near 3.975, 7.275, 14.275, 21.375 & 28.375. Contact The National Blueberry Fest. POB 224, South Haven MI 49090 **11-19** **BURLINGTON ARC'S SEVENTH ANNUAL ONTARIO HAMFEST** — Milton Fairgrounds, south of intersection of Hwys 401 & 25, Burlington, ON — B.A.R.C. Box 832 Burlington ON L7R 3Y7 **11-13** **11**
WISCONSIN NETS ASSOCIATION ANNUAL PICNIC/HAMFEST — Gene Santoski K9UTQ **12** **GENESEE RADIO AMATEURS FIRST ANNUAL HAMFEST** — Alexander Firemen's Grounds, Route 98, Alexander NY — For info send SASE to GRAM Inc Box 572, Batavia NY 14020 **12** **BROADCASTER'S ARC FOURTH ANNUAL HAMFEST** — Pocono Downs Race Track, Rte 315, Wilkes-Barre PA — Charles Baltimore, 62 S Franklin St., Wilkes-Barre PA 18773 **12** **12**	**13**	**AMSAT** Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) **AMSAT** Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) **AMSAT** Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) **14**	**15**	**16**	**SWOT QSO PARTY 17-23** **17**	**NEW HAMPSHIRE FM ASSOCIATION** — Electronic flea market at Manchester Municipal Airport — Dick DeRosiers W1KGZ **18** **CARY ARC NINTH ANNUAL MID SUMMER SWAPFEST** Cary ARC, POB 53, Cary NC 27511 **18** **12TH ANNIVERSARY OPERATION NEIL ARMSTRONG** — Neil Armstrong Air & Space Museum Wapakoneta, OH — Gary Stolzenburg, 717 W Benton St, Wapakoneta OH 45895 **18-19*** **FORT WAYNE RADIO CLUB'S ANNUAL THREE RIVERS FEST** — special events certificate Robert Marshall, POB 15127, Fort Wayne IN 46885 **18-19** **18**
AGCW DL QRP CONTEST — **18-19*** **COLUMBIAN CONTEST** — **18-19*** **SEANET C.W. CONTEST** — **18-19*** **WEST JERSEY RADIO AMATEURS 3RD ANNUAL HAMFEST** — McGuire Air Force Base, Wrightstown NJ — for info contact WB2LCC **19** **STRAITS AREA ARC ANNUAL HAMFEST** — Harbor Springs H.S., Harbor Springs MI Bernie Slotnick, 630 Ann St., Harbor Springs MI 49740 **19** **TUSCE ARC & CANTON ARC'S SEVENTH ANNUAL HALL OF FAME HAMFEST** — Nimishillen Grange 6461 Easten St., Louisville OH — WA8SHP **19** **19**	**WEST COAST BULLETIN** — 8PM PST (0400UTC) 3540 KCS, A-1 22WPM **20** **20**	**AMSAT** Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) **AMSAT** Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) **AMSAT** Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) **21**	**W1AW QUALIFYING RUN 22** **22**	**23**	**MACKINAC RACE EVENT** — **24-26*** **WEST GULF DIVISION ARRL CONVENTION** — contact Central Oklahoma Radio Amateurs POB 20118, Oklahoma City OK 73120 **24-26** **24**	**4TH ANNUAL NOARSFEST** — ARRL approved — Lorain County Fairgrounds, Rte 58 on Rte 18, Lorain OH — contact NOARSFEST, POB 354, Lorain OH 44052 **25** **PENTICTON ARC'S OKANAGAN INTERNATIONAL HAMFEST** — Oliver Centennial Park, Oliver, BC Canada — contact John Anderson VE7DTX **25-26** **SHAWANO CENTENNIAL EXPO** — Franklin Middle School Radio Club — special event station — contact WA9BZW **25-26** **VENEZUELAN C.W. CONTEST** — **25-26*** **ARRL NATIONAL CONVENTION** — Seattle WA — contact W7OM **25-27** **COUNTY HUNTERS C.W. CONTEST** — **25-27*** **25**
AMATEUR RADIO PUBLIC SERVICE ASSOCIATION SWAP & SHOP — St. Joseph County Fairgrounds, M-86, Centerville, MI 49091 — **26** **MADISON COUNTY ARC HAMFEST** — National Guard Armory on 109 Bypass, Anderson IN Everett Riley, RR4 Box 354, Alexandria IN 46001 — **26** **26**	**27**	**AMSAT** Eastcoast Net 3850 kHz 9:00 PM EDST (0100Z Wednesday Morning) **AMSAT** Mid-Continent Net 3850 kHz 9:00 PM CDST (0200Z Wednesday Morning) **AMSAT** Westcoast Net 3850 kHz 8:00 PM PDST (0300Z Wednesday Morning) **28**	**29**	**30**	**MONTANA WIMU HAMFEST** — Yellowstone MT — contact N7AIK — **31** **31**	*See June CQ

flea market

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DEADLINE 15th of second preceding month.

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QSL CARDS

QSL's — BE PLEASANTLY SURPRISED! Order our three colored QSL's in all varieties for $8.00 per 100 or $13.00 for 200. Satisfaction guaranteed. Samples $1.00 (refundable). Constantine Press, 1219 Ellington, Myrtle Beach, SC 29577.

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500 QSL's, $10. Catalogue, 743 Harvard, St. Louis, MO 63130.

QSL'S: No stock designs! Your art or ours; photos, originals, 50¢ for samples & details (refundable). Certified Communications, 4138 So. Ferris, Fremont, Michigan 49412.

DISTINCTIVE QSL's — Largest selection, lowest prices, top quality photo and completely customized cards. Make your QSL's truly unique at the same cost as a standard card, and get a better return rate! Free samples, catalogue. Stamps appreciated. Stu Goodman, K2RPZ Print, P.O. Box 412, Rocky Point, NY 11778 (516) 744-6260.

