$1.00
AUGUST 1974

73 magazine
for radio amateurs

THE SCAN CONVERTER
SSTV with ANY TV camera

a new slow scan BREAKTHROUGH

Other Features . . .

CLASS X LINEARS . . .
450 MHz FETs . . .
R–390 & R–392 MODS . . .
SWR METER YOU CAN BUILD . . .
UNIVERSAL POWER SUPPLY . . .

new

HUSTLER®

the real performer! specifically for repeater

...or any TWO-METER FIXED STATION OPERATION

With **6** db—
db—

—Gain compared to ½ wave dipole
—FCC accepted for repeater application

mechanical

Vertical element—117" long, 1-1/8" telescopic to 3/8" OD high strength aluminum

Radials—four, 21" x 3/16" OD aluminum rod

Connector—SO-239

Wind load—26 pounds at 100 mph.

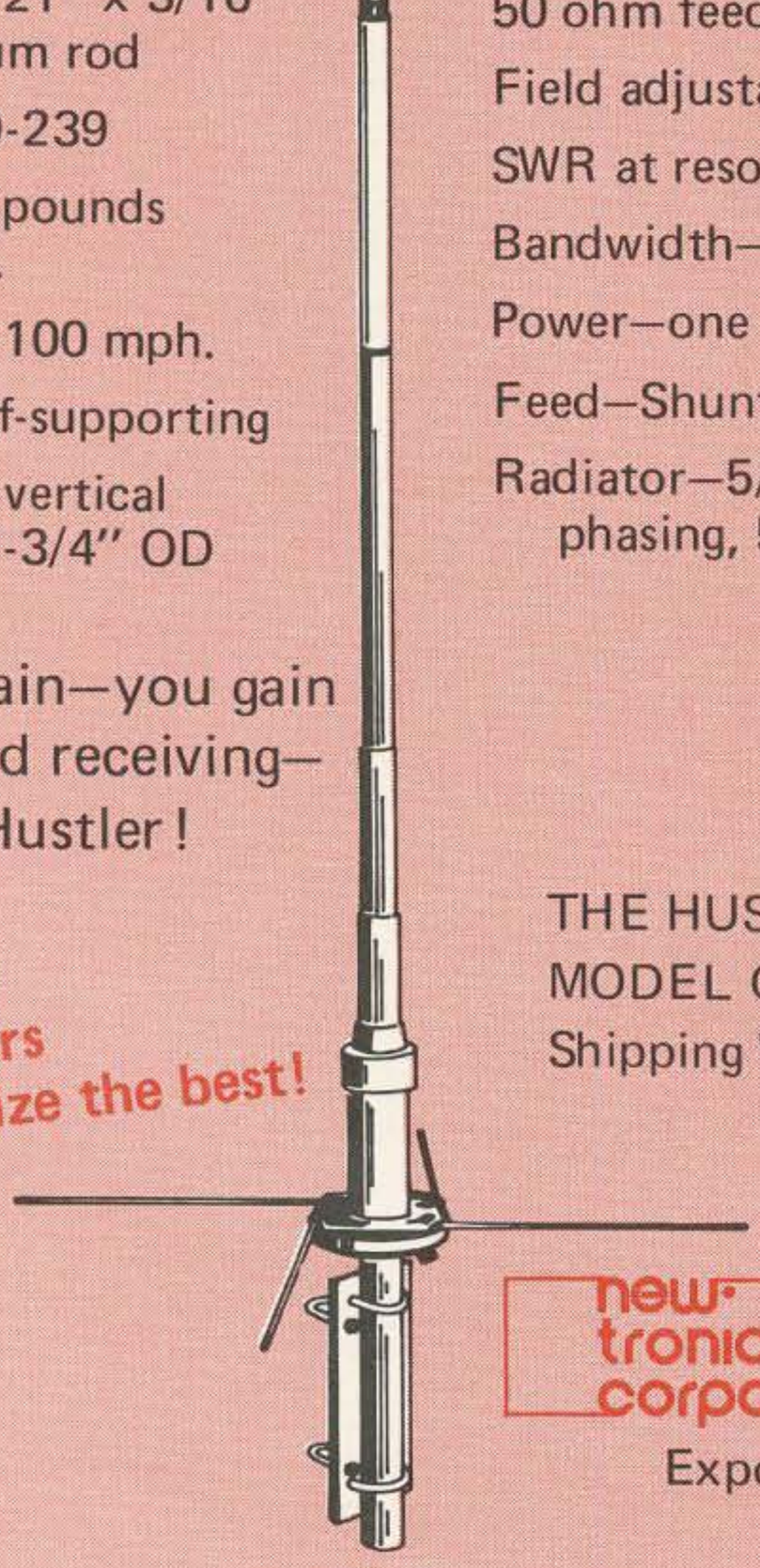
Wind survival—100 mph.

Completely self-supporting

Mounting—fits vertical pipe up to 1-3/4" OD

The gain you gain—you gain transmitting and receiving—get both with Hustler!

Available from all distributors who recognize the best!



electrical

6 db. gain over ½ wave dipole

Omnidirectional radiation pattern

Maximum radiation—at horizon

50 ohm feed impedance

Field adjustable—140-150 MHz

SWR at resonance—1.2:1 measured at antenna

Bandwidth—6 MHz for 2:1 or better SWR

Power—one kilowatt FM

Feed—Shunt with D.C. grounding

Radiator—5/8 wave lower section, ¼ wave phasing, 5/8 wave upper section

THE HUSTLER MASTER GAINER
MODEL G6-144-A
Shipping Wt.: 6.8 lbs. Price: $52.95

new-tronics corporation
15800 commerce park drive,
brook park, ohio 44142

Exporter: Roburn Agencies, Inc.,
New York, N.Y.

73 magazine
for radio amateurs

167 AUGUST 1974

FEATURES

CONTENTS

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $7 for one year in North America and U.S. Zip Code areas overseas, $8 per year elsewhere. Two years $12 and $13 overseas. Three years, $15, and $16 overseas. Second class postage paid at Peterborough, New Hampshire 03458. Phone: During office hours 603-924-3873, other times there is a tape recorder for messages on 603-924-3883. Microfilm edition of 73 available from University Microfilms, Ann Arbor MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

MORE IRS?

Several readers have suggested that 73 is not the best place for information about the IRS. I agree – completely. But, unfortunately, the publications that should be publishing this information are afraid to do it and the sad fact is that outside of 73 the chances are that you won't find much information available. Even big multimillion-dollar Playboy seems afraid of the IRS.

The complaining readers have been few and far between compared to those demanding more on the IRS scandal, so we'll give a little more. We're getting the inside dope on the ways many people are successfully not paying any taxes at all and you may be sure we'll pass them along when we know they are good.

Many readers have been sending in newspaper clippings of IRS harrassments and some are bad enough to warrant some space here – such as the recent story about the 71 year old widow in Fort Worth. Her husband had been broken by the IRS, who was sure that he had hidden some money and persecuted him for over twenty years. The IRS hauled him into court with a charge of tax evasion. He didn't want to plead guilty since he had done nothing wrong, but his lawyer convinced him it would be the best thing to do, just to settle the case. He had started as a day worker and built up to owning the Maxwell Steel Company. The IRS took everything he had, some $189,000 in stock, cash, property and life insurance of $168,000 plus 50% fraud penalty claim by the IRS. Maxwell, crushed, died, leaving his widow with nothing but the house she was living in and her Social Security pension – which the IRS informed her they could confiscate. The IRS is in the process of selling the house and may take her pension. The widow can never have a dime of her own and will live under the tax claim until she dies.

Perhaps it really is time for a tax reform which would get rid of the IRS.

ADVISORY COMMITTEE?

The hearing held in January made such an impression on the Commission that there has been increasing pressure for some sort of standing ham committee which could work with the FCC on the formulation of amateur rules and policy. The radio industry has several of these committees and the FCC finds them most helpful.

An advisory committee must meet certain FCC standards such as its chairman is normally an FCC official – the committee must have an organization structure, regular or periodic meetings and a fixed membership. The membership is chosen by the committee chairman and must be balanced as to points of view to make sure that special interests do not have inproportionate influence, and discrimination is prohibited.

The usual procedure is for the committee chairman to ask for members to be nominated. The public then petitions for membership and the chairman selects the members.

To get an advisory committee started the request for it must originate with the FCC staff – this request is then reviewed and approved by the Commission and the O.M.B. The establishment is then published in the Federal Register and a charter is prepared by the FCC which is filed with Congress and the Library of Congress. This charter is reviewed annually by the FCC and the O.M.B., and must be renewed every two years.

Meetings are called by the chairman, who approves the agenda, chairs the meetings and adjourns the meetings. The notice of meetings is published in the Federal Register and the meetings are normally open to the public. The Public Information Act applies to committee records.

The Commission appears to now be serious about setting up an advisory committee – and the next move seems to be up to them. In the meanwhile you might give serious and careful thought to who you might petition the Commission to speak for you on this committee. You'll need active amateurs – preferably amateurs who have had extensive expereince in several aspects of the hobby so they will have the background needed to help provide data to the Commission and give educated opinions. There is no prohibition against members of the committee being in the industry, though obviously not too many should, lest there be an unconscious bias toward the business end of amateur radio. Think about it.

W1AW QUIETED BY FCC

Under a recent FCC interpretation of their rules the operation of W1AW has been substantially curtailed. The station can still be used for the transmission of bulletins and code practice, but no longer may it be used for two way contacts with other amateur stations by any ARRL staff members. Visitors may use the station for such contacts.

A ruling by the Wages and Hours people shut down the 73 Magazine HQ station in 1965 when they ruled that any operator of the station *MUST* be paid at least the minimum wage. They pointed out that the operators of W1AW were being paid. 73 Magazine appealed to the FCC for advice and was informed that it was *ILLEGAL* for operators at the 73 Magazine station to be paid. The result of this was the shut down of the station on Mt.Monadnock, one of the most elaborate amateur VHF installations in the world, financed by 73 Magazine and set up by 73 employees. The station had been operated by employees in their off hours, evenings and weekends for the fun of operating.

This same ruling forced the ARRL to pay their HQ station operators for all operating, both bulletin broadcasting and hamming. The FCC kept quiet about this, condoning it, until the recent action described above.

POSSIBLE NEW PRODUCTS?

We're still looking around for some company to come out with a small and stable oscillator which could plug into the 2m FM rigs to provide a general tuning function for the receivers. For normal repeater operation crystals are just fine – they're perfect. But every now and then it is nice to be able to tune the band and hear what is going on off your crystal channels. There might be some secret repeaters – some new repeaters you haven't heard about – some simplex

Visitors – Blackie JY9BB is on the left – active on most bands from Amman, and also via Oscar. On the right is Hisham Ansari JY5HA, the Secretary of the Royal Jordanian Amateur Radio Society. Hisham is the one who has been teaching the youngsters of Jordan about amateur radio and issuing them their licenses. Blackie and Hisham were recently in the U.S. for some technical training.

channels being used you didn't know about – or you might just be in a new area for a visit and want to be able to hear all of the repeaters without having to come armed with a cigar box full of crystals.

It should be pretty simple to come up with a small oscillator which would plug into one of the crystal sockets and provide variable tuning of the whole band, even including the Mars and CAP channels on each end of the ham band.

The inclusion of a tuner in the new TPL 220 transceiver is something that other manufacturers might check. It obviously doesn't cost all that much to include that function once you have the whole receiver there anyway. TPL also has a VFO for use on transmit – plus an AM-FM switch. On 2m this would permit you to go down the band and work some of those few remaining AMers – or even get in there for some CW when aurora is active, way down on the very low end of the band.

$100 REWARD!

Many amateurs – if not most – get caught up in one aspect of the hobby and turn a blind eye to all of the other things that are going on. Well, few of us have the time to do much of a job of pursuing more than one aspect of amateur radio at a time, but this means that we are missing out on a lot of the fun that is there to be had.

The time does come when we find that the same old grind doesn't have the zip it once had for us and we notice that we are operating a lot less – sometimes not getting on the air for days at a time. It is possible that an interest in more than one phase might be an answer to that phenomenon.

Since amateurs are actively having a ball with many different sub-hobbies, it is probably a lack of knowing about these things more than anything else that is holding back many amateurs from expanding their horizons. In the hope of bringing light to this grey area, 73 would like to encourage material to be written for publication which would help others to understand the many facets of amateur radio – and perhaps convince them to give something new a try.

Accordingly, 73 is offering $100 reward for the best article received in the categories of an introduction to:

CW	Fast Scan Television
DXing	Moonbounce
QRP	Certificate Hunting
RTTY	DXpeditioning
Slow Scan	160 Meter DXing
Contests	Mobiling
Traffic Handling	80 Meter DXing
MARS	Service Nets (Ecars)
Home Building	RACES CD – etc.
Facsimile	

Here is Dave WA1UFG, one of the new hams licensed at the Crotched Mountain Rehabilitation Center, operating 2m from his wheelchair – using the special call sign WC1CMC (Wheel Chair One Crotched Mountain Center) during the weekend of the wheelchair games which is celebrated every year at the Center, which is located in Francistown NH. The radio club there is active and getting many of the students licensed.

200 WATT 2m AMPLIFIER

TPL in Hawthorne, California has been making some experimental 200 watt mobile amplifiers, but there are problems. It seems that most of the mobile antennas – the 5/8 wave jobs that most fellows are using now – won't take all that power. Watch out for someone to come out with a Big Mutha for FM. TPL has a price tag of about $350 on the amplifiers if you just can't stand not being the biggest bully on the repeater. For sure they hear you when you say, "Break!"

Many denizens of Flatland can see no reason why anyone should run much more than maybe 25 watts mobile. They can not see this enough so they are quite vocal about it. Nasty sometimes. There are some ways of rationalizing higher power – these would be clearer to them if they spent some time driving around the mountains where a ten watt signal drops out of the repeater when you get behind a little hill – and most of the roads are in the valleys, not on the mountain tops. With some beef behind the signal you can hold on to the repeater even when you're in a gulch for a bit.

W6 – KH6 Team Waiting FOR 2m FM QSO

The FM DXers in California and Hawaii are monitoring 146.52 – .55 – .58 nightly, waiting for that inevitable band opening between the two areas. Two amateurs waited it out in the 50's and won the Edison Award for their diligence – that was a prize awarded each year by General Electric to outstanding amateurs – back when G.E. sold a lot of tubes for ham rigs.

One of these evenings the band will be open and the contact will be made – who will go down in the record books this time?

MICROWAVE OVEN

Visitors to 73 Magazine seldom miss commenting on the microwave oven in the lunchroom. This certainly was one of the better investments made by the magazine and it is used every day for so many things that it is difficult to see how one could get along without it now.

Ten seconds softens refrigerator hard butter to spreading softness. A week old hard roll in a Baggie (to keep the moisture from escaping) is like oven fresh in about 20 seconds. If it is really hard it can be moistened a bit before putting in the oven. Fresh baked apples for lunch take about three minutes for the large ones – you core them, put some sugar, cinnamon, a couple of raisins and some butter or oleo in the hole, put them in a small covered dish and into the oven. Any sandwich that is better hot can be made like better than new in twenty seconds or so. Your coffee a little cool? Zap it for ten seconds. You can even have a fresh baked potato for lunch – about five minutes! Hot soup takes a couple minutes. Even (ugh!) canned hash is less unappealing after a couple of minutes of warming up... but not much.

There has been a good deal in the papers about oven leakage so the unit at 73 is checked out every few weeks – not a smidgeon of leakage yet. The oven came from International Crystal of Oklahoma City and, after several years, has given absolutely no trouble whatever. The leakage checker was sent along at no charge so the oven could be checked. When you consider

Cont'd page 111.

Gam Antenna Installed – Andy Nuttle of Gam in Manchester NH is installing one of his new two meter antennas on the 73 Test Car – the Datsun 240Z. Andy makes just about every part of these antennas himself in his highly automated factory. The SS-2 is designed to have a particularly low angle of radiation, thus squirting the rf in the desired direction and not up toward some passing plane as with some of the 2m antennas in use today.

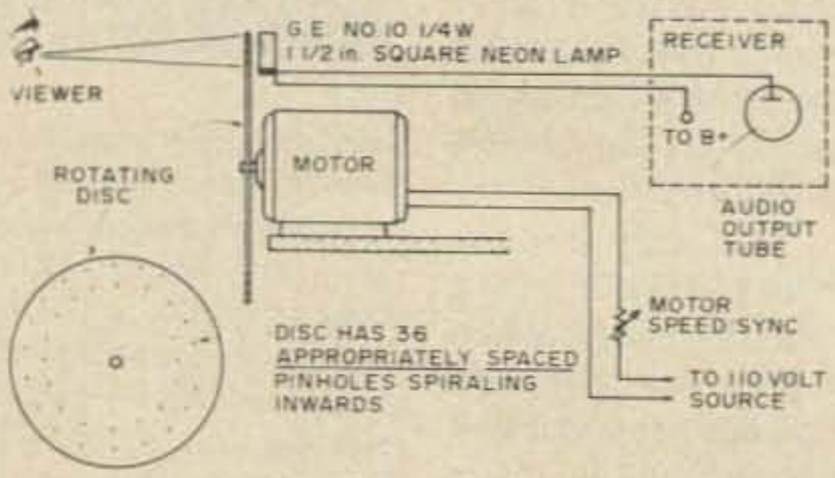
SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Would you believe amateur TV was around in 1928? It's true, although it differed tremendously from any system used today. In 1928 the General Electric Company in Schenectady NY was transmitting experimental TV signals on "wavelengths which were located by listening for unusual signals." (Available information indicates this was probably between the broadcast band and 80m.) Commercial "converter kits" were available from manufacturers like Daven Company, and QST ran a build-it-yourself article in May, 1928, for the technically minded amateur.

Basically, this TV system used a neon lamp to replace the receiver's earphones, (which were usually connected between the last audio stages plate and B+) and the Nipkow scanning disc principle. The theory here was while the incoming signal "blinked the neon lamp in a picture manner," the disc would rotate at approximately 1700rpm to place this information at the appropriate points for reconstruction of sketches in their simplest black and white form. The neon lamp's flat surface area was viewed through the disc while varying the motor rheostat until it acquired the same speed as the transmitting disc, at which time a picture was to appear rather than just a "meaningless group of dots." If the neon lamp was too dim, either lowering the grid bias or increasing B supply voltage was suggested. This was an experimental setup and I have yet to find information on how well (if at all) the system performed, although there were opinions manufacturers would soon build larger neon lamps for larger pictures. While investigating this "nostalgic TV," another item was uncovered which is worth mentioning here. In 1932, W2XF was transmitting TV programs from a QTH in Al Smith's Empire State Building to "local residents." Hams and commercial TV? Can any of you old timers shed some light on this era?

As I mentioned briefly in last month's column, this year's Dayton Convention was Slow Scan TV's greatest yet, and was suitably dubbed "The year of the Digital Scan Converter." There were actually four different slow to fast scan converters in operation at the SSTV booth: The WØLMD unit, the W9NTP unit, the WB9LVI unit and the VE3GZM/VE3DVV unit. Although all units used the same basic idea – that of first storing a Slow Scan picture then outputing this at Fast Scan rates into a conventional TV, they differed somewhat in specific circuitry. The W9NTP and WØLMD units varied primarily in "front end design," however, both units used memories which were "loaded on the fly" with up to 128 horizontal picture elements per line. Their continuously recirculating memory provided maximum utilization of the approximate 65000 bit storage. The VE3GZM/VE3DVV Scan Converter was an interesting unit. It used a large MOS shift register memory and the composite Slow Scan picture was loaded into this sync and all. The memory was then sped up 1000 times and output directly at a Fast Scan rate. . .sync included. This is simple enough provided one can lay hands on the necessary shift registers. (These guys have a really interesting story on their procurement of the surplus shift registers. If you catch them on the air, be sure to ask about it!) I understand the WB9LVI unit provided very good quality fast scan pictures with exceptional stability, but as yet I have no additional information other than what appeared in the May column on Steiber's unit. I hope to have more specific information soon. I might mention the heart of these scan converters were surplus MOS shift register ICs, (2525s) which are rather difficult to locate at low prices. All four scan converters were operating continuously at the SSTV booth; two being fed from tape recorders and two from SSTV Digital Keyboards, which also attracted quite a bit of attention. In fact, the SSTV booth boasted a large crowd all the time.



1928 style TV system for amateur test.

Final Results
Worldwide SSTV Contest
Sponsored by CQ Elettronica
and 73 Magazine
9-10 February 1974

1)	W9NTP	(77+5) x / (5x6) + (2x42) /	= 9.348
2)	WA1NXR	(44+0) x / (5x4) + (2x28) /	= 3.344
3)	WA7QBV	(42+0) x / (5x3) + (2x28) /	= 2.982
4)	WB4ECE	(43+0) x / (5x4) + (2x21) /	= 2.666
5)	IT9ZWS	(34+0) x / (5x3) + (2x25) /	= 2.210
6)	HB9NL	(31+0) x / (5x6) + (2x19) /	= 2.108
7)	WA1KYV	(33+0) x / (5x4) + (2x21) /	= 2.046
8)	EA4DT	(34+0) x / (5x4) + (2x17) /	= 1.998
9)	EA4JF	(38+0) x / (5x3) + (2x17) /	= 1.862
10)	DK5EL	(30+8) x / (5x3) + (2x16) /	= 1.786
11)	G3IAD	(33+0) x / (5x3) + (2x17) /	= 1.617
12)	HA6VK	(24+0) x / (5x3) + (2x18) /	= 1.224
13)	IØPCB	(22+0) x / (5x3) + (2x17) /	= 1.078
14)	IT9ZDA	(26+0) x / (5x2) + (2x14) /	= 988
15)	CT1PG	(26+0) x / (5x2) + (2x13) /	= 936
16)	I1PXC	(23+1) x / (5x3) + (2x12) /	= 897
17)	OZ1AT	(22+0) x / (5x3) + (2x12) /	= 858
18)	I3HDC	(15+0) x / (5x3) + (2x10) /	= 525
19)	K9BTU	(16+0) x / (5x2) + (2x10) /	= 480
20)	JA1ARA	(14+0) x / (5x3) + (2x7) /	= 406
21)	JA7FS	(10+0) x / (5x3) + (2x7) /	= 290
22)	VE6SL	(11+0) x / (5x1) + (5x1) /	= 187
23)	ISØPEM	(9+0) x / (5x1) + (2x6) /	= 153
24)	OZ2YC	Control Log	
25)	SMØCQV	Control Log	

Incidentally, while on the subject of Dayton, I wonder if any of you have found a really good application for those LED dual diodes which were so popular. These little gems (which were fairly inexpensive) will light green when passing current in one direction and red when passing current in the other direction. I tied one on a switching transistor base in an FM rig for a T/R light, however, that's a far cry from its total capability. How about a sync tuning indicator that lights green if sync frequency is low, red if sync frequency is high, and orange if sync is exactly right on? Any other ideas? If so, send me your ideas and schematic. . .I'll get them into a future column.

I have just received the final world results of the SSTV contest from Franco I1LCF, which are included in this month's column. Congratulations to all for a fine contest, and we hope to "see" you do it again (only better) next year.