CADILLAC OF QSL CARDS, 3 to 4 colors, send $1 for samples (Refundable). Mac's Shack, P.O. Box 43175, Seven Points, TX 75143.

PHOTO QSL's. Fluorescent QSL's. Distinctive "Victorian" QSL's. Stamp brings samples. A. Zanella, P.O. Box 4337, San Francisco, California 94101.

PICTURE QSL's — Quality photo and standard cards. Free samples and information. Planet Publishing, P.O. Box B, Martinsville, IL 62442.

COLLINS Mechanical filters for sale. Unused, in box. P/N 526 9522 001, 455 kHz IF, 6 kHz BW. $5.00 ea. Dave Wells, KD6TC, 3522 Boston Ave., Oakland, CA 94602.

VACKAR VFO KITS. Write Direct Conversion Technique, Box 1001, Dept. 7FM, 535 No. Michigan Ave., Chicago, Illinois 60611.

SEND S.A.S.E. for list of "hard to find" RTTY parts and supplies. H. Krakover, 459½ So. Palm Dr., Beverly Hills, CA 90212 or call Eddie (213) 274-4048.

RTTY JOURNAL-EXCLUSIVELY AMATEUR RADIOTELETYPE, one year subscription $7.00. Beginners RTTY Handbook $5.00, RTTY Index $1.50. P.O. Box RY, Cardiff, CA 92007.

SELL: Wilson System One, 5 element triband beam with BN-86 balun, $90.00. Factory rebuilt Ham III rotor w/60' cable, $90.00. DenTron 4v vertical w/50' RG8 and radials, $35.00. Swan WM-3000 wattmeter, $25.00. Turner 254-HC microphone, $20.00. Heath Cantenna w/oil, $10.00. Heath coax switch, $5.00. NØJC, 2257 West 232nd Street, Torrance, California 90501.

COMPLETE LINE OF MICROWAVE Television Converters and accessories to suit your needs. Converters have a one year warranty backed by a 3 year reputation. Call or write for complete specifications and pricing. Dealer Inquiries Invited. Triton Marketing, 1933 Rockaway Parkway, Brooklyn, N.Y. 11236 (212) 531-9004.

VOCOM POWER AMPLIFIERS. 2C025-2W, $75.00. 2 watts in, 25 watts out. VoCom telescopic antenna for 2 meters, 5/8 wave, $20.00. ELECTRONIC ACCESSORIES, CO., 2522 Westover Drive, Winston-Salem, NC 27103. 1-919-727-1777 after 6 p.m. All items shipped C.O.D. plus U.P.S. charge.

RADIO REPAIR: Fast, professional service by 1st phone. Jay Brown, WAØOJZ, Climax, Kansas 67207. (316) 583-6981.

RF POWER TRANSISTORS, most comprehensive line in U.S. Also TV, audio, radio, VTR transistors, IC's and diodes. Call 1-800-458-6053. VISA/MasterCard honored. B & D Enterprizes, P.O. Box 305, Kane, PA 16735.

CUSTOM EMBROIDERED EMBLEMS — Your design, low minimum. Informational booklet. Emblems, Dept 65, Littleton, New Hampshire 03561.

AZDEN PCS-3000 TT KITS assembled and mounted in the back of your mike. Send $25.00, your mike and TT kit to: NPS, 1138 Boxwood Rd., Jenkintown, PA 19046. Returned next day via FIRST CLASS MAIL.

PRINTED CIRCUIT BOARDS with running water! Technological breakthrough. Precise reproduction. Ideal for beginners. COVAL, Dept. HR6, 2706 Kirby, Champaign, Illinois 61820.

THE VHF SHOP — Authorized LUNAR Dealer — VHF/UHF Amplifiers, Preamps, Transverters, TAMA 432-450 Antennas, KLM Antennas, Coax relays, etc. Call or write for a quote — you won't be disappointed! MC/VISA accepted. K3MKZ Box 349, RD4, Mountaintop, PA 18707. (717) 868-6565.

RTTY CLOSEOUT: 50% off of all RTTY equipment listed on my January, 1981 list. Send S.A.S.E. for six-page list of Model 14, 15, 28, 33 and 35 Teletype equipment, parts and supplies. Lawrence R. Pfleger, K9WJB, 2600 S. 14th Street, St. Cloud, MN 56301. Phone (612) 255-9794.

HEATH — HR1680 $165, HS1661 Spkr. $20, HX1681 $210, PS23 $40, Cables, Manuals, All $400 — YOU SHIP — Chuck Lane, KAØIYE, 319-583-9432.

MANUALS for most ham gear made 1937/1970. Send $1.00 for 18 page "Manual List", postpaid. H.I., Inc., Box H864, Council Bluffs, Iowa 51502.

SELL: A-Tronix single-character code reader, two months old, excellent, $150.00, plus UPS, Richard Brock, 15806 Fernway Road, Shaker Heights, Ohio 44120. (216) 752-0355.

ATLAS DD6-C and 350XL Digital Dial/Frequency Counters. $175.00 plus $3.00 UPS. AFC! Stop VFO drift. See June 79 HR. $65.00 plus $3.00 UPS. Mical Devices, P. O. Box 343, Vista, CA 92083.

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Greenside, Johannesburg
Republic of South Africa

"HOT" General Coverage Receivers — Digital — Memory — Collins filters — Custom Modifications — Free Catalog! RADIO WEST, Dept. HR, 2015 S. Escondido Blvd., Escondido, CA 92025. 714-741-2891.

BUY-SELL-TRADE your computer, HAM, electronic equipment in COMPUTER TRADER. Send S.A.S.E. for details, Chet Lambert, W4WDR, 1704 Sam Drive, Birmingham, AL 35235.

FREE AD with subscription (limit 30 words)! Ham Buy, Sell, Trade, Want ADS, 12 issues, $3.00. WA4OSR's Rigs & Stuff™, Dept. H7, Box 973, Mobile, AL 36601.

490T ANTENNA TUNING UNIT WANTED for cash or trade. DCO, 10 Schuyler Avenue, No. Arlington, N.J. 07032 (800) 526-1270.

FOR SALE: Ten-Tec Model 200 VFO, built-in power supply, use with Drake 2-Nt, Heath HW-16, etc., transmitters $45.00. 417-537-8604 after 6:00 p.m. c.s.t. KAØGBS, Cecil Weinstein, Box 52, Golden City, MO 64748.

SSTV-KEYBOARD, P7 monitor, fast-slow converter, slow-fast converter. W1ZX/3. (301) 645-5584.

CALIBRATE voltmeters, scopes, computer A/D's, etc. Model DCS-1 Laboratory Voltage Standard; nominal 1.230 volts output is calibrated, accurate and stable to ± 1 millivolt. $35 complete including shipping on prepaid orders (California residents please include $2.10 tax). CAL-MET Co., Dept. HR-1, 323½ Richmond St., #134, El Segundo, CA 90245.

WANTED: Help in completing the largest collection of Hallicrafter equipment in the world. Urgently needed are receivers with aluminum colored panels, back lighted plastic dials with "airplane" hands, early transmitters, unusual accessories, etc. Chuck Dachis, WD5EOG, "The Hallicrafter Collector," 4500 Russell Drive, Austin, Texas 78745.

WANTED: Hammarlund HQ-100 Receivers, Prime Condition. Send description and price: Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310.

TUBES, TUBES wanted for cash or trade: 340TL, 4CX1000, 5CX1500. Any high power or special purpose tubes of Eimac/Varian. DCO, 10 Schuyler Avenue, No. Arlington, N.J. 07032 (800) 526-1270.

COLLINS 51S-1, 312B-4 for sale. Excellent condition. W5KX, 1732 Willow Point, Shreveport, LA 71119.

RECIPROCATING DETECTOR Construction Handbook. $10 ppd. Peters Publications, P.O. Box 62, Lincoln, MA 01773.

KENWOOD R820 Receiver, filters, TS820S wired to work with this R820, SP820 filter speaker and SM220 with BS-8 scoop. No dents or marks, mint condition, manuals and boxes. Package $2000. HT 207R, extra batteries, case, charger and speaker mic. As new $275. Heath dual meter HM2140 $60. W2PD (516) 541-2342.

DIRECT CONVERSION RECEIVER KITS. Write Direct Conversion Technique, Box 1001, Dept. 7FM, 535 No. Michigan Ave., Chicago, Illinois 60611.

QUALITY PRINTED CIRCUIT BOARDS mean trouble-free projects. Catalog of over 600 popular boards, $1.50 postpaid. Dynaclad Industries, P.O. Box 296, Meadowlands, PA 15347.

ELECTRONIC BARGAINS, CLOSEOUTS, SURPLUS! Parts, equipment, stereo, industrial, educational. Amazing values! Fascinating items unavailable in stores or catalogs anywhere. Unusual FREE catalog. ETCO-012, Box 762, Plattsburgh, NY 12901. SURPLUS WANTED.

KEYER PADDLES, iambic, more features, better action. Kits available. $15.00 up. Write Earl Snyder, 213 W. Davis, Sapulpa, OK 74066.

MOBILE IGNITION SHIELDING provides more range with no noise. Available most engines. Many other suppression accessories. Literature, Estes Engineering, 930 Marine Dr., Port Angeles, WA 98362.

WANTED: Government Surplus radar equipment, microwave equipment and "old" General Radio test equipment. P. J. Plishner, 2 Lake Avenue Extension, Danbury, CT 06810 WA1LDU.

SALE: HW-16, $120.00 — wanted keyer, power meter, 1-50 MHz receiver, KA4EBW.

POWERMATE PX REGULATED SUPPLY: 9.5 Amp, adjustable to 13 Volts for excellent base station or service application, $59.00. High grade industrial construction and performance. Call for specs. Hank Riley, 408 County Street, New Bedford, MA 02740. (617) 994-3487.

ETCH IT YOURSELF PRINTED CIRCUIT KIT, Photo-Positive Method — No darkroom required. All the supplies for making your own boards, direct from magazine article in less than 2 hours. Only $24.95, S.A.S.E. for details: Excel Circuits Co., 4412 Fernlee, Royal Oak, MI 48073.

DIGITAL SOLID-STATE Yaesu FT-301D Transceiver, F.P.-301 P.S., FV-301 VFO, YD-844 Mike, E.R.B., $750. Excellent Johnson 10-M. C.B. Conversion with P.S., $100. N7ACB, (208) 788-4540, Idaho.

RUBBER STAMPS: 3 lines, $3.25 ppd. Send check or M.O. to G.L. Pierce, 5521 Birkdale Way, San Diego, CA 92117. S.A.S.E. brings information.

HAM RADIO REPAIR — Professional lab, personal service. "Grid" Gridley, W4GJO. April thru October: Rt. 2, Box 138B, Rising Fawn, Georgia 30738. (404) 657-7841. November thru March: 212 Martin Drive, Brooksville, Florida 33512. (904) 799-2769.

SELL: Midland 220 MHF FM transceiver model #13-509. $100.00. WB6NOM, (415) 278-0177, P.O. Box 546, Hayward, CA 94543.

MIRROR-IN-THE-LID, and other pre-1946 television set wanted. Paying 500+ for any complete RCA "TRK" series, or General Electric "HM" series set. Also looking for 12AP4, MW-31-3 picture tubes, parts, literature on pre-war television. Arnold Chase, WA1RYZ, 9 Rushleigh Road, West Hartford, Conn. 06117 (203) 521-5280.