Finally, word just in from Barry VK5BS, who's quite active on SSTV from Australia, tell's of their SSTV net which gathers at 0100 GMT Sundays on 14.230kHz. They have a fine group active which includes VK3LM, 2KK, 3TE, 4TO and VK5BS. VK8KK now has a "video synthesizer" keyboard going, and P29MC is on SSTV from New Guinea. VK9XX and FO8AA also have joined the SSTV activity, and it looks like quite a few others are due on soon. Ah. . . for the better propagation soon to come.

K4TWJ

RADIO LIFE-INSURANCE IS STANDARD... FROM STANDARD

Only Standard offers you an Amateur Radio with a "no-fault" Life Insurance Policy that can save your radio and your pocketbook, should your Standard ever need service after its regular 180 day Warranty expires.

Your "out-of-warranty" cost

Model SR-146, Model SR-146A } $32.00 total

Model SR-C806, Model SR-C826 M, Model SR-C826 MA } $38.00 total

Repeater RPT-1 $59.00 total

Flat rate includes:

Repair of all faults in radio
Complete TX and RX alignment & tuneout
Modification updates made
Channels frequency aligned*
FM Certificate issued
Sealed in plastic & returned to you

Our exclusive Astropoint Radio Life Insurance Policy costs nothing at time of purchase, and will guaranty you a flat rate for repair after the regular 180 day free warranty expires. After an "out-of-warranty" repair, it will be re-warranted for an additional 30 days. No hidden costs beyond the flat rate repair charge listed above from our factory in Wilmington, California.

Suggested retail:
$698 RPT-1 complete

*Note: All Standard Astropoint crystals are lifetime guaranteed FREE.

Suggested retail: **$398**
SR-C826 MA with
all channels included!

Suggested retail: **$298**
SR-C146A with
5 channel
capability.

See your Standard dealer for more information on Standard's Radio Life Insurance Policy.

Standard Communications

213/835-3134 • 639 North Marine Avenue, Wilmington, California 90744

FCC NEWS

Adopted: June 5, 1974;
Released: June 7, 1974
By the Commission: Commissioner Quello not participating.

1. Notice of Proposed Rule Making in the above entitled matter is hereby given.

2. The Commission has under consideration a petition (RM-2349) filed by the American Radio Relay League (ARRL). Petitioner requests the Commission to issue an Order deleting §97.89(c) of the rules. This section now prohibits more than two repeater stations being operated in tandem, i.e., one station repeating the transmission of the other, except for emergency operations.

3. The ARRL claims a formal rule making proceeding is unnecessary in this matter, citing §553(b) of the Administrative Procedures Act and §1.412(c) of the Commission's Rules, as authority to support their position. Pursuant to those subsections general notice of proposed rule making must be published except in certain limited instances. Petitioner does not show that the proposed rule deletion comes within those exceptions.

4. In support of the requested deletion, the ARRL offers the following claims and arguments:

A. Some amateur radio organizations planning to develop networks of repeater stations for use in times of disasters are unwilling to implement their plans unless the networks can also be used for other amateur operations.

B. In the more sparsely populated areas of the country, linked repeater stations can provide more reliable communications than can operation in the high frequency amateur bands.

C. In the more densely populated areas of the country, linking of repeater stations is neither necessary nor desired by amateurs, and the privilege of linking would be self-limiting.

5. Our findings, as stated in the Report and Order in Docket 18803, 37 FCC 2d 225 (1972), upon review of the comments filed in that Docket, are that amateur repeater stations are useful for increasing the range of VHF and UHF vehicular and handheld mobile stations in conducting intra-community amateur radio communications, and for effecting emergency radio communications which possibly could not otherwise be conducted on the amateur bands. Also, in the interests of spectrum conservation, we found the majority of situations could be accommodated with a maximum of two linked repeaters. In practice, these findings have been verified through information filed with applications for repeater stations. The vast majority of repeaters use considerably less effective radiated power than is permitted, indicating most amateur repeater stations are intended for local, or intra-community, use. No specific instance of even two linked repeaters for general amateur radio communications has come to our attention. However, this aspect would not normally come to our attention. We are inclined to agree with the ARRL that the prohibition is unnecessary, since in more densely populated areas, amateurs apparently do not desire to link repeater stations In the less densely populated areas spectrum conservation is not as critical as elsewhere.

6. Therefore, we propose to delete §97.89(c),

7. Authority for these proposed amendments is contained in Section 4(i) and 303 of the Communications Act of 1934, as amended.

8. Pursuant to applicable procedures set forth in §1.415 of the Commission's Rules, interested persons may file comments on or before September 18, 1974, and reply comments on or before October 2, 1974. In accordance with the provisions of §1.419(b) of the Commission's Rules, an original and fourteen copies of all statements, briefs and comments filed shall be furnished the Commission. All relevant and timely comments and reply comments will be considered by the Commission before final action is taken. The Commission may also take into account other relevant information before it, in addition to specific comments invited by this Notice. Responses will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D.C.

Adopted: June 12, 1974
Released: June 17, 1974

SUBPART F – RADIO AMATEUR CIVIL EMERGENCY SERVICE (RACES)

General

§97.161 Basis and Purpose.

The Radio Amateur Civil Emergency Service provides for amateur radio operation for civil defense communications purposes only, during periods of local, regional or national civil emergencies, including any emergency which may necessitate invoking of the President's War Emergency Powers under the provisions of §606 of the Communications Act of 1934, as amended.

§97.163 Definitions.

For the purposes of this subpart, the following definitions are applicable:

(a) Radio Amateur Civil Emergency Service. A radiocommunication service conducted by volunteer licensed amateur radio operators, for providing emergency radiocommunications to local, regional, or state civil defense organizations.

(b) RACES station. An amateur radio station licensed to a civil defense organization, at a specific land location, for the purpose of providing the facilities for amateur radio operators to conduct amateur radiocommunications in the Radio Amateur Civil Emergency Service.

R97.165 Applicability of rules.

In all cases not specifically covered by the provisions contained in this subpart, amateur radio stations and RACES stations shall be governed by the provisions of the rules governing amateur radio stations and operators (Subparts A through E of this part).

Station Authorizations

§97.169 Station license required.

No transmitting station shall be operated in the Radio Amateur Civil Emergency Service unless:

(a) The station is licensed as a RACES station by the Federal Communications Commission, or

(b) The station is an amateur radio station licensed by the Federal Communications Commission, and is certified by the responsible civil defense organization as registered with that organization.

§97.171 Eligibility for RACES station license.

A RACES station will only be licensed to a local, regional or state civil defense organization.

§97.173 Application for RACES station license.

(a) Each application for a RACES station license shall be made on the FCC Form 610-B.

(b) The application shall be signed by the civil defense official responsible for the coordination of all civil defense activities in the area concerned.

(c) The application shall be countersigned by the responsible official for the governmental entity served by the civil defense organization.

(d) If the application is for a RACES station to be in any special manner covered in §97.41, all of the showings as specified in §97.41 for non-RACES stations shall also be submitted.

§97.175 Amateur radio station registration in civil defense organization. No amateur radio station shall be operated in the Radio Amateur Civil Emergency Service unless it is certified as registered in a civil defense organization, by that organization.

Operating Requirements

§97.177 Operator requirements

No person shall be the control operator of a RACES station, or shall be the control operator of an amateur radio station conducting communications in the Radio Amateur Civil Emergency Service unless (a) that person holds a valid amateur radio operator license, and (b) that person is certified as enrolled in a civil defense organization, by that organization.

§97.179 Operator privileges.

Operator privileges in the Radio Amateur Civil Emergency Service are dependent upon, and identical to, those for the class of operator license held in the Amateur Radio Service.

§97.189 Availability of RACES station license and operator licenses.

(a) The original license of each RACES station, or a photocopy thereof, shall be attached to each transmitter of such station, and at each control point of such station. Whenever a photocopy of the RACES station license is utilized in compliance with this requirement, the original station license shall be available for inspection by any authorized Government official at all times while the station is being operated and at other times upon request made by an authorized representative of the Commission, except when such license has been filed with application for modification or renewal thereof, or has been mutilated, lost, or destroyed, and request has been made for a duplicate license in accordance with §97.57.

(b) In addition to the operator license availability requirements of §97.83, a photocopy of the control operator's amateur radio operator license shall be posted at a conspicuous place at the control point for the RACES station.

Technical Requirements

§97.185 Frequencies available.

(a) All of the authorized frequencies and emissions allocated to the Amateur Radio Service are also available to the Radio Amateur Civil Emergency Service on a shared basis.

In the event of any emergency which necessitates the invoking of the President's War Emergency Powers under the provisions of §606 of the Communications Act of 1934, as amended, unless modified or otherwise directed, RACES stations and amateur radio stations participating in RACES will be limited in operation to the following:

Frequency or Frequency Bands	
kHz	Limitations
1800-1825	1
1975-2000	1
3515-3550	2, 4
3984-4000	
3997	3
7097-7103	4
7103-7125	2, 4
7245-7255	2, 4
14047-14053	4
14220-14230	2, 4
21047-21053	4
MHz	
28.55-28.75	
29.45-29.65	
50.35-50.75	
53.30	3
53.35-53.75	
145.17-145.71	
146.79-147.33	
220-225	

(c) Limitations.

(1) Use of frequencies in the band 1800-2000 kHz is subject to the priority of the Loran system of radionavigation in this band and to the geographical, frequency, emission and power limitations contained in §97.61 of the rules governing amateur radio stations and operators (Subparts A through E of this part).

(2) The availability of the frequency bands 3516-3550 kHz. 7103-7125 kHz, 7245-7247 kHz, 7253-7255 kHz, 14220-14222 kHz and 14228-14230 kHz for use during periods of actual civil defense emergency is limited to the initial 30 days of such emergency, unless otherwise ordered by the Commission.

(3) For use in emergency areas when required to make initial contact with military units; also, for communications with military stations on matters requiring coordination.

(4) For use by all authorized stations only in the continental United States, except that, the bands 7245-7255 and 14.220-14.230 kHz are also available in Alaska, Hawaii, Puerto Rico, and the Virgin Islands.

Use of Stations

§97.189 Points of communications.

(a) RACES stations may only be used to communicate with:

(1) Other RACES stations.

(2) Amateur radio stations certified as being registered with a civil defense organization, by that organization.

(3) Stations in the Disaster Communications Service.

(4) Stations of the United States Government authorized by the responsible agency to exchange communications with RACES stations.

(5) Any other station in any other service regulated by the Federal Communications Commission, whenever such station is authorized by the Commission to exchange communications with stations in the Radio Amateur Civil Emergency Service.

(b) Amateur Radio Stations registered with a civil defense organization may only be used to communicate with:

(1) RACES stations licensed to the civil defense organizations with which the amateur radio station is registered.

(2) Any of the following stations upon authorization of the responsible civil defense official for the organization in which the amateur radio station is registered:

(i) Any RACES station licensed to other civil defense organizations.

(ii) Amateur radio stations registered with the same or another civil defense organization.

(iii) Stations in the Disaster Communications Service.

(iv) Stations of the United States Government authorized by the responsible agency to exchange communications with RACES stations.

(v) Any other station in any other service regulated by the Federal Communication Commission, whenever such station is authorized by the Commission to exchange communications with stations in the Radio Amateur Civil Emergency Service.

§97.191 Permissible communications.

All communications in the Radio Amateur Civil Emergency Service must be specifically authorized by the civil defense organization for the area served. Stations in this service may transmit only civil defense communications of the following types:

(a) Communications concerning impending or actual conditions jeopardizing the public safety, or affecting the national defense or security during periods of local, regional civil emergencies:

(1) Communications directly concerning the immediate safety of life or individuals, the immediate protection of property, maintenance of law and order, alleviation of human suffering and need, and the combating of armed attack or sabotage.

(2) Communications directly concerning the accumulation and dissemination of public information or instructions to the civilian population essential to the activities of the civil defense organization or that of other authorized governmental or relief agencies.

(b) Communications for training drills and tests necessary to insure the establishment and maintenance of orderly and efficient operation of the Radio Amateur Civil Emergency Service as ordered by the responsible civil defense organization served. Such tests and drills may not exceed a total time of one hour per week.

(c) Brief one way transmissions for the testing and adjustment of equipment.

§97.193 Limitations on the use of RACES stations.

(a) No station in the Radio Amateur Civil Emergency Service shall be used to transmit or to receive messages for hire, nor for communications for material compensation, direct or indirect, paid or promised.

(b) All messages which are transmitted in connection with drills and tests shall be clearly identified as such by use of the words "drill" or "test," as appropriate, in the body of the messages.

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

QRP QSO PARTY RULES

QRP Amateur Radio Club International, Inc.

Starts: 2000 GMT Sat., Aug. 24, 1974
Ends: 0200 GMT Mon., Aug. 26, 1974

This contest is open to all amateurs and all amateurs are eligible to compete for awards.

Exchanges: Members: RST/RS, State/Province/Country, QRP No.; Non-member: RST/RS, State/Province/Country, Power.

Scoring: Stations may be worked once per band for QSO and multiplier credit. Each member contact counts as three (3) points, and each non-member contact counts as two (2) points. Non- W/VE stations count as four (4) points.

Multipliers: More than 100 watts (200 PEP) X 1.0; 25 to 100 watts (50-200 PEP) X 1.5; 5 to 25 watts (10-50 PEP) X 2.0; 1 to 5 watts (2-10 PEP) X 3.0; Less than 1 watt (2 PEP) X 4.0.

Score: QSO points X Total No. States, provinces and countries per band X appropriate power multiplier.

Frequencies: CW: 3540, 7040, 14065, 21040, 28040; SSB: 3855, 7260, 14260, 21300, 28600, 50350; Novice: 3720, 7120.

Call: CQ QRP.

Awards: Certificates will be awarded to the highest scoring station in each state, province and country. Second and third place awards will be given where activity warrants. A certificate will also be awarded to the lowest power station showing at least three genuine skip contacts.

Logs: Send logs to Bill Fallon W4KFB, 124 Stoll Avenue, Louisville KY 40206. Send full log date, bands used, equipment and power level used.

Note: Look for DX stations on 7030 at appropriate hours.

NEW BERN

The city of New Bern NC is celebrating its Bicentennial August 16-25. I have applied to the FCC for a special call for operations during that period. The call is KB4ERN. A special QSL commemorating the event is planned. The New Bern amateurs will be active from public events during the week and will be on the local TV station. We are especially interested in QSOing stations in Bern, Switzerland. Operation is planned for 80 through 10m, CW and SSB, 20m Slow Scan, and 2m FM via repeater. For more information contact James L. Cason II WB4CCU, 5213A Trentwood Drive, New Bern NC 28560.

WB8KZD

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

"LICENSING ARRANGEMENTS FOR AMSAT-OSCAR 7"

On March 15, 1974, AMSAT was issued a special license for the AMSAT-OSCAR 7 satellite, with the call letters W3OHI. Unique in that this is perhaps the first actual license issued to an amateur satellite service space station, the new license culminates six months of discussions and meetings between AMSAT and the U.S. Federal Communications Commission concerning the specific provisions governing the operation and use of OSCAR 7

With the license the following waivers were granted for OSCAR 7 after launch and for portable or mobile operation of the spacecraft during tests before launch:

A. Section 97.43: The requirement for every amateur radio station to have one land location was waived.

B. Section 97.61: Any mode of emission authorized on uplink frequencies may be retransmitted on the downlink. (For example, teletype transmissions allowed on two meters can be retransmitted on the ten-meter downlink of the two-to-ten meter repeater, even though teletype is not ordinarily permitted at the high end of the ten-meter band.)

C. Sections 97.7 and 97.79: Any transmissions to the satellite from amateur radio stations may be retransmitted by the satellite without regard to operator frequency privileges on the satellite downlink frequencies. (This means that, as with OSCAR 6, Technician Class licenses will be permitted to use the two-to-ten meter repeater, even though their signals will be retransmitted on ten meters, a band not normally allowed to Technicians.)

D. Sections 97.117 and 97.123: Telecommand stations authorized by AMSAT may transmit coded telecommand signals to the satellite, without identifying their transmissions.

E. Section 97.87: The various requirements for identification of the satellite's transmissions were waived to the extent that only the last two letters, HI, of the call sign W3OHI need be periodically transmitted by the satellite.

Orbital Information

Orbit	Date (Aug)	Time (GMT)	Longitude of Eq. Crossing °W
8194	1	0055.1	62.1
8207	2	0150.0	75.8
8219	3	0049.9	60.8
8232	4	0144.8	74.5
8244	5	0044.8	59.5
8257	6	0139.7	73.2
8269	7	0039.6	58.2
8282	8	0134.6	71.9
8294	9	0034.5	56.9
8307	10	0129.4	70.7
8319	11	0029.4	55.6
8332	12	0124.3	69.4
8344	13	0024.2	54.4
8357	14	0119.2	68.1
8369	15	0019.1	53.1
8382	16	0114.0	66.8
8394	17	0014.0	51.8
8407	18	0108.9	65.5
8419	19	0008.8	50.5
8432	20	0103.8	64.3
8444	21	0003.7	49.2
8457	22	0058.6	63.0
8470	23	0153.5	76.7
8482	24	0053.5	61.7
8495	25	0148.4	75.4
8507	26	0048.3	60.4
8520	27	0143.3	74.1
8532	28	0043.2	59.1
8545	29	0138.1	72.9
8557	30	0038.1	57.8
8570	31	0133.0	71.6

AMSAT Newsletter

By: Gus M. Browning, W4BPD
Drawer "DX"
Cordova, SC 29039

I was reading an article a few weeks ago that said the new 11 year sunspot cycle had already started. We all hope this is true I am sure because it will mean DXing will be a little easier. I guess it will start off gradually and slowly build up, maybe taking a few years before conditions really get "hopping" again. Band conditions will be watched very carefully to see if they are really going to get any better. We will all see about this. Can you picture the QRM when the sunspots really open up the bands?The following DX has been worked in conditions not considered good: VK2ZO/C21, 3D2CC, P29PK, A3HFX, H35FX, KA6AX, TB7AAU, JT1KAA, 3B8DA, HG8U, FO8DY, TA2SC, AP2ED, 7Q7DW, 7P8AY, 4W1AF, JT1AT, 9X5AB, A51PN, VE6CB/SU, CR8AB, AP2KS, CR4BS, RH6IEG, JY3ZH, RAØIWH, 9V1RV, 4W1GM and many more. I want to hear 20m when those sunspots get "right," it should be very interesting" to hear rare DX QRMing rare DX!

Any of you who happen to have a good (black and white preferred) photo of rare DX stations please send it to me for use in this column. My supply of really good photos is just about non-existent. Photos of DX operating positions and antennas, etc., are what most fellows would like to see.

I have been trying my best to get a complete list of every "DX spot" (islands, provinces, oblisks, enclives, states, neutral zones, etc.) in the world and have found it to be quite a task. Even when it looks complete I know many places will be overlooked. When the "Super WTW" list is printed I will leave plenty of blank places for additions as they turn up. The WTW standard list will be included in the sheets, being marked with an *, the sheets can be used for either regular WTW or the new Super WTW Award. I will let you know in this column when the all new sheets are printed and ready to be mailed out.

I mentioned some months ago how to make a "line-voltage" booster to overcome the brownouts that may occur here and there, (low line voltage is called a "brownout, in case you didn't know!). I received far too many inquiries to personally answer via mail (my time is used up here). The problem is so simple that an article on how to do the job is not necessary. Just measure your line voltage, subtract that from, let's say, 117 (the voltage you want) then select a filament transformer that will deliver that many volts plus a little because this transformer will have on its primary the brownout voltage, use one that will deliver enough amperage for your needs. Plug this filament transformer into your brownout voltage ac line, then connect the secondary (the filament winding) in SERIES with your rig, if this reduces the voltage to your rig, just turn over the ac plug on your "boosting" transformer and the voltage will then increase instead of decreasing. You can connect any number of these filament transformers up to get more voltage. Connect the primaries all in parallel and the secondaries in series. (Polarized to boost voltage, of course.) Now is this simple enough for everyone? Let me know if it is not, please.

Any of you thinking of going on a DXpedition, give it a lot of thought and keep in mind that propagation is not at its best, expenses are quite high overseas (a lot more than they used to be), allow at least 20% extra for "unknowns" to pop up, because they most certainly will, and then if it still looks good to you, go ahead with your plans and good luck to you. As for myself. I am now laying low to see what the future holds for me. I want one more crack at being rare DX for a few months or maybe even longer, but I do want propagation and the necessary finances.

I wonder if anyone would like to drop me a line telling me of anything they would like me to discuss or write about in this column? I am always wide open for your suggestions.

Any DX station that has no USA QSL manager is overlooking the easy way to QSL (cheapest way too). Plenty of USA stations will take up your QSL chores and I will be very glad to assist you in finding a QSL manager. This is not a problem.

DX stations, DXpeditions, please remember that many USA stations cannot call you below 14275 kHz, and they would like the chance to have a crack at working you. Try tuning 14275 up every now and then. If you want to select them even better, try tuning "up and down" from 14275. You will hear fellows you have never heard before, and they will thank you for being so considerate of them, and THEY WILL BE HAPPY!

I am still QRX for a few very "simple articles" on these little ICs! I would like to see an article showing a number of diagrams on how to connect various types to ÷ by 2 right on up to ÷ by 16, all numbers from 2—16, especially such numbers as 7, 9, 11, 13, 14 and 15. I am sure if I got every article ever written on the 7400 series I probably would find most of what I want to know. I spent two nights rounding up every article on those ICs and yet still nothing on the odd numbers I really wanted to know. I have an 18 position four deck switch that I want to use, with each position dividing by whatever it is set on e.g., position 9, ÷ by 9, position 13, ÷ by 13, etc. I don't care how many 7400 series ICs it takes, they are cheap enough. The articles should be written so that a fellow doesn't have to be a computer expert to understand it.

If you want to hear a lot of very good and at times rare DX, park your dial on 14331 kHz while you are fooling around your shack (with the "system" on the speaker). Of course, you will hear a lot of very common stuff most of the time, but, be very patient and sooner or later the "good stuff" will show up. It seems as if a lot of the DX stations like to "mix it up" with the gals now and then (who doesn't — hi).

The best way to work DX is to do a lot of listening and very little yak. And listen to the DX stations instructions. When they say W2 they mean just exactly that and not W4 or W7 etc. It doesn't take a big fancy antenna and a "big gallon." It just takes a little common sense and a little know how. You can do it too.

Liberia has a new prefix — A8; Burma — AP2KS has in the works a trip there, and has requested a license and hopes to put this spot on the air. Good luck Ole Buddy on this one, they wouldn't let me even get off the plane in Rangoon.

South Yemen (Old Aden — VS9). AP2KS has also applied for a license to operate from this, now rare spot. I suggest you watch the 73 Hotline for full info if it comes too fast for this column.

Tibet and Zanzibar have been removed from the DXCC list as of June 1, 1974. QSOs with Tibet will count towards China and Zanzibar will count for Tanzania. When someone operates from Kingman Reef it will be added to the DXCC. You take two backward and one forward. WTW will still keep Tibet and Zanzibar as separate countries plus we will add Kingman Reef — 3 steps forward.

I hope all of you answered the questioneer sent out by DXAC a few months ago. It was a good chance to "have your say" about countries, etc.

I guess this wraps it up for this month, see you next month fellows.