WANTED: R-278B, T-217A, & MD-129A:/GR (GRC-27 units) unit enclosures. C.T. Huth, 146 Schenhardt St., Tiffin, OH 44883.

AMATEUR REPAIR: Professional service, reasonable rates, ALL BRANDS. USA KDK repair center. Amateur Radio Repair Center of I.E.C., Inc., 1020 Brookstown Ave., #5, Winston-Salem, NC 27101 (919) 725-7500.

MUSEUM for radio historians and collectors now open. Free admission. Old amateur (W2AN) and commercial station exhibits, 1925 store and telegraph displays. 15,000 items. Write for details. Antique Wireless Assn., Holcomb, NY 14469.

WANTED: AN-MS connectors, synchros, etc. Send list, Bill Williams, P.O. 7057, Norfolk, Virginia 23509.

WANTED: Micor and Master II base stations, 406-420 MHz. Any solid state 2 and 6 GHz microwave equipment, AK7B, 4 Ajax Place, Berkeley, CA 94708.

PROM PROGRAMMING, CW-IDers, repeater controllers. S.A.S.E. catalog. W-S Engineering, P.O.B. 58, Pine Hill, NJ 08021.

RIT, DIGITAL READOUT, BEZEL KIT (HW-101) and WWV Kit for HW-101, SB-102, SB-303 and SB-401. Adaptable to other models and brands. Free info. Protronics, Inc., 20 Monte Vista, Buckley, WA 98321. (206) 829-0056.

CRYSTALS FM 2 METERS STILL AVAILABLE! Crystals for equipment on our parts list, $4.50 each. For equipment list, send self addressed stamped envelope. SAVOY ELECTRONICS, P.O. Box 5727, Ft. Lauderdale, FL 33310 — Tel. (305) 563-1333.

SUPER QRP with Direct Conversion's 5 watt transmitter kits. Write Direct Conversion Technique, Box 1001, Dept. 7FM, 535 No. Michigan Ave., Chicago, Illinois 60611.

WANTED: Motorola micor base stations. 406-420 MHz. AK7B, 4 Ajax Pl., Berkeley, CA 94708.

SATELLITE TELEVISION...HOWARD/COLEMAN boards to build your own receiver. For more information write: Robert Coleman, Rt. 3, Box 58-AHR, Travelers Rest, SC 29690.

HELP! English Amateur desperately needs 1975 fully bound "Ham Radio" to complete library collection. Any reasonable price paid and shipping arranged. Mr. Trevor Campbell Davis, McGraw-Hill Book Co., Ltd., Shoppenhangers Rd., Maiden Head, Berkshire SL6 2QL UK (684) 23431.

MAKE HAM RADIO FUN! Supplement your learning programs with a motivational hypnosis cassette. Tape #3, Learning the Code; Tape #4, Breaking the Speed Barrier; Tape #7, Electronic Theory. Free catalog. For tapes, $10.95 each to Gem Publishing, 3306 North 6th St., Coeur d-Alene, ID 83814.

VERY in-ter-est-ing! Next 5 issues $2. Ham Trader "Yellow Sheets", POB356, Wheaton, IL 60187.

CB TO 10 METER PROFESSIONALS: Your rig or buy ours — AM/SSB/CW. Certified Communications, 4138 So. Ferris, Fremont, Michigan 49412; (616) 924-4561.

NEED HELP for your Novice or General ticket? Recorded audio-visual theory instruction. No electronic background required. Free information. Amateur License, P.O. Box 6015, Norfolk, VA 23508.

CB TO 10-METER CONVERSIONS. SSB/AM/CW. Let a specialist convert your rig, or buy one complete. Write

Conversion Engineering, Box 183, Sandwich, Massachusetts 02563.

CASH for December 1915 to June 1920 QST's for personal collection. Kenn Miller, K6IR, 16904 George Washington, Rockville, Maryland 20853 (301) 774-7709.

HAMS FOR CHRIST — Reach other Hams with a Gospel Tract sure to please. Clyde Stanfield, WA6HEG, 1570 N. Albright, Upland, CA 91786.

FREE SAMPLE Ham Radio Insider Newsletter! Send large S.A.S.E.. W5YI, Box #10101-H, Dallas, Texas 75207.

MAGAZINE SAMPLES! For a free list of over 135 magazines offering a sample copy, send a stamped, addressed envelope to: Publisher's Exchange, P.O. Box 1368, Dept. 26A, Plainfield, NJ 07061.

MOBILE ANTENNAS 30-50 MHz. Baseloaded hole mount. Four ranges. First quality by Avanti. $15.00 prepaid. H. C. Van Valzah, 1140 Hickory Trail, Downers Grove, IL 60515 (312) 852-0472.

BUY-SELL-TRADE Send $1.00 for catalog. Give name address and call letters. Complete stock of major brands new and reconditioned amateur radio equipment. Call for best deals. We buy Collins, Drake, Swan, etc. Associated Radio, 8012 Conser, Overland Park, KS 66204. (913) 381-5900.

Coming Events
ACTIVITIES
"Places to go..."

ILLINOIS: Radio Expo '81 sponsored by the Chicago FM Club will be held, rain or shine, on September 19th and 20th at the Lake County Fair Grounds, routes 45 and 120 in Grayslake. Grayslake is 30 minutes north of Chicago and 45 minutes south of Milwaukee. This year we will have a super large flea market with plenty of indoor and outdoor space, free with a gate ticket. Just bring your own table and chair or tailgate it. Parking is free. We will also have new camping sites complete with power hookups. There will be Ham seminars both Saturday and Sunday. YL's have a ladies program and door prizes both days. Only the best manufacturers of Ham and computer equipment and their distributors will be at our huge display building for you to meet and buy from. As in the past, Expo will be giving out thousands of dollars worth of prizes and admission tickets are good for both days. For advanced registration, send $3.00 per person and a #10 S.A.S.E. to Radio Expo Tickets, P.O. Box 1532, Evanston, Illinois. Tickets at the gate are $4.00 each. Kids under seven are free. For more information call (312) BST-EXPO. Talk-in on 146.16/.76, 146.52, and 222.5/224.10.