73 es DX,
de, Gus BPD

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP
		Hz			
		Hz			
		Hz			
		Hz			
		Hz			

USEFUL RANGE (RADIUS)

EQUIPMENT

ANTENNAS & HEIGHT ☐ SPLIT SITE ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID–TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.

DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

UPDATES NEEDED

AL	WR4AEJ	Birmingham		6.28-6.88
AL	W4MWF	Montgomery		DELETE
AL	WR4AGA	Mt. Cheaha		6.10-6.70
AZ	WR7ACK	Sierra Vista		6.16-6.76
	Formerly: WA7KYT			
AK	WR7ACT	Eagle River		6.16-6.76
DE	WR3ACV	Wilmington		7.75-7.15
FL	WR4AEG	Melbourne		443.8-448.8
GA	WR4AED	Stone Mountain		6.16-6.76
	Formerly: W4BOC			
MI	WR8ACF	Detroit		6.04-6.64
	Formerly: K8VLN			
MI	WR8ABI	Oshtemo		6.19-6.79
	Formerly: K8TIW			
MT	WR7ADN	Bozeman		6.28-6.88
	Formerly: W7YB			
NY	WR2ADW	Utica-Rome		6.34-6.94
	Formerly: K2GVI			
OH	WR8ADQ	McConnelsville		6.22-6.82
SC		Anderson		6.22-6.82
SC	WR4AFX	Charlestown	T1.477	6.34-6.94
	Formerly: WB4QGK			
SC	WA4MPC	Columbia		DELETE
SC	WR4AGM	Florence		6.37-6.97
SC	WB4PUP	Greenville		DELETE
SC	WR4ADP	Pickens		6.40-7.00
TN	W4BS	Memphis		6.22-6.82
				444.00-449.00
TN	WR4ABS	Memphis		6.19-7.51
	Formerly: WA4HBY			
TN	WR4AEX	Memphis		6.34-6.94
	Formerly. K4BN			
TX	K4DVJ	Dallas		6.25-6.85
VA		Barren Springs		6.07-6.67
VA	WR4ADV	Charlottesville		6.28-6.88
	Formerly: WB4KNX			
VA	WB4QEP	Danville		DELETE
VA		Galax (Briarpatch Mt.)		6.43-7.03
VA	W4GCE	Lynchburg		DELETE
VA	WB4HCX	Lynchburg		DELETE
VA	WR4ADY	Lynchburg (Forrest)		6.34-6.94
VA	WB4QEO	Richmond	T1.336	6.34-6.94
VA	WR4ACL	Staunton		6.37-6.97
VA	WB4QFF	Tyson's Corner		6.31-6.91
VA	WR4AGT	Winchester		6.22-6.82
WV	K8SXO	Huntington		DELETE
WV	WR8ABY	New Martinsville		6.34-6.94
	Formerly: WA8ART			
WI	WR9ACQ	Fon Du Lac		7.69-7.09
WI	WA9AYR	Green Bay PL	T1.8	6.28-6.88
				7.72-7.12
WI	WR9ACR	Plymouth		7.84-7.24
	Formerly: WB9FXS			
WY	WR7ADK	Laramie		6.34-6.94
				6.76-6.94
	Formerly: WA7EGK			
BERMUDA				
	VP9BA			6.34-6.94

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Aaron Jackson Jr.
P.O. Box 123
Clinton NC 28328

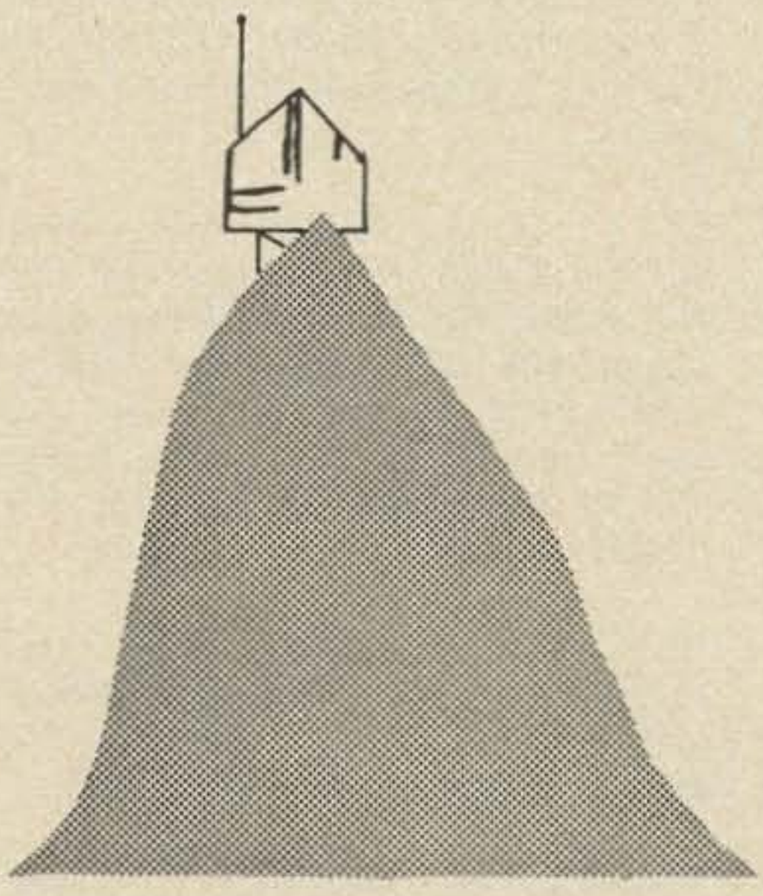
James D. Guy K7UAN
5818 S. 21st Dr.
Phoenix AZ 85040

Robert Bryan
P.O. Box 71
Cockeysville MD 21030
Telephone: 301-666-8453

Bishop L. Ellison
P. O. Box 631
West Branch IA 52358

REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.



REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

SENTRY MANUFACTURING COMPANY
Crystal Park, Chickasha, Oklahoma 73018

PHONE: (405) 224-6780

TWX-910-830-6425

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

TOROIDS 88mH, 44mH, unpotted, for RTTY SSTV, filter and oscillator applications. $5 per dozen, postpaid. Telecom Services, Box 4117, Alexandria VA 22303.

FREE CRYSTALS with the purchase of any 2m FM radio. Write for our deal on the rig of your choice. Factory authorized dealers for Collins, Regency, Drake, ICOM, Alpha, Kenwood, Tempo, Genave, Swan, Clegg, Ten-Tec, Standard, Midland, Telex, Hallicrafters, Venus, Hy-Gain, CushCraft, Mosley and Hustler. For the best deal around on HF or VHF gear, see us first or see us last, but see us before you buy. Write or call us today for our low quote and become one of the many happy and satisfied customers of Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. (812) 894-2397.

SELL: Drake TR22 3 months old mint condition. Cables, nicads, case 52/52, 94/94, 13/73, 16/76, 34/94, 72/12. Joseph Reed WB9JXU, Route 1, Mountain WI 54149.

HALLICRAFTERS SX-111 receiver, 80-10 meters, product detector, notch filter, .5–5kHz selectivity. $100 or nearest offer. David Lindey, Box 708, USNSGA, FPO NY NY 09518.

WANTED: Complete Collins S-line; Ken WA5JJB, P.O. Box 355, Nederland TX 77627. Phone (713) 722-4196.

TECH MANUALS for government surplus gear – $6.50 each: R-390/URR, R-220/URR, URM-25D, CV591A/URR, CV-278/GR, TRM-1, TS-382D/U, TS-497B/URR, TT-63A/FGC, URM-32. W3IHD, 7218 Roanne Drive, Washington DC 20021.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis. Please send Money Orders or Certified Checks only to 73 Magazine, Peterborough NH 03458.

MITS 908M Calculator w/p.s./case (S143) new	$ 90
Vanguard Scaler – by 10 – to 200MHz (S120)	$ 75
Regency 16ch scanner TME-H-LMU (S300) new	$ 245
SBE Scanvision, complete, like new (S900)	$ 500
Pickering CW keyboard KB-1 (S235) tested	$ 175
Gladding Hi-Scan 8ch scanner–tested (S180)	$ 89
Motorola KW 2m amplifier–used	$ 350
Heath IC-2009 calculator brand new (S92)	$ 88
Signal One CX7-A–tested–perfect–like new fantastic	$1990
Kenwood Twins–tested–like new (S900)	$ 750
Concord video monitor VM-12 tested (S400)	$ 250
Concord all channel TV tuner Dem-911 (S600)	$ 250
Regency 450 MHz scanner–(S200)–like new	$ 140
Varitronics PA-50 2m amp (S110)–brand new–10w in 50 vout	$ 75
RP tone burst gen–5 freq–T8-5–exc (S37.50)	$ 25
Hitachi stereo cassette recorder exc–(S120)	$ 75
Hitachi AM-FM cassette recorder–exc–(S90)	$ 50
Antenna Spec rubber ducky antennas HM-4 2m	$ 4
Radio Shack Code cassette–new (S6)	$ 4
Regency HR-6 (S240) six meter 10w xcvr 12ch	$ 199
Regency ACT-R8H/L Scr (S160) VHF/UHF 8ch scr receiver	$ 136
Standard SR-C826MA (S398) Latest model 10w 12ch 2m xcvr	$ 339
Regency HR-2MS (S319) 2m 15w xcvr with 8ch scanner	$ 269
SBE SB-450TRC (S180) 450 MHz transverter	$ 149
SBE SB-1PA (S190) 10w in 40w out power amplifier 2m	$ 159
Regency Pocket scanner 4 channel ACT-P4H (S120)	$ 99
Cobra 220 MHz Transceiver 10w 12ch (S300)	$ 255
Amphenol RG-8/U Polyfoam 100' w/PL-259 connectors (S24)	$ 19
Standard 14U 2m 22ch superfantastic rig, VOX (S510) demo	$ 439
Pacificom 2m HT–brand new–(S250)	$ 199

All Prices fob: UPS collect.
73 Magazine – Peterborough NH 03458

FOUNDATION for Amateur Radio Annual Hamfest Sunday, October 20, 1974 at Gaithersburg Maryland Fairgrounds.

SELL: Drake TR4, AC4, MS4 Speaker, Heath HD-10 Keyer, HM-102 Wattmeter, HD-15 Phone Patch, Eico Model 460 DC Wide Band Oscilloscope 2KW Linear Homebrew. All Mint, Best Offer. Knud E.M. Keller c/o 73 Magazine, Peterborough NH 03458.

HERE IT IS – Heathkit 10-105 – still in the box unassembled. List $400 – our sensational price $379.00. 73 Magazine, Peterborough NH 03458.

TELETYPE EQUIPMENT For Sale: Models 14, 15, 19, 28, 32, 33. TD's, Reperfs, KSR's, ASR's. Parts or complete machines. Write needs and send SASE for complete listing and prices Larry Pfleger, 10615 W. Ridge Rd., Apt. 54, Hales Corners WI 53130.

MIX PLEASURE with pleasure at the Hamburg International Hamfest on September 21. For information contact Lin Brownell WB2HCL, 210 Buffalo, Hamburg NY 14075.

AUTOMATIC TELEPHONE Answering Computer. The best available. List $239.95. I have two new and still in boxes for $150.00 each. Warranty is still good. First check takes one or both. WB8CTA, 1000 Moore Road, Conway MI 49722.

THE ORIGINAL FM Hamfest Sunday August 4, 1974, near Angola IN. Free flea market, entertainment for ladies and kids. Picnic grounds, campsites, boating, food, soft drinks, available rain or shine. For information contact: Fort Wayne Repeater Assoc. Box 6022, Fort Wayne IN 46806.

DANVILLE HAMFEST at Douglas Park in Danville IL on September 1, 1974. Take Bowman Avenue Exit off 1-74 and follow the signs. Prizes will include a low-band rig and VHF gear, antennas, electronic keyer, wattmeters, SWR bridges, and many others. Camping and motel accomodations nearby. Food and plenty of parking available. Huge flea market and commercial displays. Tickets are $2 or three for $5. Advance tickets available from Dave WA9PDS, Dolan Rd., Catlin IL 61817. Send check or M.O. and SASE. Talk-in on 22/82 and 94 simplex.

WYOMING RANCH LAND. No QRM-QRN. Wild horses, antalope, deer. 10 acres – $25 down, $25 month. Owner – Michael Gauthier K6ICS, 9418 Florence, Downey CA 90240.

MOTOROLA PORTABLES – Expert repairs, reasonable prices, fast turnaround time. More details and flat rate catalog FREE. Ideal Services, 6663 Industrial Loop, Greendale WI 53129.

BUY-SELL-TRADE write for monthly mailer, give name, address, call letters. Complete stock of major brands new and reconditioned equipment. Call us for best deals. We buy Collins, Drake, Swan, etc. SSB & FM. Associated Radio, 8012 Conser, Overland Park KS 66204. 913-381-5901.

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding. Literature Estes Engineering, 543-A West 184 Street, Gardena CA 90248.

PERSONAL ATTENTION plus the best cash deal anywhere is what you receive at QUEEN CITY ELECTRONICS in the heart of the Midwest. Queen City carries all major brands including; Drake, Tempo, Kenwood, Yaesu, Swan, Regency, Clegg, Standard ICOM, Genave. Write or phone us for your equipment needs. Queen City Electronics, Inc., 7404 Hamilton Avenue, Cincinnati OH 45231 (513) 931-1577.

SARA HAMFEST Sunday August 11, 1974. Riverside Park Murphysboro IL. Tickets $1, 3 for $2. Write Wm. Johnson, 502 W. Kenicott, Carbondale IL 62901.

FREE BARGAIN Catalog. Transistors, relays, ICs, puts, LEDs readouts, resistors, capacitors, thermocouples, transducers, circuit boards, unique components. Chaney's, Dept. A, Box 15431, Lakewood CO 80215.

HANDIE-TALKIE 2m, 5 channels, 2.2W, with external speaker/microphone, case and spares, Repco 8TN1H55KM. $250.00. WB6UMJ – call (714) 870-6829.

TRADE COMPLETE collection 73 Magazines in 73 binders for either SB-610, SB-620, SB-630 in good condition. K4PNJ/5, 2321 Shadywood Drive, Forrest City AR 72335.

NOW PAYING $1750.00 and up for 618T/ARC-102 - $1200.00 and up for ARC-51 – %1500.00 and up for GRC-106, also parts for these sets. D&R Electronics, R D. #1 Box 56, Milton PA 17847 after 6:00 (717) 742-4604.

WARREN HAMFEST, largest family style hamfest at the East. Sunday, August 18th, at Famous Yankee Lake Park. Giant fleamarket, swimming, picnicking: all free. Details, QSL W8VTD.

WANTED: RCA CMCT 30. Also, G.E. 2m progress line base and manuals for them. Patrick Butler, 5110 Willard Rd., Peoria Heights IL 61614.

F.R.R.L. HAMFEST– September 22, at beautiful Phillips Park, Aurora IL. Picnicing, Zoo and Gardens for the whole family. Talk in on .94 and .52. Mail $1 advance donation with SASE to WB9HYH, President, 1888D Carnation Ct., Aurora IL 60506. Drawing #1: HR-2b, #2: ACT-R10H/L/U and many others. Will ship U.P.S.

CALL LETTER LICENSE PLATES – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate -- most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our ' HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945–74. Indispensable!)

JIG SAW PUZZLES wanted. If you have any old wooden jig saw puzzles in your attic -- or run across them at an auction (the go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck apiece for them. C/O 73 Magazine, Peterborough NH 03458. Wood, not cardboard -- and complete.

REGENCY Scanner ACT10H/L/U, new in sealed carton (extra Father's Day present) – $135. TRC-8 and AN-TRC-19 220MHz gear also. Carpenter K1TGE, Parmenter Rd., Hudson MA 01749.

HAMFESTERS 40th annual Hamfest and picnic, Sunday August 11, 1974, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL (southwest of Chicago). Exhibits for OM's, XYL's. Famous Swappers Row. Information – contact, Vince Pronites WA9EOM, 7206 So. Damen Avenue, Chicago IL 60636. Tickets write – Jos. Paradyla, WA9IWU, 5701 So. California Ave., Chicago IL 60629.

NOVICES 75W monoband transceivers 80-40 or 15m only $59.50 75W tribanders 80-40 and 15m only $89.50. Unconditionally guaranteed. Fully expandable into general when you get general class license. Get on the air immediately. Send for free literature Hermes International, Box 989, Floral City FL 32636.

WANTED: General Class (or higher) hams to join 4,500 member Morse Telegraph Club. Hundreds of hams already belong. Send modest $3 annual dues (includes subscription to great slick paper newspaper, "Dots and Dashes"), to GST A.J. Long, 520 West Schwartz St., Salem IL 62881 for membership card and assignment to nearest chapter.

TRADE Collins R-390A/URR excellent, cabinet and complete set cables and tubes. Want synthesized 2m FM xceiver or complete SRC-146A and amplifier. Will ship. T. Fleming, 5019 W. 29th, Little Rock AR 72204 (501) 664-3498.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

From WA7ECY. . .worked KL7IBG in Ketchikan twice, Hank was in from 0251 to 0648 C.U.T. with signals at times peaking 10 over. Most contacts during this period were into California and Arizona. Scott says the band was in excellent shape in other directions too with contacts made during the same period into Iowa and South Dakota. "Most of the months (May) DX was concentrated to the southern half of the U.S. Nothing much to the Midwest or East coast and New England. Most of us in Oregon need W1 contacts for WAS. So far things have been slow and not too exciting." I am sure many of you would disagree with Scott's evaluation in view of the above.

Joe WB4OSN, says Florida has had some good openings to the West coast with W6ANN, WA6MHZ, K6ODV, K7PXI and K7TLO worked with nice signals. "On the morning of the 25th, while sitting and drinking coffee with Bob W4GDS, we listened to a fantastic opening to the West coast and Puerto Rico. The California stations were 40 to 50dB over as were the KP4's. We worked W1OOP/KP4 who had a 5-9 signal while running on TWO Watts." Joe says he has heard several stations say they did not have an address for KZ5OO and passes along the information. Send your QSL (with 1 or 2 IRC's) to Don KZ5OO, P.O. Box 2097, Balboa, Canal Zone.

Art WA1EXN, has his Laporte Rhombic up and estimates 27dB gain. The 249.93m (820') of wire is mounted on seven push-up TV masts and fed by 68.58m (225') of Belden #8290 twin lead to a balun at the transceiver. The whole thing is pointed at Boise ID with a slight overlap on Montana and Utah, the other states Art needs to complete the 48. Es have not been too great at this time of writing but expectations are high for June and July.

Another group formed to promote 6m is the SIX-SIX Club, Inc., with headquarters in Indiana. Contact the Secretary/Treasurer, Ted Winkel WB9AHJ, 607 East Street, Madison IN 47250 for an application form and further information. The club has over 100 members in seven call areas and publishes a newsletter which is available for an SASE.

Ray K5ZMS, reports SMIRK is over the 300 mark with members in 37 states and 10 countries. I am sure anyone even slightly active on the band is aware of the interest and activity the SMIRK organization has created. Ray requests that check and money orders sent with membership applications be made out to SMIRK rather than to him and mentions also that it is not necessary to send a QSL. Ray will be more than happy to QSL from Texas for those who need it but the QSL work load in addition to the membership certificate work is getting the best of him.

Ted WA9FEF, of SPESM says the three organizations mentioned above are forming a council to coordinate the programs of all three in order to better accomplish their common aims and invites similar organizations to join in their efforts to increase band occupancy, eliminate TVI and in general make 6m a better band.

WAØABI

SOLID STATE NEWS

In a recent editorial Wayne asked if there was anyone out there in Hamdon who would like to write a solid state column for us. The result: We were inundated with sample columns. Our minds were boggled and we couldn't reach a decision on which column to run. So we've decided to let you make the decision for us. Here are two columns. Next month we'll run more. Write and tell us which column you liked the best. We'll tally up the results and use the column that gets the best reader response.

William J. Vette K6TXR

Besides the well known advantages of life in California – anyplace in California – life in the San Francisco Bay area (southern peninsula) has many special advantages for anyone interested in the fantastic development of solid-state electronics. The Santa Clara Valley is now known the world over as "Silicon Valley." In the cities of San Jose, Santa Clara, Sunnyvale and Cupertino you will find the plants of most of the solid state manufacturers of the world, and fascinating new developments are practically everyday occurances.

Each month I will brief you on what new products the various manufacturers have announced.

Quad Op Amps And A Synthetic Transistor

To lead off, I called Art Fury WA6JLJ, the Linear Products marketing manager at National Semiconductor, to see what was new with them. I expected to hear some more about their new series of quad op amps (the LM139/LM239/LM339 quad comparators and the LM124/LM224/LM324 and LM3900 op amps). The last time I talked with Art he was quite excited about the advantages of these new ICs. The chips in this series each consist of four independent operational amplifiers or comparators, with numerous advantages over most previous op amps. These quad devices are made to operate over a wide range of supply voltages (2-36Vdc) from a single voltage source, or from separate positive and negative supplies such as are required by most other types of op amps. These chips feature very low current drain, extremely low bias current, and the output is fully compatible with TTL, DTL, ECL, MOS and CMOS logic systems. All in all, an extremely interesting lot of chips, with numerous applications to ham uses such as active filters, oscillators, pulse generators, time delay generators and a host of other interesting circuits. A great bargain, even if you don't use all four of the amps on the chip. The price of the LM3900 is only 75 cents in lots of 100!

That wasn't the device Art wanted to talk about this time. He was all excited about National's new transistor which is not a transistor. The LM195/LM295/LM395 is an IC which pretends to be a PNP power transistor – and an FET, at that! The masquerade is so complete as to include packaging in a standard TO-3 transistor case, with a pair of pins for base and collector connections. The emitter is connected to the case and will be grounded in most applications. The LM195 refuses to act like a transistor, however, in one important characteristic – it is practically indestructable. Excessive voltage will destroy it, but it incorporates complete overload protection; current limiting, power limiting and thermal overload protection are all included on the chip. Those of you who are accustomed to thinking of transistors as "3-legged fuses" will have to find another description for this one.

The device will deliver load currents in excess of 1A, and can switch 40V in 500ns. Its high input resistance makes it a very handy transistor for use as a high power op amp, and it has numerous other applications to circuits of interest to us hams. It can be handily applied to variable from about 4–35V at an amp of current, or to a high current solid state relay, or any other circuit where you need an indestructable 1A transistor. Since the high impedance input allows long time delay circuits with reasonable values of capacitance and resistance, I am going to put the LM395 to use in a photo timer circuit. The LM395 goes for about $7.50 in single unit quantities, and about $4.95 each in lots of 100.

Temperature Transducer

Another fairly new National IC I was able to get some data for is the temperature transducer IC, the LX5600AH/LX5600H or LX5700AH/LX5700H. This chip, in a TO-5 package, includes a linear temperature sensor, an amplifier and a stable voltage reference. The output of the chip is a temperature reading, in degrees Kelvin, over a range of -55°C – 125°C ±4°C. The current price of this chip (around $40.00) will have a limiting (or should we say cooling) effect on ham interest in it, but it is predicted that within a year the price will be down to a figure which will have us all designing indoor-outdoor thermometers, pyrometers and all sorts of other interesting temperature measuring devices.

For additional information, prices or applications of any National semiconductor products just drop a line to the advertising department, *National Semiconductor Corp., 2900 Semiconductor Drive, Santa Clara, CA 95051.*

Improved Function Generator

Among the new products at Exar Integrated Systems in Sunnyvale CA is an improved function generator IC, the XR2206/XR2306. This is an evolutionary development based on the XR205 function generator which Exar introduced some time back. The XR2206/XR2306 does a much better job than the XR205, and the XR2306 will probably sell for less money. Sine wave output of the XR2306 (the "industrial" and lowest priced version) exhibits less than 3% distortion without adjustment and can be adjusted to give less than 1.5%; the XR2206 is an order of magnitude better (2% and 1% vice 3% and 1.5%) but sells for about 2½ times as much. Square, triangular and sine waves are available from these generators, at frequencies up to slightly more than 1MHz.

A function generator kit, consisting of a PC board and two XR2306 ICs (one for the function generator and the other for a modulator) will be available soon from Exar for about $12.00.

For additional information about these or other Exar Products, write to *Leonard A. Greene, Product Marketing Engineer, Exar Integrated Systems, Inc., 750 Palomar, Sunnyvale CA 94086.*

K6TXR

Jim Trulove WB5EMI

In this fascinating world of electronics, new solid-state devices are being introduced almost as fast as they can be conceived. Keeping up with new developments can indeed be a very time consuming job. IC complexity is increasing, as are gain, frequency response, and power handling capabilities of discrete transistors. Whole technologies are being born virtually overnight, accompanied by a myriad of "alphabet soup" anachronyms – CMOS, MNOS, ECL, I^2L, VLSI, PMOS, EFL – the list goes on and on. While not all of these technologies impinge directly on the amateur radio community, a fair majority will eventually find their way into our circuits.

What we modestly hope to do in this space each month, is give you some introduction to new solid-state developments that appear to be of ultimate use to hams. For those of you that avidly experiment with your own circuit designs, this column should give you a head start on the latest new devices. Others will have

the opportunity to become conversant with new technology as soon as it arrives on the electronic scene. General principles and characteristics of solid-state developments will comprise the bulk of material. Detailed designs and specific circuit applications for the new devices will be covered in the format of complete articles.

We'll start by covering a few specific developments in integrated circuits. As you may have noticed, the traditional dividing line between digital and linear (or analog) is waning thin. Not the least of the new progenies of the digital world is a new dual voltage-controlled oscillator (VCO) in Texas Instruments' Schottky TTL line. Dubbed the SN74S124, the VCO can be varied from -35 to +75% of the nominal center frequency set by a fixed capacitor. The center frequency can be anywhere between 0.12Hz and 85MHz. The foremost feature of the VCO is a frequency range input which allows the oscillator frequency range to be varied from ±1% to over ±100% of the center frequency. Further, a synchronous enable input allows you to turn the output pulses on or off in as little as 70ns. The circuit can be crystal-controlled and is available in a 54S military version for precision work. This is one circuit that should find immediate application in phase-locked-loop frequency synthesizers, FSK generators and manual VCOs. It has a high enough frequency range to be used to generate direct FM on 6m, or through a x2 multiplier, on 2m. Another handy application might supply a variable 45MHz local oscillator injection for your 2m receiver. Best of all is the price – under $4.50 in singles. Check with your local TI supplier.

Another new type of linear/digital device that is making waves is the CMOS analog switch. In the analog switch, the series resistance, drain to source, of a MOS transistor is varied by a control voltage input from an "on" low of about 300Ω to an "off" high of several megohms. The switching can take place quite rapidly, thus making an ideal analog multiplexer. An example of this type of IC is RCA's CD4016 QUAD Bilateral Switch, which can handle a 15V peak-to-peak signal at switching rates to 10MHz. Siliconix makes a pair of similar devices, the DG200 Dual SPST Switch and the DG201 QUAD SPST Switch. Any of the control inputs may be ganged to yield up to a 4-pole switch. Gain control is possible by varying the control voltage.

Analog switches and multiplexers can be used to advantage to mix or alternately inject different signals into a common output path. One typical application might be a logic controlled audio mixer for a repeater, bringing together code or voice ID, time announcements, and receiver audio, perhaps from several receivers in a voting-scheme.

A new solid-state technology, charge-coupled devices (or CCD's), is beginning to challenge conventional vidicons and orthicons in miniature TV cameras. The CCD image-sensing arrays being developed by Fairchild Semiconductor utilize a multiphase clock signal to transfer charge packets off the chip. Individual charge packets are proportional to the amount of light falling on each sensing element. The technology was originally introduced with a linear 500 element sensor, and has recently been joined by a 100 x 100 area sensor array, the CCD-201. The 10,000 silicon photosensor elements are in a 4:3 aspect ratio and require only 50mW from a 20V supply. Fairchild has constructed a television camera with the CCD-201 that is about half the size of a pack of cigarettes! Since the device is already digital in nature, it lends itself rather well to slow speed scan conversion. This should be great news for slow scan enthusiasts who could scan the array at a slow rate for direct slow scan transmission.

At present the CCD-201 is priced at around a kilobuck, but this should change quite rapidly with volume production. After all, the first calculator chip was initially priced way up there, but chips can now be bought for well under $10.

If you want more information about any of the above new devices, write directly to the manufacturers at the following addresses: *Texas Instruments, Inc., Inquiry Answering Service M/S 308, P.O. Box 5012, Dallas TX 75222; RCA Solid State Division, Box 3200, Somerville NJ 08876; Fairchild Semiconductors, 313 Fairchild Dr., Mountain View CA 94040; Siliconix Inc., 2201 Laurelwood Rd., Santa Clara CA 95054.*

WB5EMI

DX IS AMATEUR RADIO . . .EVERYWHERE

There are countries which belong to the ITU and in which the only amateur operation is DXing. And when the one or two or the handful of amateurs in that country turns on his rig, he's DXing.

Take Nepal. . .9N1MM operated by Father Moran has been the only amateur activity there for some years. Or Sudan. . .where ST2SA operated by Dr. Sid Ahmed Ibrahim is the only Sudanese station on the air. Pitcairn Island maintains its weekly contact with the outside world through VR6TC operated by Tom Christain. In Cambodia there is XU1AA and XU1DX, in Viet Nam it is XV5AA and XV5AB. These stations are operated by DXers and they are the only amateur activity in those countries. You can check Macao, or Sarawak or Brunei. You can check St. Helena Island and the Falklands and Tristan de Cunha and you will find that DXing is the amateur activity. And in Sikkim, AC3PT the only station on the air there is operated by the prince who rules the country. In Jordan King Hussein signs JY1 and a check of any call-book will show many calls in the Arabian Peninsula countries where the holders name is preceded by 'Prince' or 'King.' In many countries DXing is the only amateur activity and there is nothing else.

There is an International Frequency Conference set for 1979. There will be representatives from member countries of the ITU and among the things that will be discussed will be the amateur frequencies. When a DXer from the U.S. encounters a DXer from another country there, they will speak a common language. But what about the others?

There are those among us in amateur radio who say that DXing has been overblown. That there has been too much emphasis and that it should be de-emphasized. To believe this would be to believe that the one activity that is common to amateur radio in every country that is signatory to the ITU treaties is not an especially important activity and should be down graded.

Perhaps it is felt that the emphasis properly should be on traffic handling. Perhaps at an ITU meeting it would be well to talk of traffic nets and phone patches and those many other activities peculiar to the U.S. It might be well to speak about such things as the National Traffic System and the Transcontinental Net. . .or the myriad of other traffic nets. It might be well to talk about these but the question must be asked as to whether one would find a responsive ear.

If one talks with someone from without Region II of the IARU, you would be speaking about something that is not legal in most countries of Region I and III. Third party traffic on amateur frequencies is absolutely illegal in many countries which are signatories to the ITU treaties.

So it is DXing which may be the only amateur radio activity which is common to any member country of the ITU which allows such amateur activity. There are those who say that OSCAR or AMSAT is the future of amateur radio. If this be true it may

be a distant future for presently amateur radio lacks and probably will always lack the awesome capability needed to put a transponder in earth-orbit. And until amateurs are able on their own to launch their own packages into orbit and to be totally independent of any other agency or activity, there must be some reason to feel that these are parasitic efforts which depend on someone else for an essential part of the effort.

But at the same time DX can be achieved with a simple rig and a simple dipole. It can and it has and it will.

There are some amateurs who get up tight over Citizen Band operators and some of the things they hear on the CB channel. Often they are strong in their condemnations of matters they consider to be extra-legal and improper. One would wonder what might be the reaction of a delegate to an ITU conference from a country in Region I or III when they consider the traffic handling systems that are active on amateur bands within the U.S.

Perhaps the emphasis has been wrong. Take a look at the multitude of amateur station appointments available for traffic work. There is the Official Phone Station and the Official Relay Station. The Phone Activities Manager is a 'leadership' post or organize phone traffic nets and the Route Manager organizes the CW traffic nets. There is the National Traffic System and the various regional traffic systems with official status, and there are the multitude of area traffic nets.

All of these exist. . .and all are devoted to an activity which is illegal on amateur frequencies in most countries of the world. But that activity that is legal everywhere. . .and which is the only amateur activity in many countries that belong to the ITU, that activity is considered in some sectors as 'overemphasized.'

Many are beginning to worry about 1979 and the way amateurs may fare at the allocation of frequencies by the ITU treaties. Many have their own panaceas. . .many of which have been tried before.

Perhaps it is time to consider how amateur activities within the U.S. look to other countries. Each month QST lists over many pages those activities which are illegal over two thirds of the earth. DX plods it way along. . .short on attention and encouragement. But it survives.

DX is Amateur Radio. . . Everywhere!! Can you name other activities which can say that?

There are none.

Hugh Cassidy WA6AUD
Reprint WCDXB

LETTERS

ou goons don't ever proofr
l as
bunch of rocks
you ignored my comments in
I insist that you print ev

NUDE COVER

I can't say that I was shocked when the June issue of 73 appeared in my mailbox naked, but I was displeased at the battered and folded condition of the cover not protected by the usual brown wrapper. In these many years I have never received an issue of 73 that had been damaged in the mails, and now I find myself buying a newsstand copy so I can have a decent one for the collection. No doubt taken as an economy move, your deletion of this protective cover seems to be a mistake. I'm sure that your staff doesn't like to put together a nice photographic or artistic cover and then have an address label stuck on the middle of it, or have you seen a magazine that has gone through the mails the way we all get it? Please reconsider the brown wrapper as being a small but worthwhile expense.

J.R. Johnson WA5RON
Austin TX 78751

Sorry about that. Nothing to do with economy at all. The only way we could get the issue into the mail during the strike at the printer was without wrapper — and even so it came out two weeks late! This issue should be wrapped again. . .wayne.

HE DOESN'T LIKE US

I did not like the cover of the May issue of 73. I have not liked some of the other issues that tried to be a sex cover magazine. If I want a sex magazine I will buy one. Please get back to HAM RADIO.

Dick Wright

The May cover was not a sex cover. . .ed.

READER DEMANDS

Please be informed that I intend to cancel my husband's subscription unless you show the front of the streaker of your May issue on a forthcoming magazine.

Mrs J. B. Smith
XYL/W6REI

SCOUTS WANTED

An attempt is being made to locate as many Boy, Girl and Adult Scouters that hold amateur radio licenses for the promotion of Internation Radio Scouting. Would anyone interested please contact me. Thank you.

Don Wibel K9ECE/WI9BSA
5115 Delaware Ave.,
Fort Wayne IN 46805

WHY NOT MORE FIELD OFFICES

I was reading the aritlce in June's 73 by W6HEC concerning paying $9 for re-application of a ham license. Well at the present time I am a novice, and I don't think I would mind paying the fee if it was put to better use. Why doesn't the FCC establish more field offices throughout the country?

When I was living in Altoona PA, I would have to drive to Pittsburgh — 2 hours each way — so that I could take an exam once every three months. To take it during any week I would have to drive to Philadelphia — 12 hours round trip.

I have just moved to Cleveland OH. I don't have the long drive now, but I can still only take it once every three months, or drive to Detroit MI — about 5 hours each way.

I am sure there are many novices and other hams trying to obtain a higher class license throughout the country who have worse problems than this.

Greg Haines ex/WN3TJU/8
Cleveland OH 44133

The FCC is not unaware of your problem and they are indeed working on a solution. Instead of a handful of FCC offices giving the amateur exams, they are now experimenting with having the Civil Service administer the exams — and this could result in about 1000 examinating offices. A test is now being run with Civil Service offices in five areas to see what bugs develop.

WELL DONE

As a charter member of the "Hate Wayne" fraternity, it hurts me to say, "Well Done!"

First, I don't like to write fawning letters just to get your approval, so I won't sign it (and also protect myself from the IRS Gestapo).

My resistance began to crack, when I realized that, "By golly, he does turn out a good magazine with some good technical articles and not all that crap about contests and clubs, etc."

Then came the diatribes about the IRS and FCC/Walker. I thought that the IRS articles especially had no place in a radio publication. Then I realized that if we let the IRS go unchecked, we won't have any free-

Cont'd on page 106.

P. G. Martin G3PDM
Oak Cottage
Witton Gilbert
Durham, England

SOME DIRECTIONAL WATTMETERS AND A NOVEL SWR METER

Most conventional reflectometers cannot be used for accurate power measurement because their sensitivities are frequency dependent. This is due to the use of combinations of reactance and resistance in the sampling circuits which detect the transmission line current and voltage.

This basic problem can be solved by the use of conventional lumped components instead of the distributed parameters of a transmission line. The line voltage can be sampled by two resistors or two capacitors used as a voltage divider, rather than one resistor and some distributed capacitance.

The line current can be monitored by a properly designed current transformer instead of an inductance and resistance. High frequency current transformers consist of primary and secondary windings on a ferrite or iron dust toroidal core, with a low value of load resistance across the secondary winding.

All SWR bridges and directional wattmeters need to generate two dc voltages proportional to the forward and reflected voltages or currents of the transmission line. To achieve this one has either the current detector or the voltage detector providing two antiphase signals so that addition and subtraction can be performed.

A Frequency-Independent Directional Wattmeter

M. B. Allenson G3TGD, has designed a wattmeter using the above principles, where the low resistance in the current transformer secondary circuit is split into two equal parts. The center connection is taken to the voltage sampling point so that sum and difference voltages are available at the ends of the transformer secondary winding, see Fig. 1.

With two meters, this circuit can be used as a versatile calibrated directional wattmeter over the freqnecy range 100 kHz to 70 MHz, with an accuracy of about 10 per cent. Precise calculations of SWR and transmitter efficiency can be made.

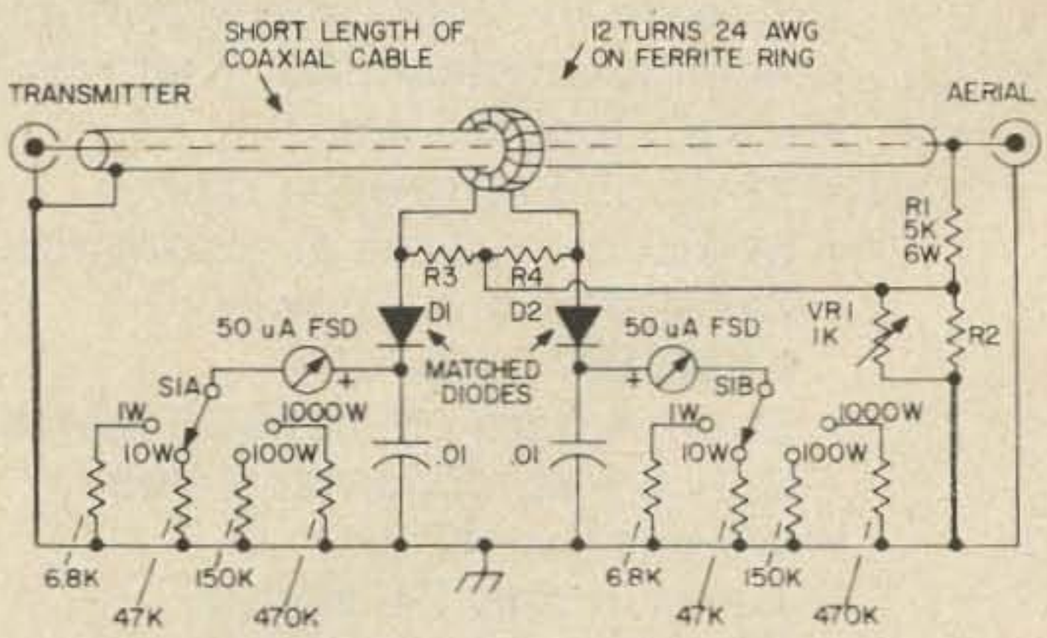
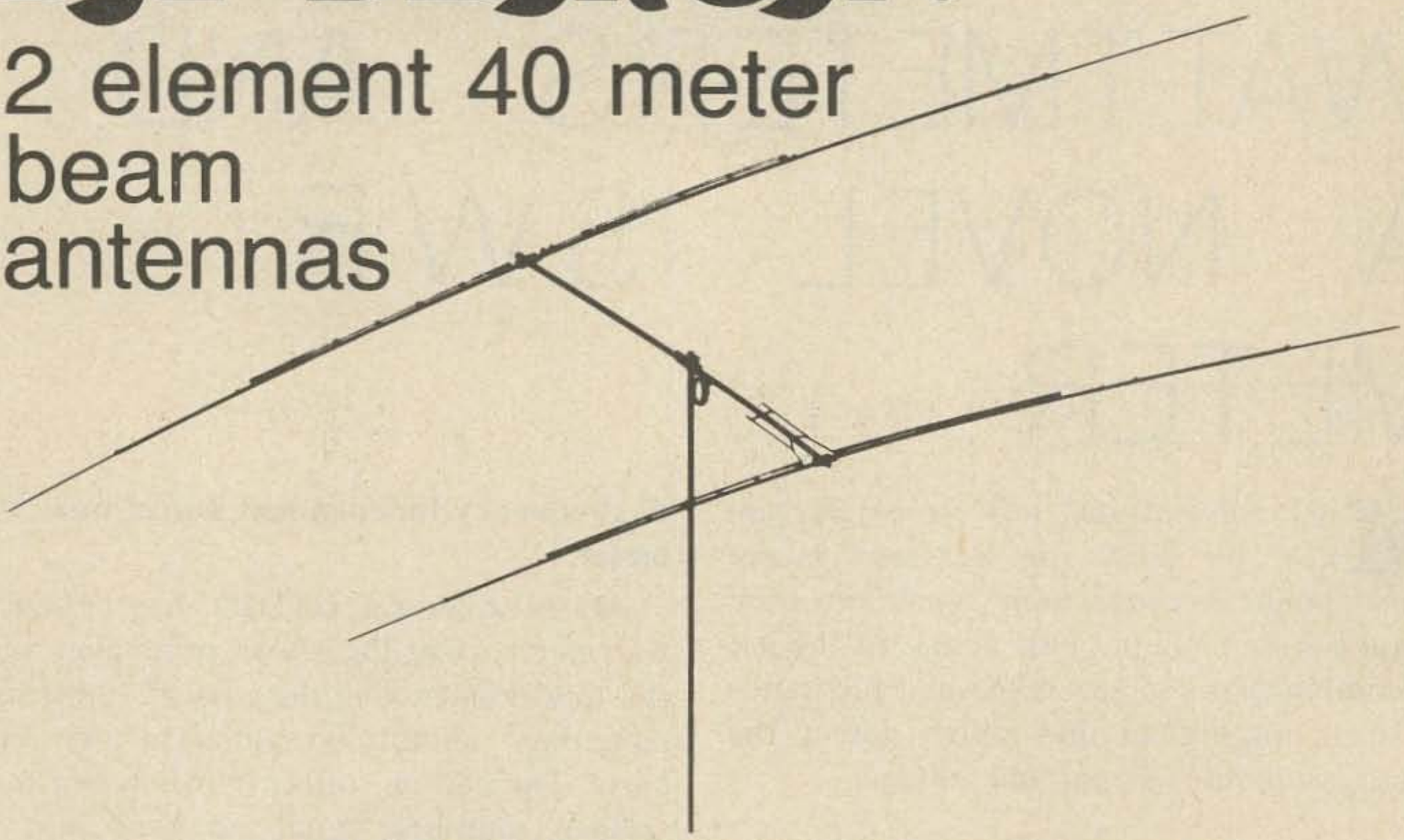


Fig. 1. Circuit of the basic frequency-dependent directional wattmeter due to G3TGD. The two meters indicate forward and reflected powers.

Maximum sensitivity with a 50 μA meter is less than five milliwatts, but with the

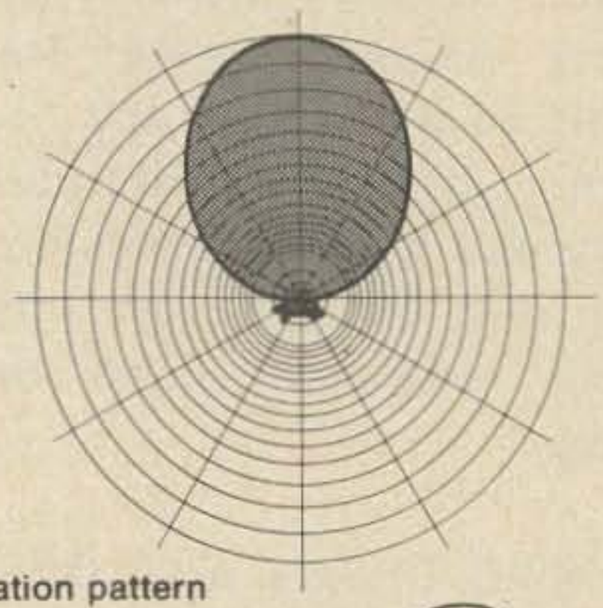
402BA
DX-DEMON!

2 element 40 meter beam antennas



Shed unwanted QRM and Foreign Broadcast signals with a 25 db front-to-back. Work stations you never knew existed. Let the Hy-Gain 402BA help you make 5 Band DXCC and 5 Band WAS. Designed with only one objective...optimum performance in a small package, the 402BA offers mechanical and electrical superiority at an affordable price. A unique linear loading stub delivers maximum performance without the loss of center loading coils. Can be easily stacked with tri-band or 20 meter beams and requires only 10′ separation. The exclusive Hy-Gain Beta Match gives positive DC ground to drain away precipitation static. For best results, use with Hy-Gain BN-86 Balun.

- 4.9 db forward gain.
- 12-25 db Front/Back ratio.
- SWR 1.5:1 or less at resonance.
- Takes maximum power, 1 KW AM, 2 KW PEP.
- Boom length 16′, longest element 43′.
- Only 6.5 sq. ft. surface area.
- Weighs just 47 lbs.
- Turns in only 24′ radius.
- DC grounded, driven element.
- Wind survival—80 mph.



Actual radiation pattern

Order No. 397

For prices and information, contact your local Hy-Gain distributor or write Hy-Gain.

hy-gain

Hy-Gain Electronics Corporation; 8601 Northeast Highway Six; Lincoln, NE 68507; 402/464-9151; Telex 48-6424.
Branch Office and Warehouse; 6100 Sepulveda Blvd., #322; Van Nuys, CA 91401; 213/785-4532; Telex 65-1359.
Distributed in Canada by Lectron Radio Sales, Ltd.; 211 Hunter Street West; Peterborough, Ontario.