SOUTHERN ILLINOIS: Shawnee Amateur Radio Association's 25th anniversity Silver Jubilee Hamfest will be August 30 at JOHN A. LOGAN College in Cartersville, Illinois. Offerings include Air Conditioned Flea Market — Prizes — Forums — Computers — Food — Refreshments — Contests. For details QSL Bill May, KB9QY, 800 Hilldale, Herrin, IL 62948 or (618) 942-2511 days.

ILLINOIS: The Belvidere Hamfest on August 2nd, rain or shine, at the Boone County Fairgrounds, Hwy. 76. Camping available. Will be held rain or shine. Indoor facilities available with tables at a nominal charge. Contact Bob Anderson, 910 W. Locust St., Belvidere, Illinois 61008 for advance tickets at $2.00 (S.A.S.E. please) or telephone at (815) 544-3215.

INDIANA: The Madison County A.R.C.'s MCARC Hamfes' on July 26th starting at 8:00 A.M. at the National Guard Armory on the Rt. 109 bypass in Anderson. Dealers set up at 7:00. Advanced tickets: $2.50. Vendor spaces without tables: $1.75 and w/tables: $2.50. Admission at the door: $3.50. Door prizes and more. Talk-in on 146.22 and 146.52 simplex. Advanced tickets and space contact: Everett G. Riley, RR #4, Box 354, Alexandria, IN 46001.

INDIANA: The Steuben County Radio Amateurs present the 23rd annual Crooked Lake FM Picnic and Hamfest in Angola, Indiana on August 2nd.

INDIANA: The annual LaPorte County Hamfest, sponsored by the LaPorte and Michigan City A.R.C.'s will be held, rain or shine, on August 30th at the County Fairgrounds on Highway 2, west of LaPorte (50 miles S.E. of Chicago). Overnight trailer parking available. Paved flea market area. Indoor tables are $1.00. Satellite TV demonstration. Advanced tickets $2.00 with S.A.S.E. to P.O. Box 30, LaPorte, Indiana 46350.

KANSAS: The Northwest Kansas first Amateur Radio Swap Meet on August 2nd at the Community Building, Colby, Kansas starting at 9:00. Auction at 2:00. Admission: $1.00, tables: $1.00 each (same for dealers). Talk-in on 146.22/.82 and .52/.52. No speeches, meetings, etc., just old fashioned swapping, selling and visiting. XYL activities. TVRO demonstration. Lunch available. Sponsored by Trojan A.R.C. Contact WAØGBN or KAØFBQ for more information.

MICHIGAN: The 33rd annual Upper Peninsula Hamfest sponsored by the Delta County Repeater Association on August 1st and 2nd in Escanaba at the Flat Rock Township Hall. Registration: $2.00. DX forum, ARPSC workshop, satellite-TV seminar, slow scan, net meetings and swap & shop. Many prizes and banquet. More info: Aileen Gagnon, WA8DHB, Kipling Loc., Mtd. Rte., Gladstone, Michigan 49837.

MICHIGAN: The Amateur Radio Public Service will hold a swap and shop on July 26th at the St. Joseph County Fair Grounds, M-86, in Centerville. Admission: $2.00. Tables: $3.00. Gates open at 7:00. Talk-in on 146.52 simplex.

MISSOURI: The third annual Northcentral Missouri Hamfest on August 2nd in Moberly at the air conditioned Municipal Auditorium. Doors open at 9:00. Tickets: $1.50 advanced and $2.00 at the door. Commercial dealers & flea market (no charge for tables). ARRL display, exhibits, prizes, women's activities, and a special forum featuring Bob Heil, K9EID, on CB to ten meter conversions. Buffet lunch plus more. Talk-in on 147.69/.09 and 3963. More info: Charles Coy, WBØENV, 601 McKinley, Moberly, Missouri 65270.

NEW HAMPSHIRE: Fly-in to New Hampshire's 3rd largest electronic flea market on July 18th at the Manchester Municipal Airport starting at 9:00. Sponsored by the New Hampshire FM Association. Admission: 50¢; Dealers: $2.00. Sellers should bring their own table or tailgate. Commercial displays welcome. Refreshments and door prizes. Talk-in on 146.52 FM and 124.9 AM. More info: Dick DesRosiers, W1KGZ, (603) 668-8880 or Doug Aiken, K1WPM, 30 Meadowglen Dr., Manchester, NH 03103. (603) 622-0831.

NEW JERSEY: The 3rd annual West Jersey Radio Amateurs hamfest on July 19th at McGuire A.F.B. in Wrightson. Admission: $2.50. Starts at 9:00. Table spaces and outdoor tailgating: $2.50. Bring your own tables. Contests, films, refreshments and more. Prizes every 15 minutes. Talk-in on 146.52 simplex and 147.15 and 145.47 repeat. Advanced tickets or info: Bill Luebkemann, WB2LCC, 116 Country Farm Rd., Box 140, Marlton, NJ 08053. (609) 983-8844 daily 6 p.m. until midnight. S.A.S.E. appreciated.

NEW JERSEY: The Gloucester County A.R.C.'s G.C.A.R.C. Hamfest on August 30th at the Gloucester County College, Tanyard Road in Sewell from 8:00 to 3:00. Admission: $2.00 advanced and $2.50 at the door. Tailgaters and dealers: $6.00 (includes one free admission). Speakers, seminars, prizes and contests. Free parking, handicapped parking, food and beverages. F.C.C. exams will be given for Tech through Advanced. Please write or call for details. Dealers set-up at 7:00. Talk-in on 146.52 and 147.78/.18. Info and reservations: S.A.S.E. to G.C.A.R.C. Hamfest Committee, P.O. Box 370, Pitman, NJ 08071. Telephone day: (609) 456-0500 or (609) 338-4841. Evening: (609) 629-2064.