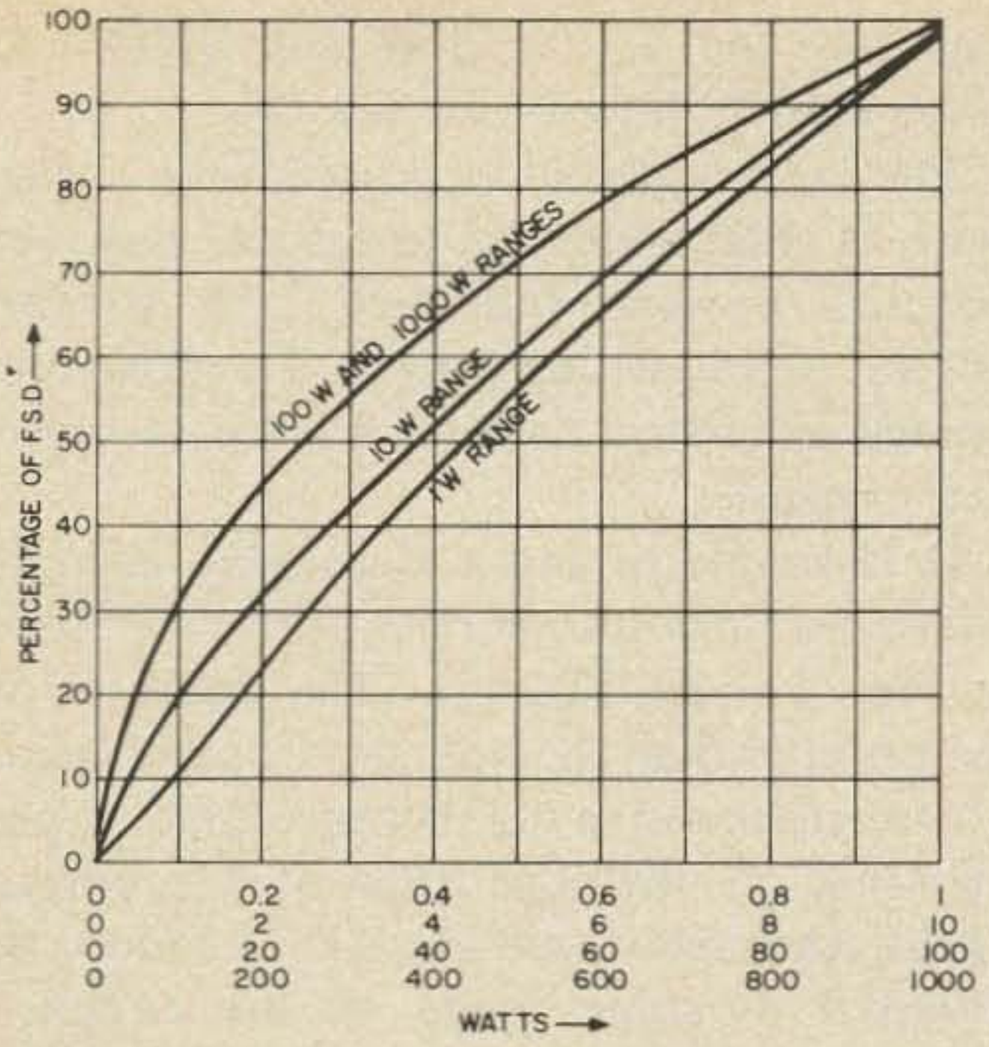


Fig. 2. Calibration curves for the instrument described in Fig. 1.

multiplier resistors specified in Fig. 1, full scale deflection corresponds to power of 1, 10, 100 and 1000 watts. Calibration is non-linear, because the instrument samples voltage, and power is proportional to voltage squared.

Unfortunately, two transmission line impedances are in common use in coaxial systems: 50Ω and 75Ω. As it is not possible

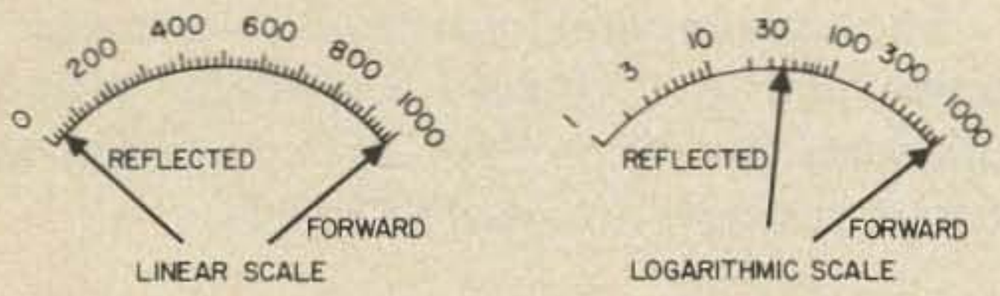


Fig. 3. Linear and logarithmic scales. The inherent advantages of the logarithmic form are immediately obvious.

to design instruments whose sensitivities are independent of line impedance, some component values must depend on the impedance in use. For simplicity, only one of the voltage driver resistors need be changed, but instrument calibration will be different. By changing the current transformer resistors as well as one of the voltage divider resistors, the calibration is the same for both line impedances. This technique has been adopted here, and the calibration curves in Fig. 2, are correct for 50 or 75Ω lines provided the resistor values in Table I are used.

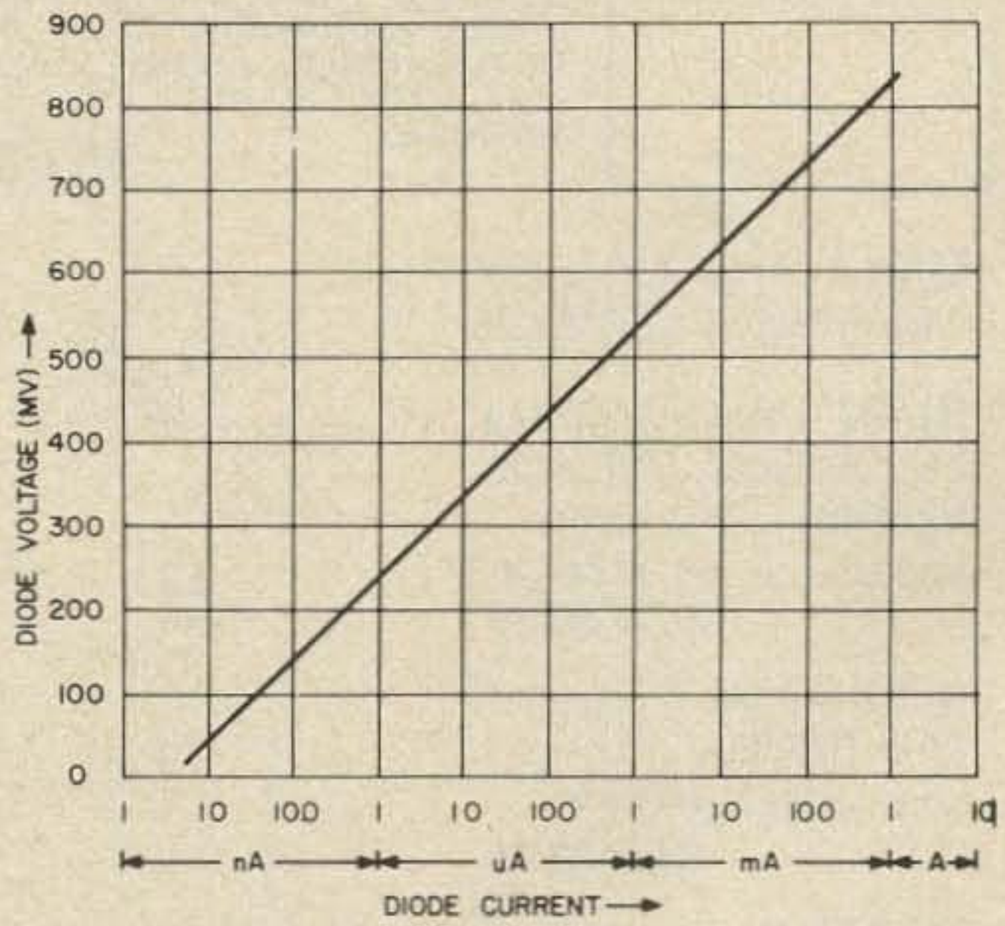


Fig. 4. Smoothed experimental plot of the current /voltage characteristic of a 1N4002 silicon junction diode, showing its logarithmic properties.

The Logarithmic Wattmeter

The basic instrument can be simplified by including a logarithmic network so that the power range switch is redundant and a single meter scale can be used for powers from, say, one watt to 1000 watts. A logarithmic

scale has the 1, 10, 100 and 1000 watt points equally spaced (see Fig. 3).

The advantage of a logarithmic instrument is that one can measure very low reflected powers and very high forward powers simultaneously with the same percentage accuracy, without having to switch meter ranges.

It is simple to add a reasonably accurate *wide-range* logarithmic network to the meter in Fig. 1 (see Fig. 5). The basis of its operation is that the voltage dropped across a forward-biased p-n junction diode is proportional to the logarithm of the current passing through it (see Fig. 4). To reduce the potential dynamic range of the circuit, a relatively insensitive meter is used, and a small resistance is added in series with the logarithmic diode to restore a logarithmic form to the scale (see Fig. 6).

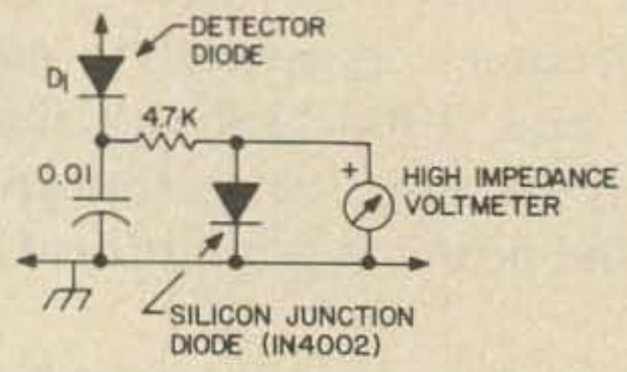


Fig. 5. Basic wide-range logarithmic converter.

An experimental logarithmic wattmeter is shown in Fig. 7. Figure 8 gives the calibration scale for 50 or 75Ω lines, provided the correct resistors are used (Table I).

A Direct-Reading SWR Meter

A particularly useful device would be an instrument giving a direct measurement of the standing wave ratio on a transmission line, independent of the absolute power levels or the frequency in use. Such an instrument, with its single meter, would be ideal for incorporation into transmitters and transceivers (especially with the physically small sampling circuits associated with it).

The swr can be expressed in terms of the forward and reflected voltages according to:

$$\text{swr} = \frac{E_f + E_r}{E_f - E_r} \qquad (1)$$

We wish to generate this function electronically, so that outputs of the two detec-

Table I

	Ω	Ω
Line impedance	50	75
R3 and R4	27	33
R2	220	180

Values for R2, R3 and R4 to be used in 50 and 75Ω transmission lines.

tors can be used to generate a meter current proportional to SWR. This would be rather tedious, though not impossible.

Conveniently, manipulation of equation (1) shows that:

$$\frac{E_f}{E_r} = \frac{SWR + 1}{SWR - 1} \qquad (2)$$

which although not proportional to SWR, is a mathematical function of it only. Electronic division of E_f by E_r is easily done by taking logarithms and subtracting. That is:

$$\log \frac{E_f}{E_r} = \log E_f - \log E_r$$

In Fig. 9, the two silicon diode voltages are proportional to the logarithms of their currents, which in turn are proportional to the forward and reflected voltages. The two diode voltages can be subtracted directly by connecting a meter between them, rather than from each one to chassis.

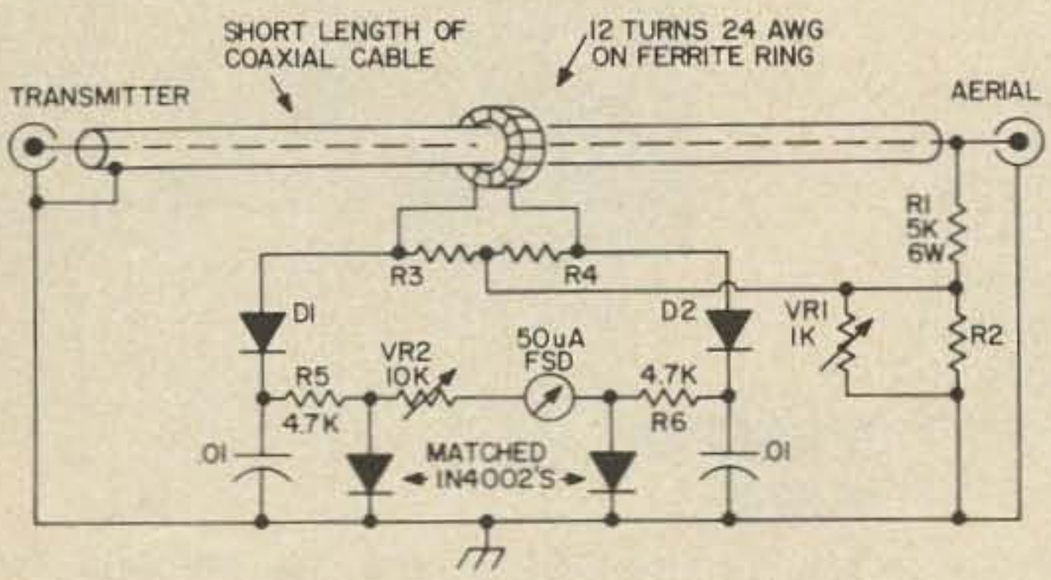
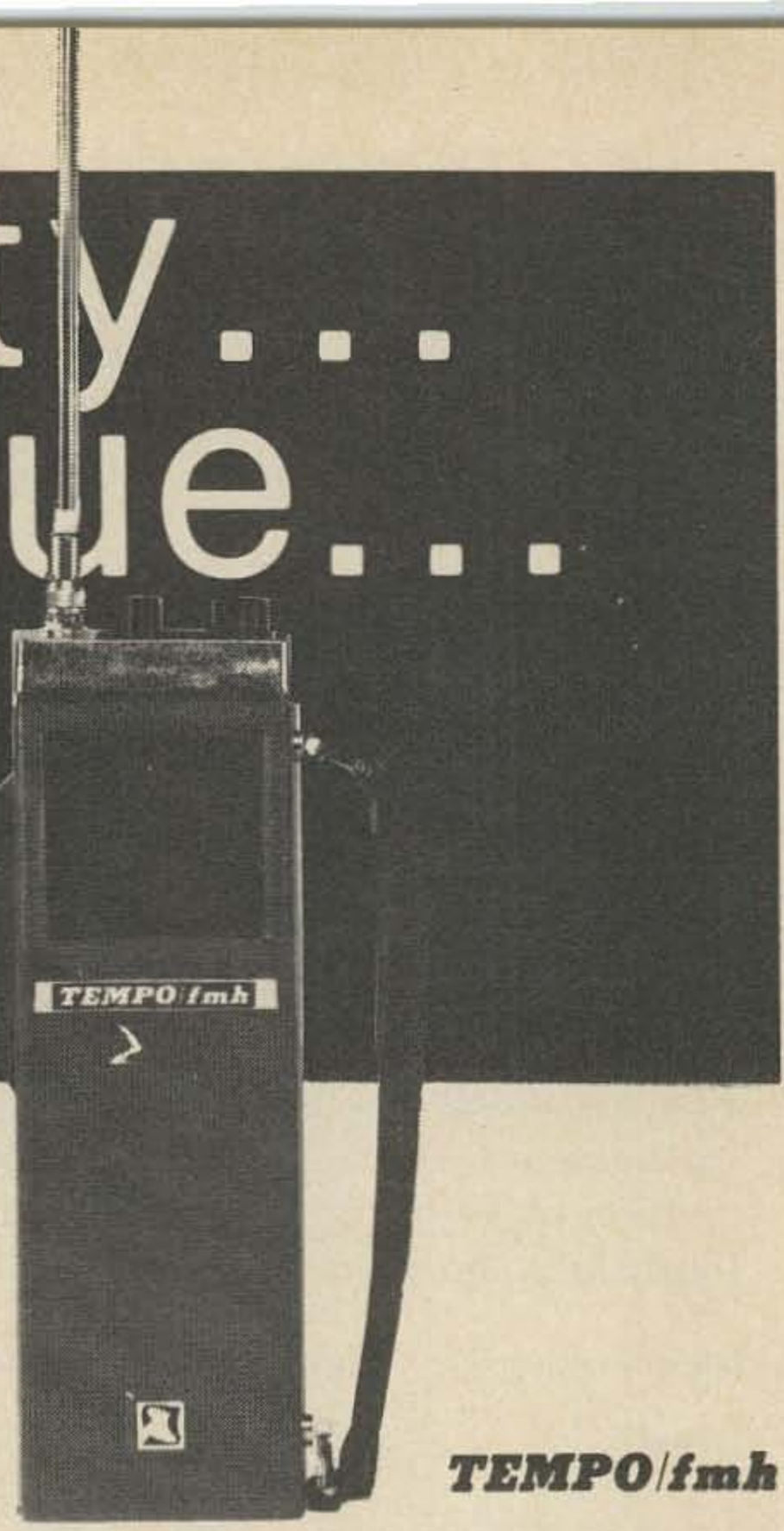


Fig. 6. Circuit of the logarithmic directional wattmeter. D3 and D4 are matched (see text).

The meter cannot be calibrated linearly in SWR, because of equation (2), and because the circuit does not take anti-logarithms after subtracting the logarithms. The outcome of this is beneficial: the SWR meter is increasingly sensitive as the standing wave ratio approaches 1:1. This is where one wants most sensitivity: to make the final

top quality... top value... fm by tempo



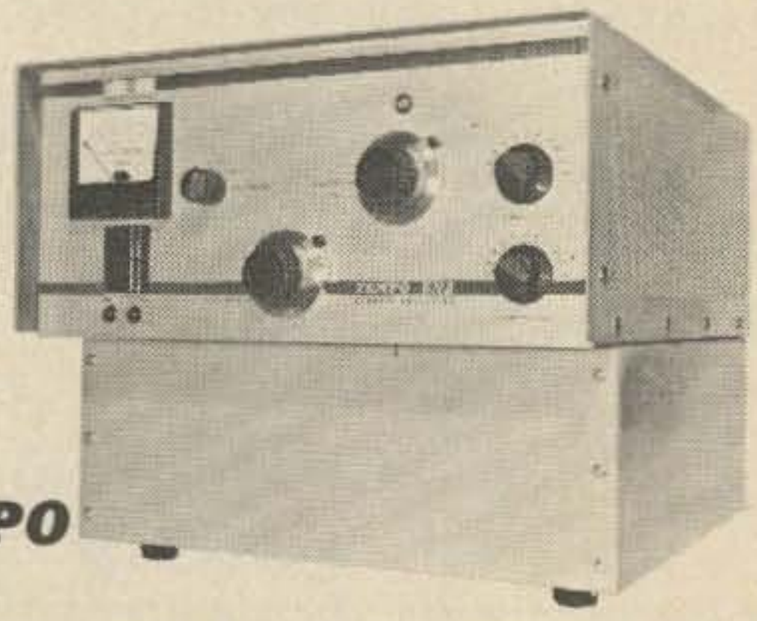
Tempo's Commercial Line VHF transceivers offer commercial performance at amateur prices. Compare these transceivers with any other available. Compare their performance, their quality of construction, their ease of maintenance, and then compare prices. Your choice will have to be Tempo.

TEMPO/fmh

So much for so little! 2 watt VHF/FM hand held. 6 Channel capability, solid state, 12 VDC, 144-148 MHz (any two MHz), includes 1 pair of crystals, built-in charging terminals for ni-cad cells, S-meter, battery level meter, telescoping whip antenna, internal speaker & microphone. $199.00

TEMPO/CL 146

The CL-146 offers operation on the 146 MHz amateur band. The price includes a microphone power cord, mounting bracket and one pair of crystals. A full line of accessories is also available. • 12 channel capability • 13 watts or a power savings 3 watts • All solid state, 12 VDC • 144 to 148 MHz (any two MHz without retuning) • Supplied with one pair of crystals • RF output meter, S-meter, receiver detector meter • Provisions for external oscillator • Monitor feature • Audio output at front panel •Internal speaker • The Price: $299.00



TEMPO 6N2

The Tempo 6N2 meets the demand for a high power six meter and two meter power amplifier. Using a pair of Eimac 8874 tubes it provides 2000 watts PEP input on SSB and 1000 watts input on CW and FM. Completely self-contained in one small desk mount cabinet with internal solid state power supply, built in blower and RF relative power indicator. $695.00

TEMPO/CL 220

As new as tomorrow! The superb CL-220 embodies the same general specifications as the CL-146, but operates in the frequency range of 220-225 MHz (any two MHz without retuning). At $329.00 it is undoubtedly the best value available today.

TEMPO VHF/UHF AMPLIFIERS

Tempo offers a broad line of FM power amplifiers. Rugged, dependable and all solid state. Outputs from 30 to 120 Watts.

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

AVAILABLE AT SELECT DEALERS THROUGHOUT THE U.S.

Prices subject to change without notice.

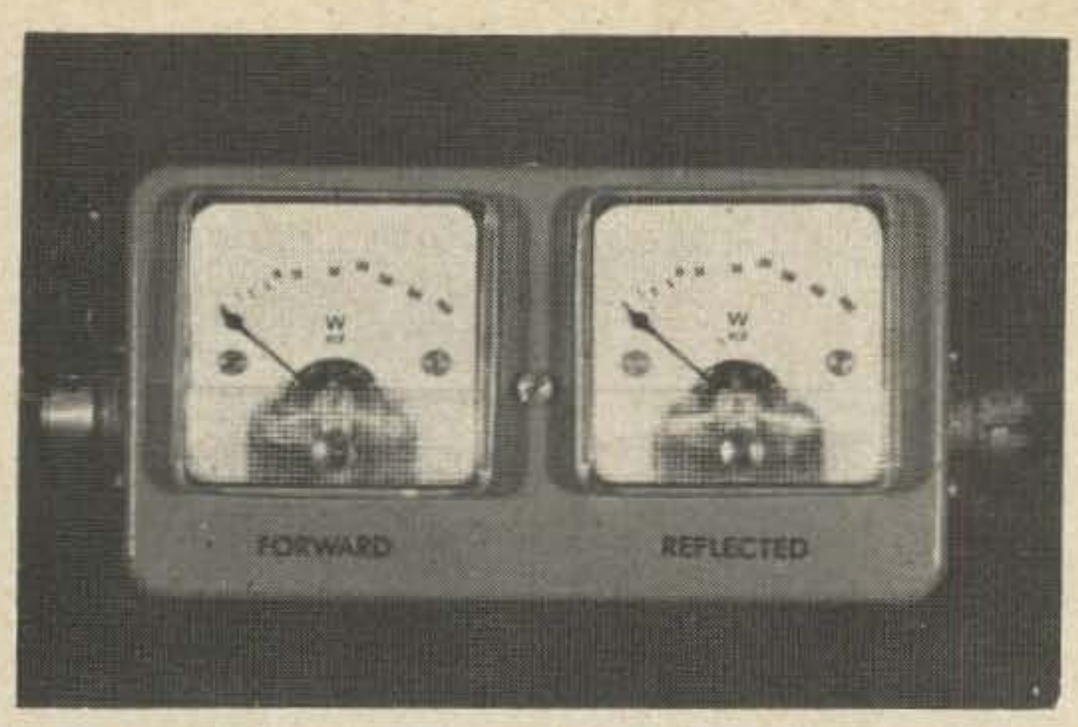


Fig. 7. An experimental logarithmic wattmeter.

adjustments to aerial arrays, to measure the variations in SWR over a band, and so on. Fig. 10, shows a calibration curve for SWR meters. Naturally the meter sensitivity cannot be completely independent of the power level in use. Accuracy falls when the reflected power is less than about half a watt (this corresponds to an SWR of 1.05:1 when the forward power is 1 kW).