PENNSYLVANIA: Philadelphia's Mid-Atlantic A.R.C.'s annual J.B.M. Hamfest on August 9th at the Budco 309 Drive-in Theatre, Montgomeryville (¼ mile north of the intersection of Route 63 and Route 309 and 6 miles north of the Fort Washington Interchange of the Pennsylvania Turnpike). Starts: 9:00 rain or shine. Hamfest will be combined with the Alternate Energy Fair. Major door prizes, refreshments, exhibits, flea market and more. Energy fair will include educational and commercial Alternative Energy Exhibitors featuring solar heating, building design, an energy devices flea market, alternative energy door prizes and much more. Admission: $2.50. Tailgaters: $1.00 for one space and 75¢ for every space after one. Talk-in on club repeater, WB3JOE, 147.66/.06 or 146.52 simplex. More info call Don Schuenemann, WB3AYT, (215) 822-9076.

TENNESSEE: The Radio Amateur Transmitting Society's (RATS) Nashville Hamfest on July 26th at the National Guard Armory, Sidco Dr., Nashville. Starts: 8:00. Admission: $2.00. Tables: $5.00 each. Refreshments available. Talk-in on .90/.30. More info: RATS, P.O. Box 2892, Nashville, Tennessee 37219.

VERMONT: The Burlington A.R.C.'s annual International Hamfest on August 8th and 9th at the Old Lantern Campground in Charlotte (14 miles south of Burlington, just off Route 7). Admission: $4.00 (U.S. funds). Flea market, commercial exhibits, CW contest, tower raising contest, HT transmitter hunt and the traditional Canadian-American tug of war. Talk-in on .34/.94. More info: Hap Preston, W1VSA, P.O. Box 312, Burlington, Vermont 05402. Campground reservations: 1-802-425-2120 (Old Lantern Campground, Charlotte).

WASHINGTON: The Radio Club of Tacoma's annual Hamfair on August 15th and 16th at the Pacific Lutheran

University in Tacoma. Many outdoor technical seminars, games, contests, large flea market, commercial displays dinner, entertainment, door prizes, trailer parking, lodging and much more. For details on the largest ARRL sanctioned hamfest in the Northwest contact: Eva Anderson, WB7QNS, 517 Berkeley Ave. West, Tacoma, Washington 98466 or call (206) 564-8347.

CANADA: The Burlington A.R.C.'s seventh annual Ontario Hamfest on July 11th - 13th at the Milton Fairgrounds (south of the intersection of Hwys. 401 and 25, exit 39) in Burlington. Admission: $3.00 at the gate and $2.00 in advance (before June 15th). Gates open at noon on Friday and 7:00 on Saturday. Flea Market opens at 8:00. Tables free. Camping, food and lots of prizes. Talk-in on 147.81/.21. More info: B.A.R.C., Box 836, Burlington, Ontario, L7R 3Y7.

OPERATING EVENTS

"Things to do..."

MAY 30th - SEPTEMBER 6th: The Parma Radio Club will once again be operating from the WWII submarine, USS Cod using the club call, K8UZW. Operations will run every weekend (except the Field Day weekend) through September 6th. An attractive certificate will be awarded for 2-way contacts from the ship upon receipt of a QSL and 30¢ to cover postage. All bands will be operated, 10 to 80, band conditions will determine band of major activity. Send QSL's to: WD8RZG. Info: Don Winner, WD8RZG, 8927 Torrance Ave., Brooklyn, OH 44144.

JULY 2nd - 7th: CJ3VM will be operated by members of the Niagara Peninsula ARC from July 2-7/81, for the special anniversary celebrating the bi-centennial of Niagara-on-the-Lake, Ontario, and the bi-centennial Boy Scout Camporee. Operation will be on 80-10 meters. Special QSL cards will be available via P.O. Box 692, St. Catharines, Ontario. L2R 6Y3.

JULY 17th - 23rd: SWOT (Side-Winders-on-Two) is holding its fourth annual QSO party. Begins at 0000 UTC on the 17th and ends 2359 UTC on the 23rd. No restrictions on number of hours operated. Must exchange Call signs, Geographic location and SWOT members must include SWOT number. Must use CW or SSM mode and contacts must be made direct without the aid of satellites, etc. No logs should be submitted unless requested. Summary must be sent postmarked no later than August 21st. More info or summary: S.A.S.E. to Dean Figgins, WA7EPU, P.O. Box 1141, Carefree, AZ 85377.

JULY 18th and 19th: The Neil Armstrong Air and Space Museum in Wapakoneta, Ohio is the operating place for the 12th anniversary commemorating Neil Armstrong's historic first walk on the moon. Wapakoneta is the hometown of Neil Armstrong. Hours: 9:00 AM on the 18th to 8:00 PM on the 19th local time. Two station on following frequencies depending on propagation conditions. 40M-CW: 7.075-7.125 (to help novices). 40M-Phone: 7.250-7.300. 75M-Phone: 3.950-4.000. 20M-CW: 14.1 ± 1 kHz. 20M-Phone: 14.300-14.350. 15M-Phone: 21.400-21.450. All frequencies may not be used, but we will operate as many as possible. WD8RVZ will be used. Commemorative QSL available with S.A.S.E. U.S. and Canadian QSL direct to WD8RVZ. All others, please use bureau. Visiting amateurs may check in on 147.93/.33, Wapakoneta DSA repeater.