A differential amplifier could be added to the circuit of Fig. 9, to enable a less sensitive meter to be used.

Construction of the Instruments

Layout of the sampling circuits is fairly critical, see Fig. 11. The input and output sockets should be set a few inches apart, and

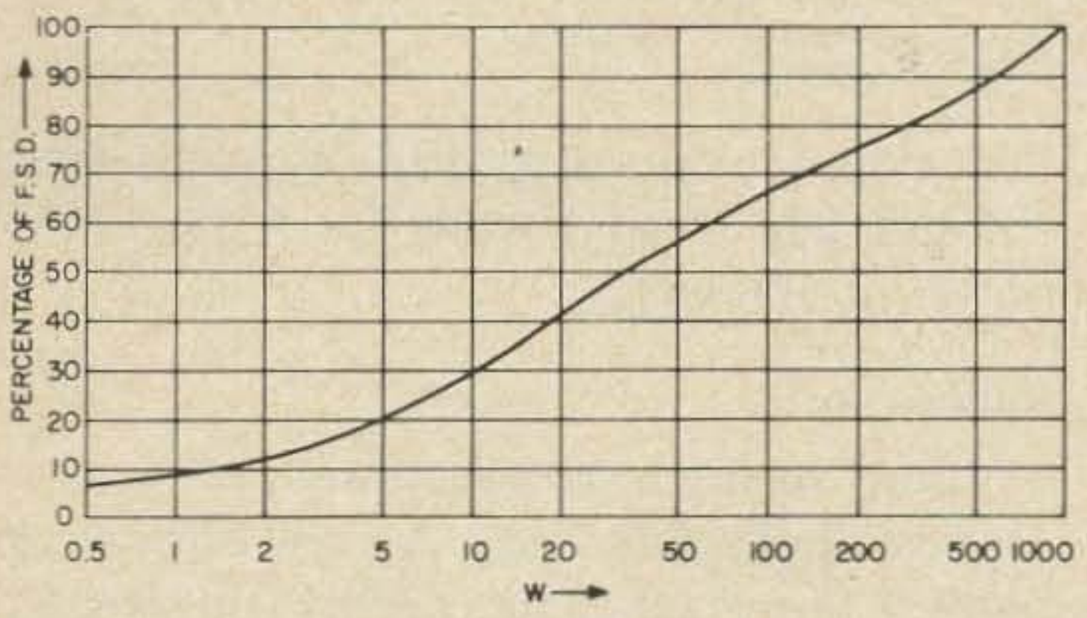


Fig. 8. Calibration curve for logarithmic wattmeters.

connected together with a short length of coaxial cable. The coax braid must be grounded at one end only, so that it acts as an electrostatic screen between the primary and secondary windings of the toroidal transformer. Twelve turns of 24 AWG enamelled wire, equally spaced around the circumference of the ring, form the secondary winding. The primary is formed by simply threading the ring onto the coax.

A suitable ferrite ring is the Mullard FX1596, made in England, although other types are suitable. The FX1596 has an outside diameter of half an inch, and is designed for wideband rf applications between 5 and 20 MHz. The main requirement is that the ferrite material should maintain a high permeability over the frequency range in use.

Other components in the sampling circuits should have the shortest possible leads. R1, R2 and R must be non-inductive solid carbon types; for high power levels (about 100 watts) R1 should consist of two or three 2 watt carbon resistors in parallel. VR1 should be a miniature skeleton potentiometer to keep stray reactance to a minimum, although it may be dispensed with by trying various fixed resistors for R2 until the reflected indication under matched conditions is zero.

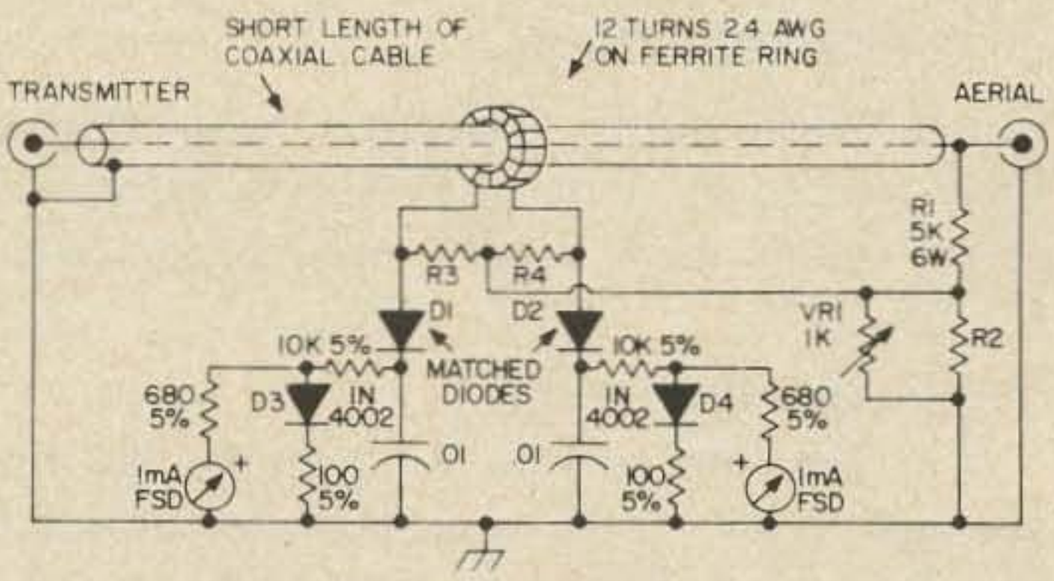


Fig. 9. Complete circuit for a power-independent, frequency-independent direct-reading SWR meter.

The detector diodes need to be matched for similar voltage drop, using the circuit in Fig. 12. Point contact germanium types with a PIV rating of 80 volts or so are recommended.

Logarithmic diodes should be modern medium-current silicon junction types, such as conventional rectifier diodes. The 1N4002 is specially recommended for its good logarithmic properties. Log diodes should also be matched with the circuit in Fig. 12.

The 0.01 μF decoupling capacitors should be a disc ceramic type.

In designing a toroidal transformer different to that specified, several factors should be borne in mind. As the number of secondary turns increases, the self-capacitance rises and causes the response to fall at high frequencies. Failure of this nature causes the reflected power indication to rise; in other

words the directivity of the instrument falls. If the 27Ω resistors are raised appreciably in value, the instruments will eventually become frequency sensitive.

The ratio of the voltage sampling resistors (R1 and R2) in the HF designs is determined by the sensitivity of the current sensing circuit, and the two sampling voltages must be equal in magnitude under matched conditions. VR1 provides fine adjustment of the ratio. Absolute values of the resistors can be

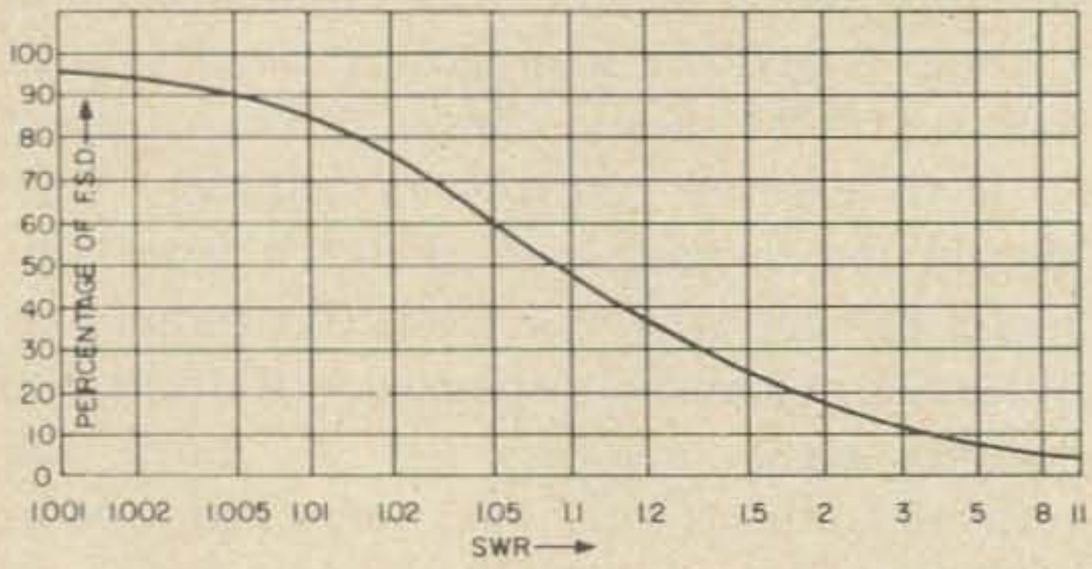


Fig. 10. Calibration curve for SWR meters of the type described in Fig. 9.

varied considerably, bearing in mind that as their values increase the stray capacitance across them may need to be compensated for.

Useful Equations

Let the line current be I amps, the line voltage be V volts, and the characteristic impedance of the transmission line be Z_o. Then $V = IZ_o$.

If the current transformer has a ratio of 1:n, and each of the resistors in its secondary circuit has a value of RΩ, then the rf voltage across each of them is given by:

$$V_{(i)} = \frac{IR}{n} \qquad (3)$$

The voltage detector output is obviously

$$V_{(v)} = \frac{VR_2}{R_1 + R_2} = \frac{R_2}{R_1 + R_2} IZ_o$$

Which is, to a good approximation,

$$V_{(v)} = \frac{R_2}{R_1} IZ_o \qquad (4)$$

The main design equation for all the HF instruments is therefore:

$$R_2 = \frac{R.R_1}{n.Z_o}$$

Fig. 11. Photograph showing layout of sampling circuits used in an experimental swr meter.

where the value for R2 includes the effect of VR1, if fitted.

The dissipation of some of the components specified is quite high. For those planning different circuits, the following equations express the dissipation of R1 and the current transformer resistors R:

$$W_{(R1)} = \frac{Z_o.W}{R_1} \text{ watts,}$$

where W is the transmitter output power.

$$W_{(R)} = \frac{W.r}{n^2.Z_o} \text{ watts.}$$

In the instruments described, $W_{(R1)}$ is about 5 watts, and $W_{(R)}$ 2 watts for a transmitter power of 500 watts.

Calibration

If any of the instruments are built exactly as described, and used in systems of the correct impedance, the calibration given in Figs. 2, 8 and 10 will be sufficiently accurate for most purposes. For those designing their own circuits, the following procedure is recommended.

Test equipment needed includes a high power rf source (a transmitter) and an rf voltmeter. The instruments can be calibrated with less accuracy without the rf voltmeter. The wattmeters are calibrated by feeding power through the meter into an appropriate dummy load (50 or 75Ω). VR1 is set for minimum reflected power indication, and the power scale is marked according to the rf

Hi SPIRE TOWERS

The Best Ham Tower

* Self-Supporting With A Tri-Bander (xx)
* 32' – 40' – 48' – 56'
* 3 Mounting Bases
* Heavily Galvanized

(xx) Limited to JR TriBander, unless guyed, on 56' towers.

SPIRE CONSTRUCTION

Heavy steel "beaded" channel design for exceptional strength –much stronger than tubular of same weight. "X" bracing & bridge type construction for exceptional torsional stability. Positive riveted construction & heavy galvanizing makes it exceptionally durable for minimum maintainance. Tapering design provides "nesting" shipment at lower cost to you, as well as lighter sections as you go higher, making it easier to erect.

THREE BASES: Rigid concrete (recommended base is 3x3x3' in firm soil, 32/40' models, and 4' deep on 48/56' models. **Hinged concrete** base provides option of lay-over, providing you have suitable "gin-pole" and tackle facilities. And the **EARTH ANCHOR** base requires no concrete and holds well in firm (clay, etc.) soil and may be relocated later.

A custom drilled rotor plate is provided that accepts all CDE rotors (AR22R, TR44, HAM-M) and also the HY-GAIN with slight enlargement of bolt holes. A friction thrust (lateral) bearing is included.

$109.95 (A) 32 FOOT TOWER

"THE BEST TOWER VALUE!"

BANKAMERICARD

master charge

TOWERS WITH RIGID CONCRETE BASE

A	32'	133 lbs.	$109.95
	40'	175 lbs.	$139.95
	48'	243 lbs	$189.95
	56'	308 lbs.	$249.95

TOWERS WITH HINGED CONCRETE BASE

B	32'	147 lbs	$119.95
	40'	189 lbs	$154.95
	48'	248 lbs	$204.95
	56'	313 lbs	$259.95

TOWERS WITH EARTH ANCHOR BASE

C	32'	191 lbs	$149.95
	40'	233 lbs	$179.95
	48'	390 lbs	$299.95
	56'	455 lbs	$359.95

"T" wrench to drive anchors (8 lbs.) 9.95

Includes anchor base and anchors (anchor bases require no concrete). Earth anchors screw into the ground and hold well in firm soil. May be removed and relocated later.

"HI-SPIRE" towers shipped truck collect from Indiana.

NOTE! ADD 10% TO PRICES SHOWN FOR WEST COAST – Ariz. –Colo. –Wyo. –Mont. and all states West of these.

Hi Hobby Industry

Box 864–Council Bluffs, Ia. 51501

CALL: Tues. to Sat.–Noon to 5PM.

(712) 323–0142

AL McMILLAN..... WØJJK

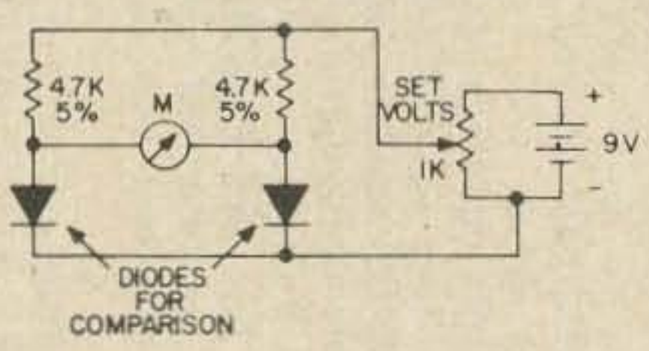


Fig. 12. Hookup circuit for matching detector diodes for equal forward voltage drop, and silicon junction diodes for similar logarithmic properties. The meter should be as sensitive as possible (say 50 μA fsd), and should not deflect appreciably as the voltage is varied between zero and nine volts.

voltage appearing across the load. If an rf voltmeter is not available, a peak-reading type can be made with a diode, capacitor and dc voltmeter. As the detector output is equal to the peak rf voltage applied to it, equation (4) leads to:

$$V_{(det)} = 2.8\ V \frac{R_2}{R_1} = 2.8 \sqrt{WZ_o \frac{R_2}{R_1}}$$

It would be difficult for most amateurs to obtain sufficient high power carbon resistors to calibrate an SWR meter by means of deliberate mismatching. An indirect method is therefore recommended.

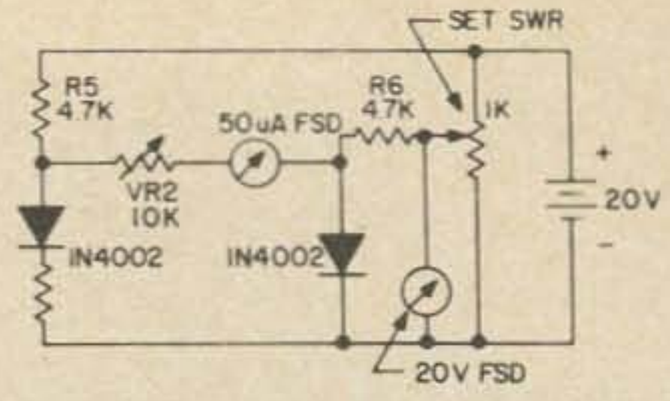


Fig. 13. Circuit used to calibrate SWR meters(see text).

Disconnect R5 and R6, Fig. 9, from the detectors, and connect them instead as shown in Fig. 13. One voltage is fixed at about 20 volts, and the other is varied between zero and 20 volts. The ratio of these voltages corresponds to a definite SWR which can be determined from equation (1). Before carrying out this procedure, however, VR2 should be set for full scale deflection of the meter under matched conditions at the highest power level to be used.

Conclusions

All of the instruments described in this article have been tested under actual operating conditions, on all amateur bands between 1.8 MHz and 30 MHz. Power levels used varied from 100 to 1200 watts. With the components specified, the instruments will sustain power levels well above the kilowatt level for periods of tens of seconds.

It is hoped that by introducing frequency independent directional wattmeters, one will be able to make useful comparisons of absolute power levels and accurate assessments of standing wave situations. The logarithmic scales are an added convenience, and the direct-reading SWR meter offers a saving in meters.

The photographs were originally published in *Radio Communication* and are reproduced here by courtesy of the *Radio Society of Great Britain.*

Supplies of Ferrite Rings

So that constructors of the instruments described above can be sure of best results, I have made arrangements to export Mullard FX1596 ferrite rings from England. The cost of two rings, postage, import duty, etc., is one dollar (dollar bill or check), from P. G. Martin, G3PDM, Oak Cottage, Witton Gilbert, Durham, England.

. . . **G3PDM**

Bill Hoisington K1CLL
Farover Farm
Peterborough NH 03458

FET ON 450 MHz

This article describes a basic rf amplifier using FETS in the 420 to 450 range. Emphasis is placed on the complete isolation between the input and output circuits, achieved without neutralization. This is a vital requirement for a modern 450 MHz amplifier. Well over 20 dB gain is achieved in this amplifier, with all details of construction and testing methods included here. When RCA says that "these devices are useful to 500 MHz," they certainly tell the truth!

General

We will confine ourselves in this article to two FET devices which are readily obtainable, one is the 3N200 at approximately $4.30 each, and the 40841, at 68¢ each.

The 3N200 units are "militarily tested" so you can depend on them for operation. The 40841 are "batch-tested" and you should test them all in a suitable circuit, rate, and number them yourself. So far I have failed to find one that didn't work well. At 68¢ for a 20 dB plus, non-neutralized amplifier at 450 that's a good value.

Fig. 1, shows the internal wiring detail of both the 3N200 and the 40841. They are alike so you can make up one test jig for

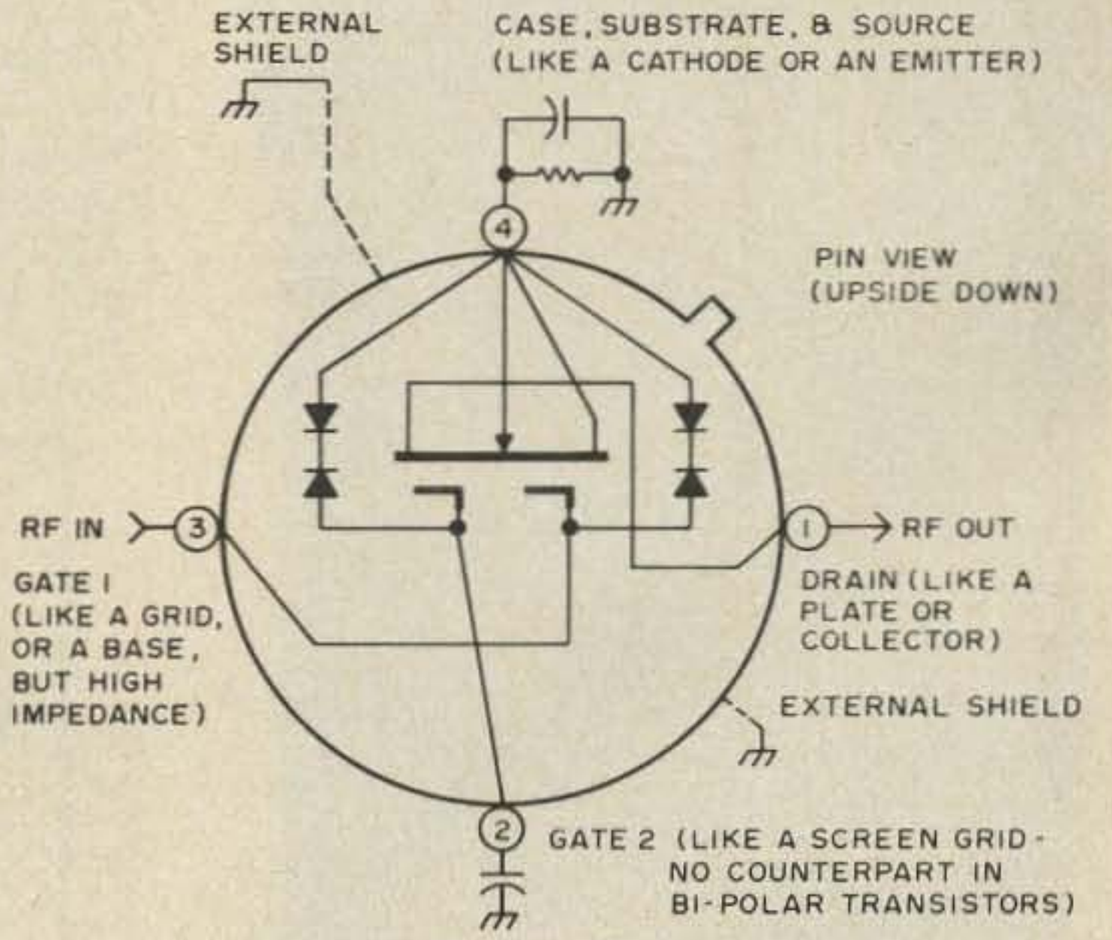


Fig. 1. Basic pictorial of 3N200 and 40841 FETs.

both, at 60 MHz or 147 MHz, as shown in a good *73* article entitled *"Taming Those Hot 500 MHz FETS."* I have turned the usual basing diagram around and added a few external indications so you can see at a

Wilson Electronics

DIRECT

SPECIAL SUMMER SALE !!!

WILSON 1402SM HAND HELD
2.3 WATT FM TRANSCEIVER

*Rubber Flex Antenna
*Complete Set NiCad Batteries
*Leather Case
*Three Sets of Crystals

16/76, 34/94, 94/94, Other Available at $8.00 Pr.

ALL FOR JUST $199.95

- 6 Channel Operation, Individual Trimmers On All TX and TR Xtals. All Xtals Plug In.
- S Meter Battery Indicator.
- 10.7 IF and 455 KC IF Ceramic Filter.
- .3 Microvolt Sensitivity For 20dB QT.
- 2.3 Watts Minimum Output.
- Microswitch Mike Button.
- Size 8-7/8 x 1-7/8 x 2-7/8 Inches.
- Weight 1 lb. 4 counces, Less Battery.
- Current Drain Rx 14MA TX 380 MA.