JULY 25th: Buffalo, Wyoming Amateurs in cooperation with the Sheridan A.R.C. will operate SSB on or about 14.280 & 21.360 MHz under the call W7GUX. The station will be operated in honor of and during the Johnson County Centennial Celebration. Certificates will be awarded to all contacts that mail S.A.S.E. to: 7BVX, Bob Glenn, P.O. Box 383, Buffalo, Wyoming 82834.

JULY 25th and 26th: The Franklin Middle School Radio Club and Shawano area amateurs will operate a special event station from the Shawano County Fairgrounds in conjunction with the exposition honoring various Shawano groups for either 100 or 50 years of service. Hours: From 1800 UTC on the 25th to 1700 UTC on the 26th during times the bands are open. Frequencies plus or minus QRM: 3980, 7280, 14280, 21580, and 28580 as well as 146.52 for those in the area. QSL with business size S.A.S.E. and 25¢ for certificate or we'll be happy to exchange QSL cards with you. For certificates, cards, or further information: Al Hovey, Jr., WA9BZW, 314 Fairview Way, Shawano, WI 54166.

AUGUST 1st - 2nd: The nineteenth annual Illinois QSO Party from 1800Z August 1st to 2300Z August 2nd with a rest period from 0500Z to 1200Z on the 2nd. All bands, CW and Phone will be used. No repeater contacts allowed. Any frequency will be used, but look for activity about 60 kHz from low end on CW, about 3975, 7275, 14275, 21375 and 28675 on Phone and about 25 kHz from low end of each Novice band, especially on the hour and half hour. Exchange RST and county by Illinois stations and RST, state, province and/or country by others. Certificates awarded to the top three Illinois scorers in single-op, multi-op, multi-multi, portable out of home county, mobile, Novice, and CW Tech. More info, S.A.S.E. to: RAMS/K9CJU, 3620 N. Oleander Ave., Chicago, IL 60634.

AUGUST 8th: The Radio Central A.R.C.'s unusual 24 hour mini-expedition to Little Gulf Island commencing August 8th at 1600Z to August 9th 1600Z. Call sign will be WA2UEC. Little Gulf Island is a small island in Long Island Sound about 15 miles northeast of Orient Point. Operations will be on the lower portions of the General bands, 10 to 80 meters, both CW and SSB. There will also be a Novice station operation. A photo QSL card will supply all information about the trip. Please QSL via callbook WA2UEC with S.A.S.E., the W2 Bureau or IRC's. This will be the first of a series of mini-expeditions.

AUGUST 15th - 17th: The Englewood A.R.A.'s 22nd annual New Jersey QSO Party starting 2000 UTC the 15th to 0700 UTC August 16th and from 1300 UTC the 16th to 0200 UTC the 17th. Phone and CW considered the same contest. General call is "CQ New Jersey" or "CQ NJ." New Jersey stations are requested to identify themselves by signing, "DE NJ" on CW or "New Jersey calling" on phone. Suggested frequencies are: 1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50-50.5, and 144-146. Phone activities on even hours, 15 meters on odd hours, (1500 to 2100 UTC) 160 meters at 0500 UTC. Exchange QSO number, RST, and QTH. Certificates awarded to first place station in each NJ county, ARRL section, and country. Novice and Tech certificates also awarded. More info S.A.S.E. to E.A.R.A., P.O. Box 528, Englewood, NJ 07631.

AUGUST 22nd - 23rd: The Ohio QSO Party from 0000Z on the 22nd to 2400Z on the 23rd. All dates and times are UTC. Contest open to all Amateurs world wide on any amateur band from 160 to and including 2 meters. Exchange RST and your QTH. Frequencies: 5 kHz up from the low end of each General band, both on SSB and CW. Club will operate near these frequencies using W8VPV. Plaques for top single operator in Ohio and outside Ohio. Certificates to the top single operator, multi-single, and multi-multi in each ARRL section, county (Ohio) and DXCC country. More info S.A.S.E. to The Cuyahoga Falls A.R.C., P.O. Box 6, Cuyahoga Falls, Ohio 44222.

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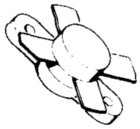

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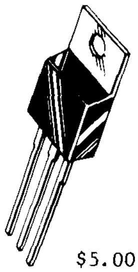

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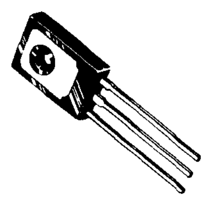

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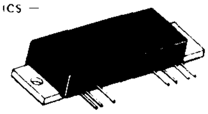