ACCESSORIES:

SMI Speaker Mike $24.00
BCI Battery Charger $29.95
1410A Amplifier Mobile Mount $99.00

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

Ship me 1402 SM Special Summer Package
Plus ☐ SM1 ☐ 1410A ☐ BC1

Enclosed is $ _____ ☐ Check ☐ Money Order
☐ Master Charge ☐ Bank Americard
_____ M/C Interbank # _____
Card Expiration Date _____
Extra Xtals _____ _____ _____

Name _____

Address _____

City and State _____ Zip _____

All orders will be shipped Air Mail within 24 hours after receipt of order (excluding weekends). Enclose additional $3.00 for prepaid Air Mail shipping. Nevada residents add sales tax.
Sale ends October 31, 1974

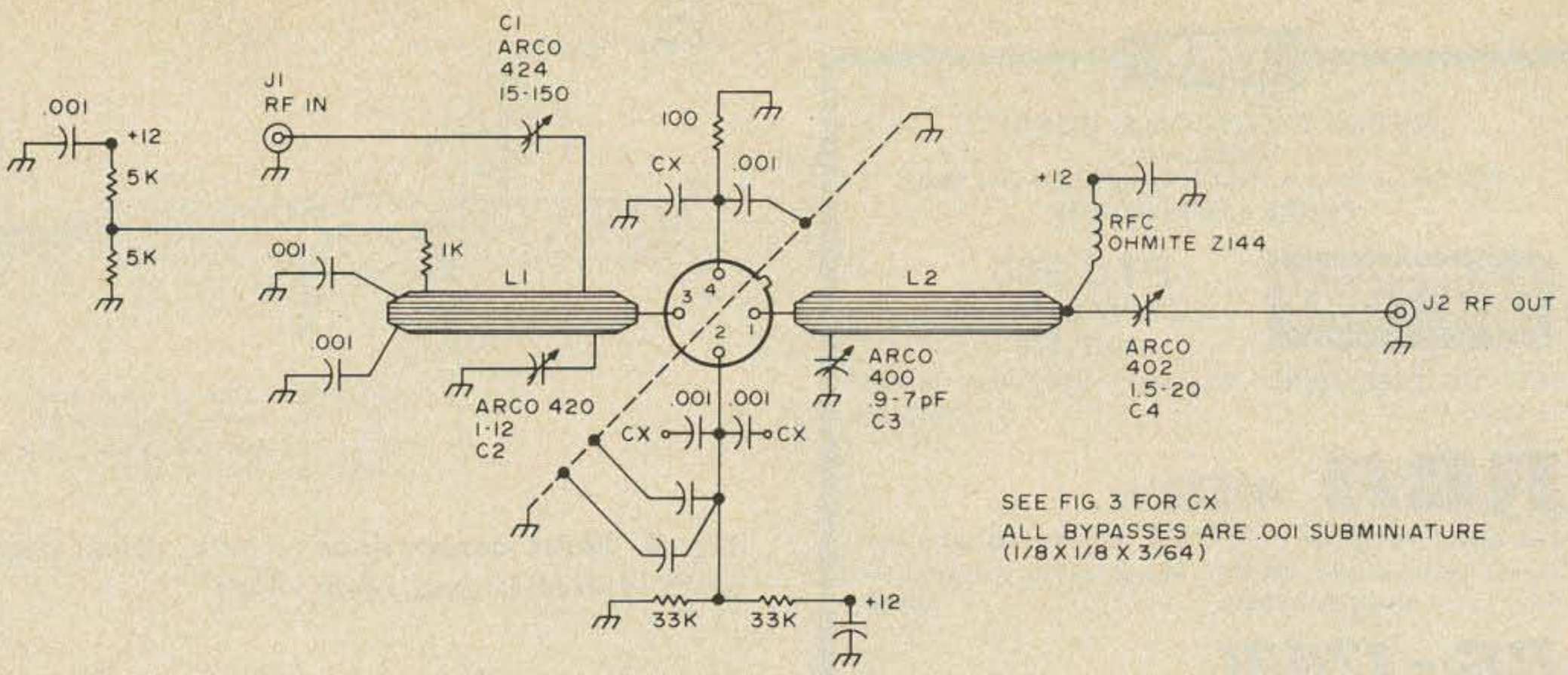


Fig. 2. Schematic, FET amplifier, 420–450 MHz (pin view).

glance what is going on and how to think about it. You will have plenty to do without translating figures. I think the figures in this article, 1 through 6, are clear and have all the details and notes you need for the project.

These devices are "N-channel silicon depletion types, dual-insulated-protected-gate metallic-oxide semiconductor field-effect transistors," if you can say all that in one breath. They have excellent power gain, over 20 dB in this example, at 450 MHz, linear circuit operation, and a wide dynamic operation range. Their square-law characteristics result in low cross-modulation performance over the AGC range, if used. The very low feedback capacitance eliminates the need for neutralization, and reduces local oscillator feed-through to the antenna. Back-to-back diodes protect the two gates from electrostatic charges and act as "transient trappers" for inputs that exceed ±10V. Be careful and don't put 12V straight from the car battery on a gate. I did!

Circuit

Fig. 2, shows the circuit in schematic form, and Fig. 3, shows details of the source bypass capacitor plate labeled "Cx." This special capacitor is very important and is necessary to properly bypass the source and tie it to the groundplane (baseboard) rf-wise. Bear in mind that at 450 MHz, shape is beginning to assume major importance, and as you get closer and into microwaves it is almost the whole deal. The oft-repeated "keep the leads short" is of great importance also. In particular the input (gate 1) and the output (drain) should be connected with careful attention to soldering very close in to the case of the device. Going around the pins on the device as in Fig. 2, pin 1 is the drain (whoever decided to use *that* word?) which is connected to the output circuit L2. Pin 2

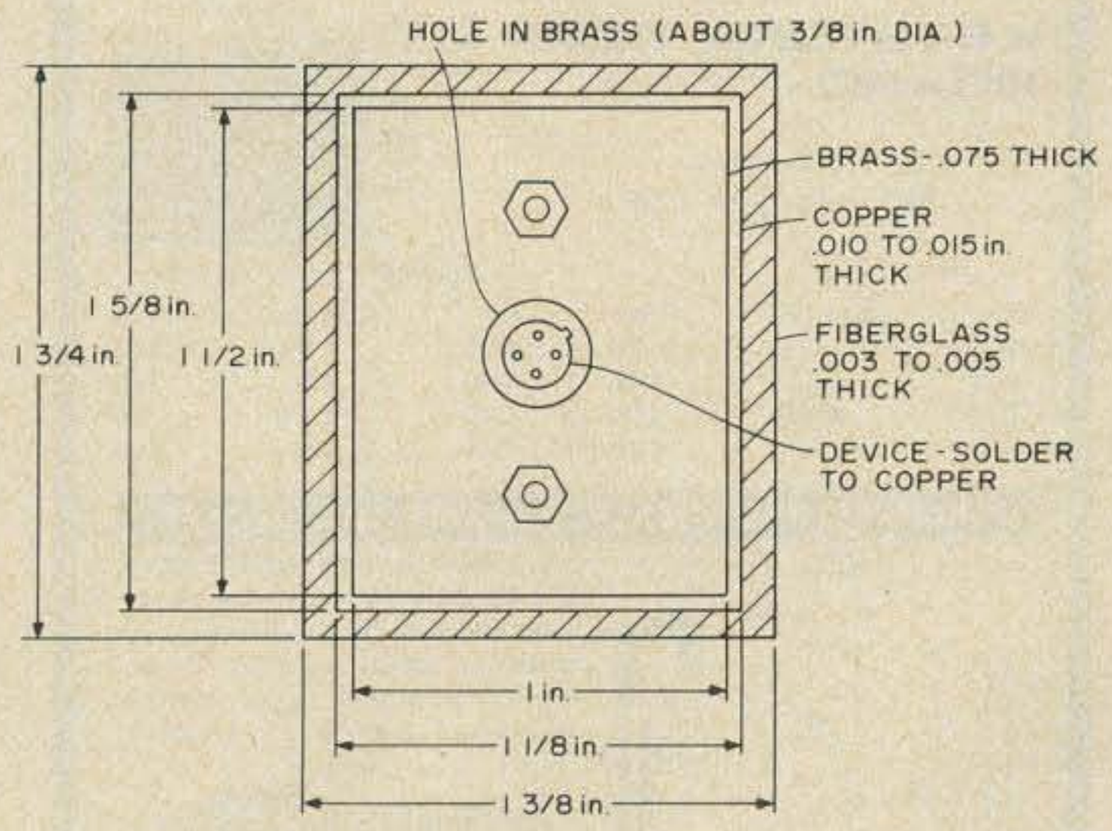


Fig. 3. Dimensions of device mount and capacitor "Cx."

is gate No. 2, serving here somewhat in the same fashion as the screen grid of tubes. Pin 3 is gate No. 1, connected to the input circuit L1. Pin 4 is the source, substrate (like a baseboard inside that little tin can), and the case. It is very important that the source is internally connected to the case, as you will see later. The type of connectors used for input and output matching, the kind of cables, and the equipment used at the other end of both cables all play a part in matching. Granted, the ideal is a pure 50Ω resistance, but you should be that lucky!

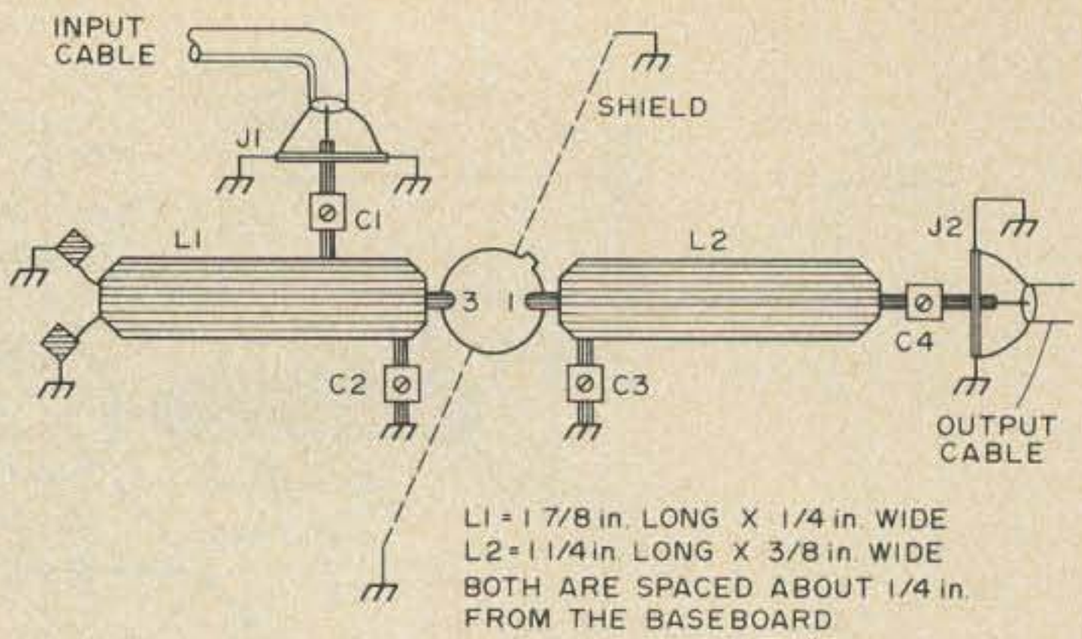
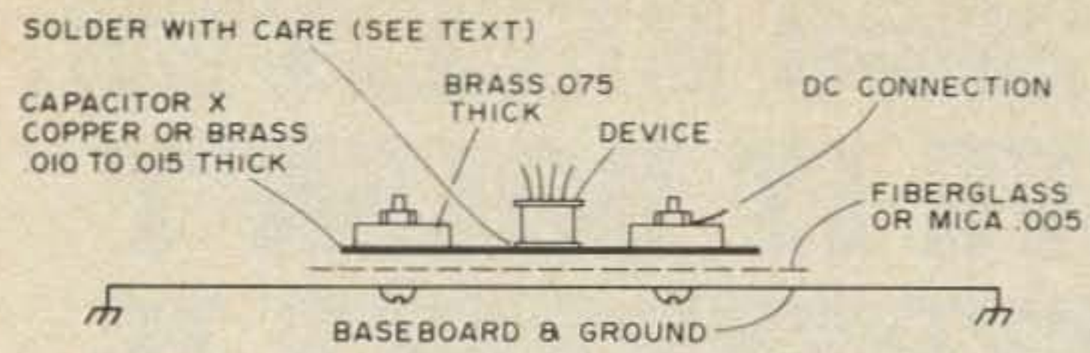


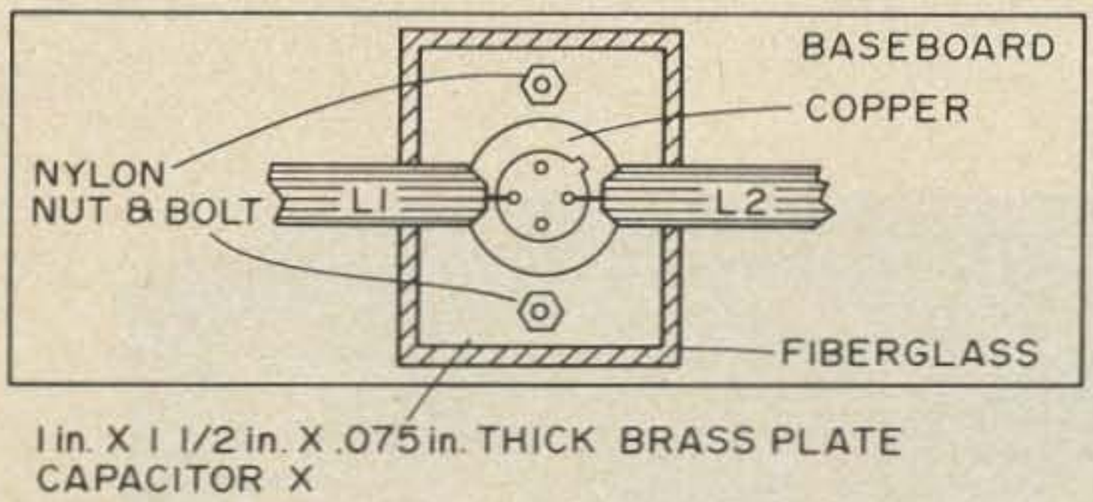
Fig. 4. Short connections to gate, drain, caps and jacks (450 MHz amp.) (pin view).

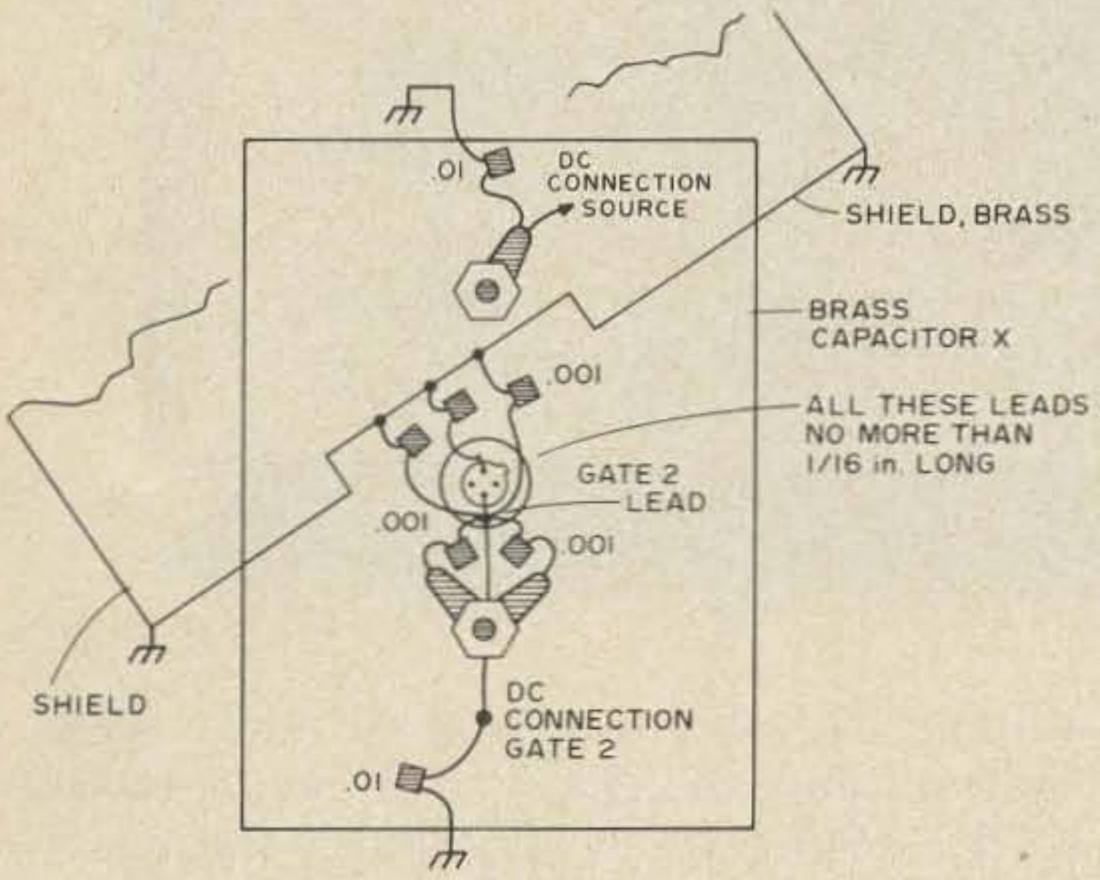
Referring to Fig. 4, for clarity, the input may be connected to almost any position along L1, to help with the matching. Bear in mind that some mismatch gives the lowest noise figure, with a sacrifice of only a dB or so out of over 20 dB of gain. C1 may also be varied for a maximum of over 100 pF, down to the small values, such as a 1 to 12 pF trimmer. I have shown the output connection as a series tuned circuit, and it works well that way into my tuned diode receiver for testing, but you may also use the same method as shown for the input. You should always make up a breadboard first, even though that has already been done for you here. 450 MHz needs some familiarization work, to say the least. At any rate, make a place on the baseboard and get ready to vary C1 along L1, and C4 along L2. If you move C4 up on L2, put in the grounding capacitors as shown for L1.

Bypassing

At 450 MHz you will have to use some construction methods not ordinarily needed for VHF work. We start off with making sure that the source is grounded for rf. Fig. 5, A, B, C and D, show the method I used, along with a whole collection of those tiny bypass capacitors, the "Lafayette Specials." The thin copper plate (see Figs. 3 and 5) is first soldered to the case of the FET. Hold the copper in a vise, as in Fig. 6, tin both sides lightly. Then tin the case also very lightly, applying heat for less than a second. Solder the case to the copper, as in Fig. 6, for no more than one second. A good idea is to practice on a 40841 that is either "gone" or a low gain one – or any other FET in the same size case. Do not use too







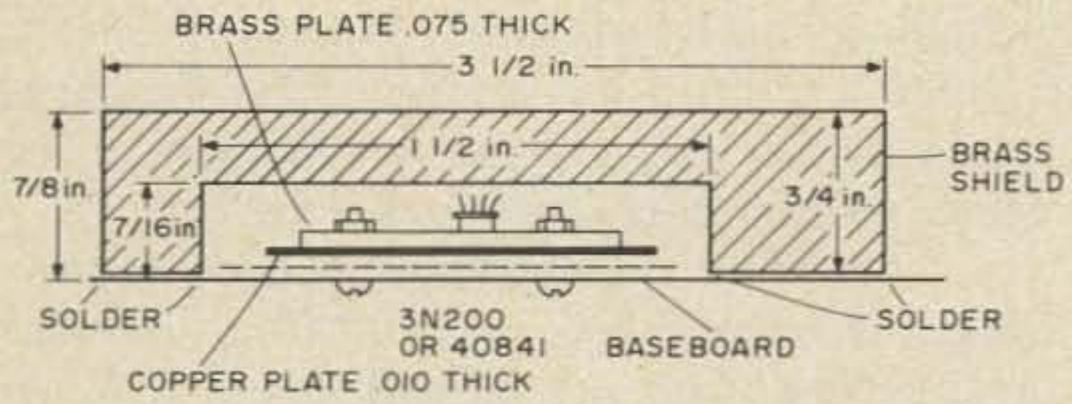


Fig. 5. A, B, and C (450 MHz amp).

low a wattage iron that will cause you to apply barely enough heat, since this means long application. I use a 50 watter for about one-half a second. Drill holes for the nylon bolts in the copper sheet and the brass "Cx" plate at the same time, holding them together in a drill vise or with C clamp. Be sure and insert fiberglass sheet, no more than .005 thick, or mica, under the copper when mounting. Check afterward with an ohmmeter for insulation. Use soldering lugs as in Fig. 5C, adjusting them so that there is about .13 cm spacing between the tips of the lugs and the gate 2 lead. Solder L1 and L2 as close as possible to the FET case. I managed about .06cm as in Fig. 5B. Solder a .001 from the shield to the source lead with no more than .16cm (1/16") leads, as in Fig. 5C. Solder two .001 capacitors from the gate 2 lead over to the capacitor "Cx" soldering lugs, as in Fig. 5C. Solder in C1, C2, C3 and

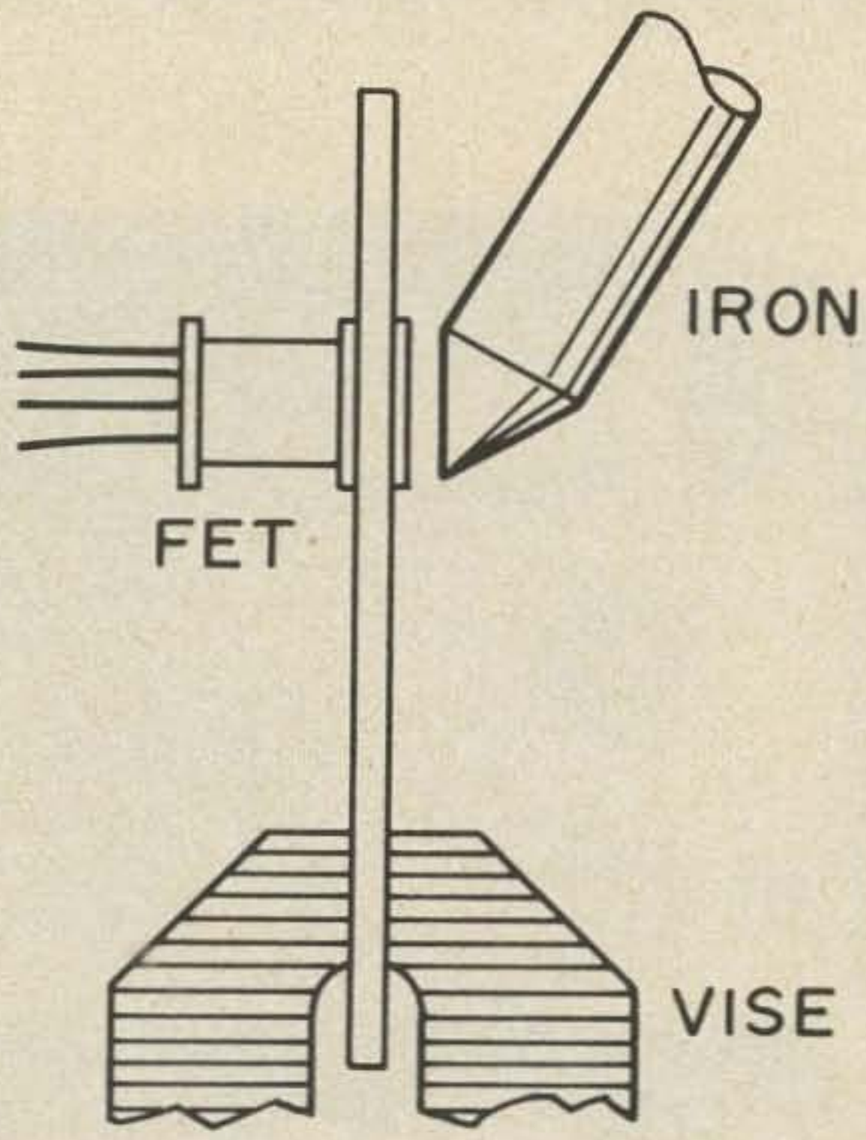


Fig. 6. Soldering FET case to copper sheet of capacitor X (450 MHz amp).