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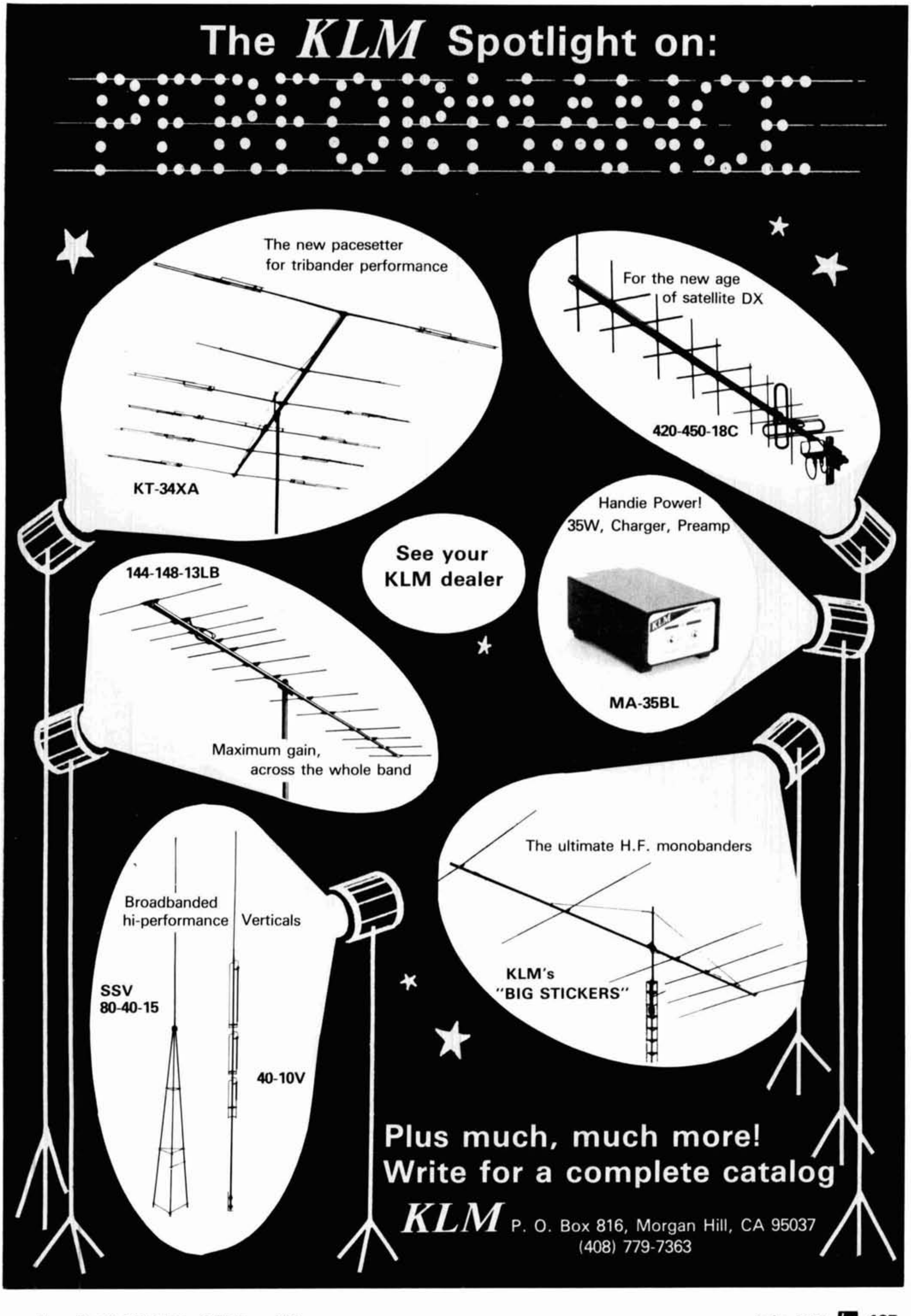
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THE EVOLUTION OF A CHAMPION!

FT-101ZD Mk III

The FT-101ZD Mk III is the latest chapter in the success story of the FT-101 line. Armed with new audio filtering for even better selectivity, the FT-101ZD now includes provision for an optional FM or AM unit. Compare features and you'll see why active operators everywhere are upgrading to Yaesu!

Variable IF Bandwidth
Using two 8-pole filters in the IF, Yaesu's pioneering variable bandwidth system provides continuous control over the width of the IF passband — from 2.4 kHz down to 300 Hz — without the shortcomings of single-filter IF shift schemes. No need to buy separate filters for 1.8 kHz, 1.5 kHz, etc.

Improved Receiver Selectivity
New on the FT-101ZD Mk III is a high-performance audio peak/notch filter. Use the peak filter for single-signal CW reception, or choose the notch filter for nulling out annoying carriers or interfering CW signals. In the CW mode, you can choose between the 2.4 kHz SSB filter and an optional CW filter (600 or 350 Hz) from the mode switch.

Diode Ring Front End
The FT-101ZD now sports a high-level diode ring mixer in the front end. This type of mixer, well known for its strong signal performance, is your assurance of maximum protection from intermod problems on today's crowded bands.

WARC Bands Factory Installed
The FT-101ZD Mk III comes equipped with factory installation of the new 10, 18, and 24 MHz bands recently assigned to the Amateur Service at WARC. In the meantime, use the 10 MHz band for monitoring of WWV!

RF Speech Processor
Not an additional-cost option, the FT-101ZD RF speech processor provides a significant increase in average SSB power output, for added punch in those heavy DX pile-ups. The optimum processor level is easily set via a front panel control.

Worldwide Power Capability
Every FT-101ZD comes equipped with a multi-tap power transformer, which can be easily modified from the stock 117 VAC to 100/110/200/220/234 VAC in minutes. A DC-DC converter is available as an option for mobile or battery operation.

Convenience Features
Designed fundamentally as a high-performance SSB and CW transceiver, the FT-101ZD includes built-in VOX, CW sidetone, semi-break-in T/R control on CW, slow-fast-off AGC selection, level controls for the noise blanker and speech processor, and offset tuning for both transmit and receive. The Mk III optional FM unit may be used for 10 meter FM operation, or choose the optional AM unit for WWV reception or VHF AM work through a transverter (AM and FM units may not both be installed in a single transceiver).

Full Line of Accessories
See your Yaesu dealer for a demonstration of the top performance accessories for the FT-101ZD, such as the FV-101Z External VFO, SP-901P Speaker/Patch, YR-901 CW/RTTY Reader, FC-902 Antenna Tuner, and the FTV-901R VHF/UHF Transverter. Watch for the upcoming FV-101DM Digital Memory VFO, with keyboard frequency entry and scanning in 10 Hz steps!

Nationwide Service Network
During the warranty period, the Authorized Yaesu Dealer from whom you purchased your equipment provides prompt attention to your warranty needs. For long-term servicing after the warranty period, Yaesu is proud to maintain two fully-equipped service centers, one in Cincinnati for our Eastern customers and one in the Los Angeles area for those on the West Coast.

Note: A limited quantity of the earlier FT-101ZD (with AM as standard feature) is still available. See your Yaesu dealer. FT-101ZD Mk III designates transceivers bearing serial #240001 and up, with APF/Notch filter built in and AM/FM units optional.

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