C4 as in Fig. 4. Small vertical pieces of copperclad are very handy for mounting J1 and J2 and for making good ground connections to them. Wire in resistors and other capacitors. Bypass the +12 lead wherever possible. I used red subminiature plastic covered No. 30 stranded for this. Dc voltage readings: When set up ready for testing, gate 1 showed 1V; gate 2 was at 5V, and the emitter was at .4 to .8V, depending on the resistor to ground. This should be adjusted for a total drain current of about 10 mils. Use more current for more gain and less current for a better noise figure.

Rf Testing

A separate section in *73* describes a good 420 to 450 signal source for this work. I used a tuned diode receiver, as shown in that section, for a receiver, with a good 0 to 50 microamp meter movement. A 10K pot in series with it allows voltage measurements of less than .05V, up to 10V. This is dc, at the diode output. First set up the signal source without the amplifier so that some con-

THE NEW ITC AR-2000 RECEIVER. IT'S SO SELECTIVE IT DOESN'T KNOW WHAT INTERFERENCE IS.

The AR-2000 is a completely solid-state, dual-channel communications receiver with 0.15 uV sensitivity (10 dB S+N/N) and selectivity that renders it virtually interference-proof (more selective than you ever thought a receiver could be). Blocking, intermodulation, adjacent-channel and crossmodulation rejection characteristics are better than any other receiver on the market and are typically beyond the scope of measurement.

This plus: modular construction; digital frequency readout; all bands (160m-10m) in 1 MHz ranges; two independent channels for dual receive, transceive-plus-receive or split-frequency operation; adjustable IF Passband (to within 100 Hz); 16-pole filter for over 200 dB skirt selectivity (standard 2.1 kHz BW, shape-factor 1.4:1); adjustable-Q/adjustable-frequency Notch and Peak Filters; adjustable-threshold noise-blanker; Receiver-Incremental-Tuning; and many other features found in no other receiver. Introductory price: $1,250 with **two-year** warranty.*

The AT-2000 matching transmitter is completely solid-state, provides adjustable output power from 1W to 175W, requires no tuning, can be remotely operated by the AR-2000, has a built-in RF Speech Processor, VOX, Sidetone and Heavy-Duty Power Supply. Introductory price: $945 with **two-year** warranty.*

*Warranted to be free from defects in materials and workmanship.
Factory or authorized dealer repairs at no cost to owner for two years from date of purchase.

The ITC AR-2000 Receiver and AT-2000 Transmitter– performance that challenges your imagination.

INTERNATIONAL TELECOMMUNICATIONS CORP.

P.O. Box 4235, Torrance, Calif. 90510 • (213) 375-9879

venient low reading may be logged, such as .02 to .05V, or near. Then when the amplifier is connected in the line some very much larger figure can be read, such as I found. For example, to be 20 times larger. Squaring the voltage to (at least approximate) get the power figure, and assuming that the diode is on a fairly straight-line portion of its curve, which may not be exactly the case, one could say that the power gain was 400 times, or well over the 20 dB mark. If you have a milliwattmeter, or a buddy who has one, or someone who works in a "radio" job, you can check it out that way. And also calibrate your signal source and attenuator.

Alignment, or tuning L1 and L2 at 450 MHz is easier than matching the input and output cables, jacks and equipment at the other end of those cables. This you will find out as you get into the testing of these types of units. Remember that if you make it as shown, very excellent isolation of the input and output circuits will result. This shows up nicely as you tune up the output, for example, and find that the input tuning does not change. A very desirable result, of course. Note again, if you are the real experimenter type and wish to learn about 450, make a breadboard first, play around with it, and then make up a finished good looking unit using the same parts and placement. Small coils of three or four turns, about .13 cm O.D., can be substituted for L1 and L2, but you will then have to work in real close and use expensive, very small ceramic trimmers.

Conclusion

A good high gain, 20 dB plus, rf amplifier for 420 to 450 MHz has been built, is working, and has been described in detail here. You will have to pay a lot of attention to those tiny capacitors and to the short leads, though. Suppliers are as follows: FETs and mica compression trimmers from Cramer Electronics, Inc., 85 Wells Ave., Newton MA 02159, telephone 617-969-7700. Small capacitors from Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset L.I. NY 11791, telephone 516-921-7500.

...K1CLL

FINGERNAIL CLIPPERS

Kent A. Mitchell W3WTO
1004 Mulberry Avenue
Hagerstown, MD

Fingernail clippers, usually costing only about 25¢, make a handy tool for trimming back coaxial cable braid, such as during the preparation for the installation of a connector. Remove the outer protective covering, being careful not to cut or nick the braid beneath. Work the exposed braid inward from the end of the cable until the braid is bulged at the location of the desired trim length. Cut braid with fingernail clippers, as shown, and remove. Smooth out remaining strands.

...W3WTO

2 METER FM HEADQUARTERS

Only STANDARD
sells more STANDARDS
than ..... ERICKSON!

and here's
ANOTHER
ERICKSON
SPECIAL

SRC–826 MA

A better BEST BUY than ever . . . . . .

OUR DEAL:	
826 MA list	**$398.00**
+ 16 extra xtals	**80.00**
Package list price	**$478.00**
You pay only	**$359.00**
YOU'VE SAVED	**$119.00**

YOU GET *Standard's 826MA, the best 12-channel 10-watt solid state rig on the market, factory set up on four channels plus crystal coupons for eight more channels (16 of Standard's lifetime Astropoint crystals!) of your choice; with helical-resonator front end receiver, built in provision for tone–coded squelch, rear panel test point/monitor/control sockets – all in one compact, reliable package* – at a GIANT $119 ERICKSON saving ! !

Shipping prepaid for cashier's check or MO.

Handheld Special

SRC–146A with:

- Deluxe basecharger
- "Stubby" antenna
- Leather case
- Ni-cads
- 94/94, 34/94 and one other channel of your choice

List Price	**$369.00**
Our Price	**$319.00**
YOU SAVE	**$50.00 ! !**

Another Best Buy from Erickson

Make ERICKSON your headquarters for all your FM needs . . .

SEND QSL FOR COMPLETE SPECIFICATIONS

ERICKSON COMMUNICATIONS

3501 W. Jarvis, Skokie, IL 60076 (312) 677-2161

F. G. Rayer G3OGR
Longdon Heath
Upton on Severn
Worcester, England

GDO To Find C

An Accessory For Your Grid Dip Oscillator.

Most amateurs have a grid dip oscillator lying around, and an easy accessory can allow it to be used to read the values of unknown capacitances up to about 1000 pF. This is useful for unmarked surplus, those with obliterated markings, or to find the swing of small variables. Or we may check the best value found in some circuit position with a preset or variable, then measure this and substitute a near value fixed capacitor.

Figure 1 is the circuit. C1 and C2 are on the lid of an insulated box, carrying also spring terminals for CX. The capacitors have good knobs with pointers. Coil L can be half a dozen turns of stout wire, self-supporting, or anything which comes within a convenient range of the GDO (say 2.5–10 MHz) with both variables fully closed.

To calibrate, close C1 and C2 fully. Tune the GDO for the usual dip. Note the frequency on the box for future use. Take a few 1% capacitors, such as 100 pF, 200 pF, and so on, up to a total of about 1000 pF. Clip one to CX. Open C2 to restore the dip on the GDO. Mark the capacitor value on C2 dial. Series and parallel capacitors give more values. For example, 100 pF plus 200 pF in parallel gives 300 pF, while 500 plus 200 gives 700 pF, and so on.

Restore C2 to its fully closed mark. Repeat to calibrate C1, this time using

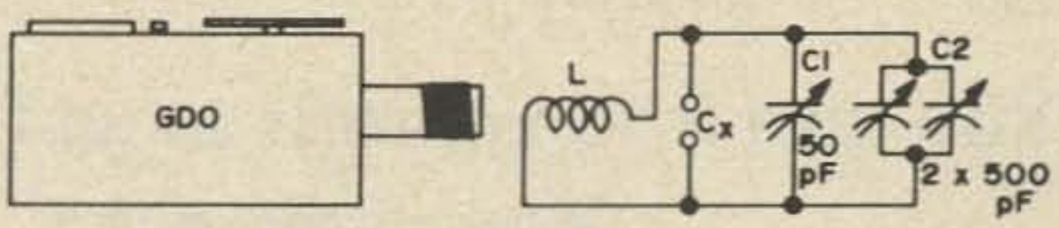


Fig. 1. GDO to find C.

capacitors such as 5 pF, etc., up to about 50 pF. When you see how the scales mark, estimate intermediate markings, to fill in.

Once calibration is finished, it is easy to find a capacitance value from about 2.5 to 1000 pF. Close C1 and C2. Put the GDO near L and tune the GDO for dip. Clip the unknown capacitor across CX. Open C1 or C2, as appropriate, to restore the dip. Read off the value from the scale. That's all there is to it!

. . .G3OGR

The Ultimate F.M. Transceiver

Here it is, the FMer's dream, a fully synthesized transceiver that'll cover the entire two meter band, PLUS a built-in scanning receiver that'll locate any repeater frequency in your area that's in use.

And get a load of these other features that make the ultimate rig:

- Operates on FM, AM or Modulated CW
- Built-in DC and AC power supplies
- Frequency Range of 143.5 to 148.5 MHz in 5 KHz increments
- Autoscan in 5 KHz steps across entire band, with adjustable speed and frequency limits.
- Synthesizer flexibility that offers choice of 600 KHz up or down, 1 Meg up or down, simplex, frequency split, or any nonstandard split (programmable) all from a single function switch.
- Receiver Sensitivity of 0.35 Mv for 12 db SINAD on FM
- Dual power output of 20 watts or 5 watts across entire band
- Adjacent channel rejection (30 KHz) 100 db minimum
- Image spurious and intermodulation (EIA) 80 db minimum
- 10 pole, 13 KHz crystal filter
- Receiver Superhet, single conversion
- Frequency stability of 0.0005%
- Built-in tone burst and PL encoders and decoders
- Built-in touch tone pad
- Full LED Digital readout
- Built-in S Meter also serves as VSWR bridge, power output meter, battery indicator, deviation indicator and discriminator meter.
- Audio output 4 watts @ 10% THD
- Speaker built-in to left side of cabinet for maximum mobile reception
- Headphone jack for noise-free mobile operation
- Independent selectable priority channel
- Built-in Auto CQ
- Temperature range from -20^{o} to 170^{o} Fahrenheit
- Size: 4" H x 8" W x 10" D Weight: 10 pounds
- One million channels (1000 Rec. x 1000 Trans.)

$1495 00

A $150 deposit will insure early delivery and guarantee price

You owe it to yourself to go first class. Try an EBC 144 –
You deserve it !

---

emergency beacon corp.

15 SS River Street
New Rochelle NY 10801 (914) 235-9400

AMATEUR PRODUCTS DIVISION

Dave Ingram K4TWJ
Rt. 11 Box 499
Eastwood Village 50N
Birmingham AL 35210

Super Trimline For 2

The popular Trimline telephones have recently started appearing on the surplus market at fairly reasonable prices and are being grabbed up quickly by the 2 meter FMers.

The phone can be converted in about an hour and they provide a mike, Touchtone pad and earphone in a convenient case ready to use.

Assuming you have acquired a Trimline through a local electric supply or surplus company, your first move is to check out the unit to ascertain that it is working. First, open the telephone by removing the 1/2" x 1" plastic strap between the top of the pad and the earpiece (easily popped out with a knife edge slid in the hole on the right side of this strap, and turned). Unscrew the two screws under this cover, then squeeze the front sides of the phone slightly to free the back cover.

Now connect the jumpers as in Fig. 1, and apply 6 to 8 volts to the pad. Pushing the numbers now should produce the tones on the earpiece. Audio can also be fed from the mic side of the .005 to an audio amplifier to

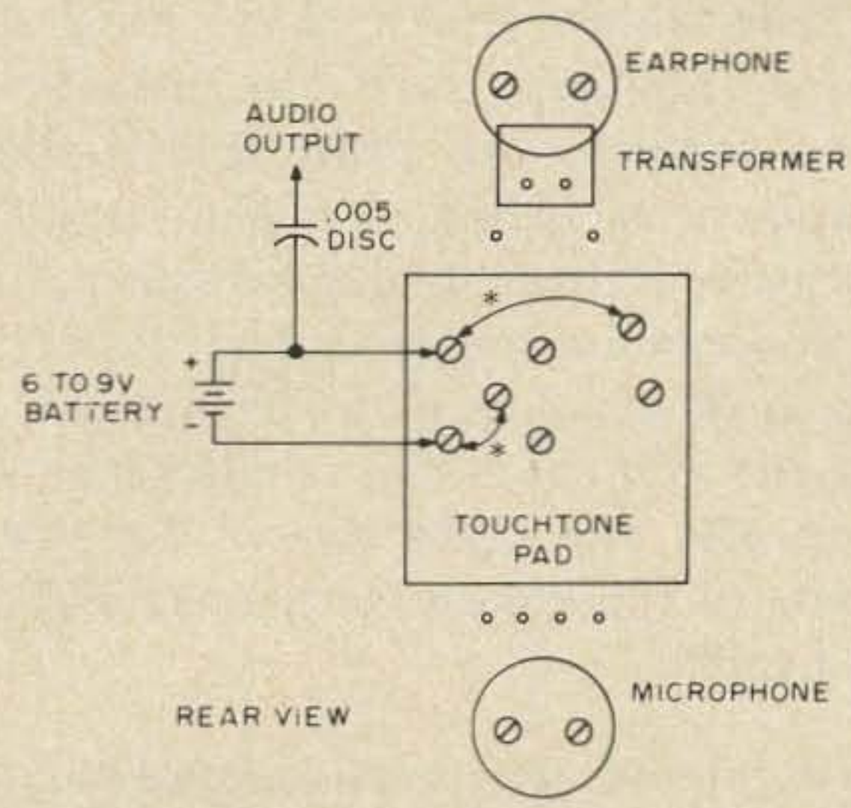


Fig. 1. Interconnections for checkout and operation of Trimline and pad; (*) jumpers added to unit.

check this – either way is OK. I might also point out that I've seen a dozen different ways to jump and connect these pads and they all seem to work fine. My particular method doesn't require a cut-off switch on the battery. If the pad works you can now start the conversion.

The flexible pc overlay must be removed. Unscrew it from the earphone, pad, and mike and unsolder the 4 or 6 connections (depending on your unit) above and below the pad. Discard the pc overlay as it will not be used. Next, remove and discard the transformer which is screwed into the earphone. A battery (either a Burgess H175 or H165R, both about 7 volts) will be installed here, with tape to hold it in place (these batteries fit snug and won't move when the back is replaced).

The pad now has to be removed to gain access to the mike. Unscrew the *4 large screws on the pad's brackets not the 4 small screws on the pad proper*, the latter will separate the pad's circuitry from the push buttons and it will drive you insane trying to get that disaster working properly again. Now *carefully* lift out the pad and you can gain access to the screws holding the mike bracket. With these loose, the carbon mike flops out and you can replace it with a mike to match your rig. For convenience connect the mike wires to the holders spring clips making sure the connection is on the left (viewed from rear). Then reassemble the holder and retaining bracket and replace the pad. The screw terminals on the mike holder are now ready for connection (you did mark the + end didn't you?). Now, using small insulated hook-up wire (to prevent accidental contact with other leads) connect the jumpers as in Fig. 2 (again, remember you removed them to discard the pc overlay). You can use the pc lead on the left side of the pad, which runs to its bottom, and solder the .005 from this connection to the resistor, R1. The other side of this resistor connects to the mike +, so the pad and mike are in parallel.

Now remove the earphone and carefully drill a small hole right beside and slightly below it to accommodate the P.T.T. switch (switchcraft #953 or similar) mount the

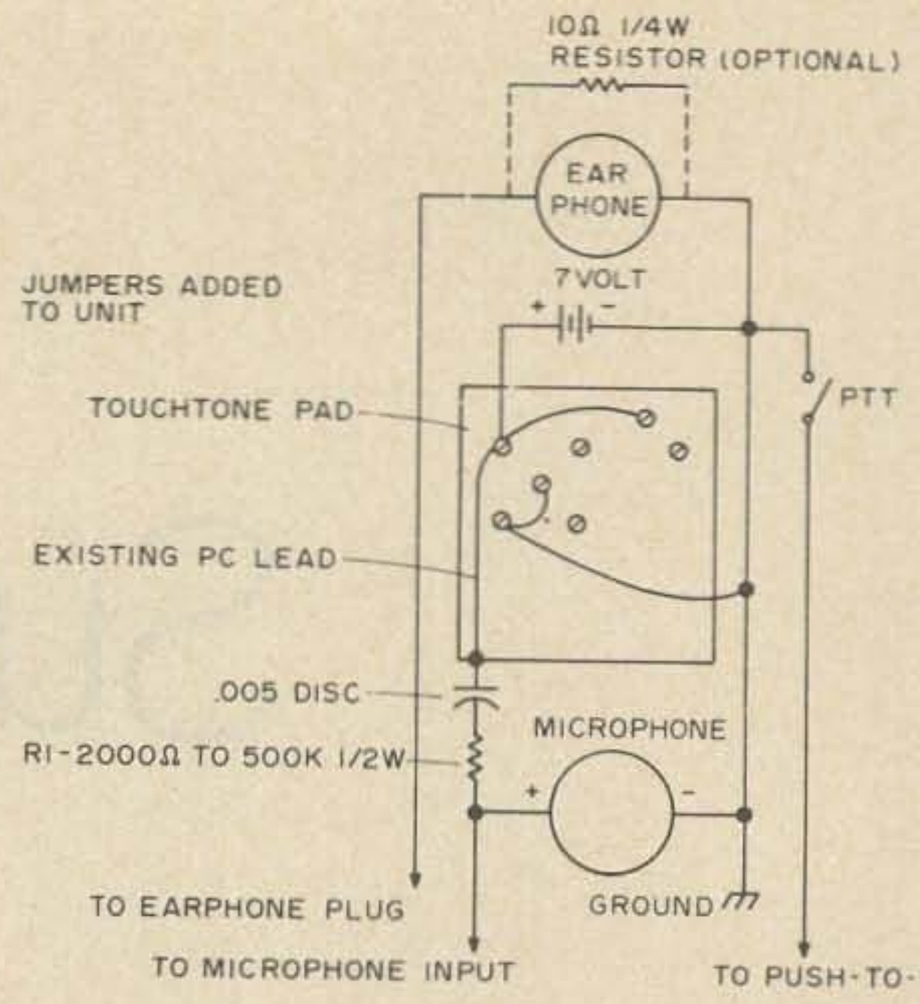


Fig. 2. Wiring diagram for "Super Trimline." The optional 10Ω resistor across the earphone gives an 8Ω load to the rig. (Existing earphone is 600Ω).

switch and replace the earphone. Wire in the battery.

Next, using more insulated hook-up wire, connect all the grounds together: the mike; the pad ground; the P.T.T. ground and the earphone ground.

All that remains is the curl cord and plugs (mike and earphone) to match your rig. A Belden #8497 cord was used, which has 3 conductors, and one shielded. Remove the rubber jacket so about 8 inches of each wire is available. Strip each wire end 1/4" and connect the P.T.T. lead, earphone +, mike +, and ground leads. I found a small piece of metal and force fit this between the curl cord end and the grooves on the mike holder's slots to retain the cord under heavy stress. Resistor R1 is found experimentally by temporarily substituting a 1 or 2 meg variable and adjusting this so the pad's output level is the same as your voice. When this level is found, measure the value of the pot and replace it with a fixed resistor of the same value. This isn't critical – my particular unit used a 6800Ω resistor.

Replace the back of the Trimline, the screws and little plastic cover above the pad and you have a dandy "Super Trimline."

... **K4TWJ**

M. J. Schaffer W60NL
4424 Baron Avenue
Sacramento CA 95821

R-390A Modifications for Improved Performance

Not for sale: One R-390A receiver, original cost $3,900. Depending upon condition surplus costs vary from $550 to as much as $1,500 each. The receiver features four mechanical filters, 2 kHz, 4 kHz, 8 kHz and 16 kHz, with additional bandwidth switching to 1 kHz and .1 kHz. The receiver has two individually controlled audio channels. One for conventional local reception, and a second 600Ω output for phone patch connection. The phone patch output has a vu meter that can be adjusted by a front panel line gain control, and a line meter level switch to read audio levels at -10 vu, 0-vu and +10 vu. A front panel carrier level meter is calibrated not in S-units but from zero to 100 dB. It features a 850 cycle audio filter, frequency digital readout accurate to 200 Hz or better, 100 kHz calibrator, a BFO that swings 3 kHz each side of center frequency with extreme accuracy. The receiver covers .5 MHz to 32 MHz in 1000 kHz segments. Muting, AGC output, space diversity connections, etc., are available at rear-end terminals. An on-off switch is provided to turn on temperature controlled ovens within the various oscillators. Except for the 455 kHz i-f stages, all other stages from the rf to the second and third conversion stages are permability tuned. This and many other features make this one of the best radio receivers available today. After having obtained one a number of years ago I decided that it had some unsatisfactory shortcomings that I needed for sniffing a gas-bubble out from under a hurricane of big pile-ups. In my opinion, it lacked sensitivity, had insufficient and poor audio quality and the limiter contributed nothing to DXing, SSB, or anything else for my modes of operation.

After studying the manual and its various diagrams for several weeks I decided that many improvements could be achieved by adding or subtracting components, and revising certain circuits. All modifications that would be made were with the intent for quick and easy restoration in the event that a sale or swap might be forthcoming at some later date.

After having made the modifications I've reached the conclusion that nothing I have tried in the way of other receivers even closely approaches a comparison of performance.

Modifications

For my applications the R-390A has unsufficient earphone volume. Inspection of the manual diagram shows that the earphone audio has been padded down purposely by a resistive network. Fig. 1, shows the simple modification for increasing earphone volume from 2 mW to 500 mW. As seen in Fig. 1, this modification is a jumper placed across

How to win the fist fight... with CW equipment from HAL.

The economical HAL 1550 keyer.

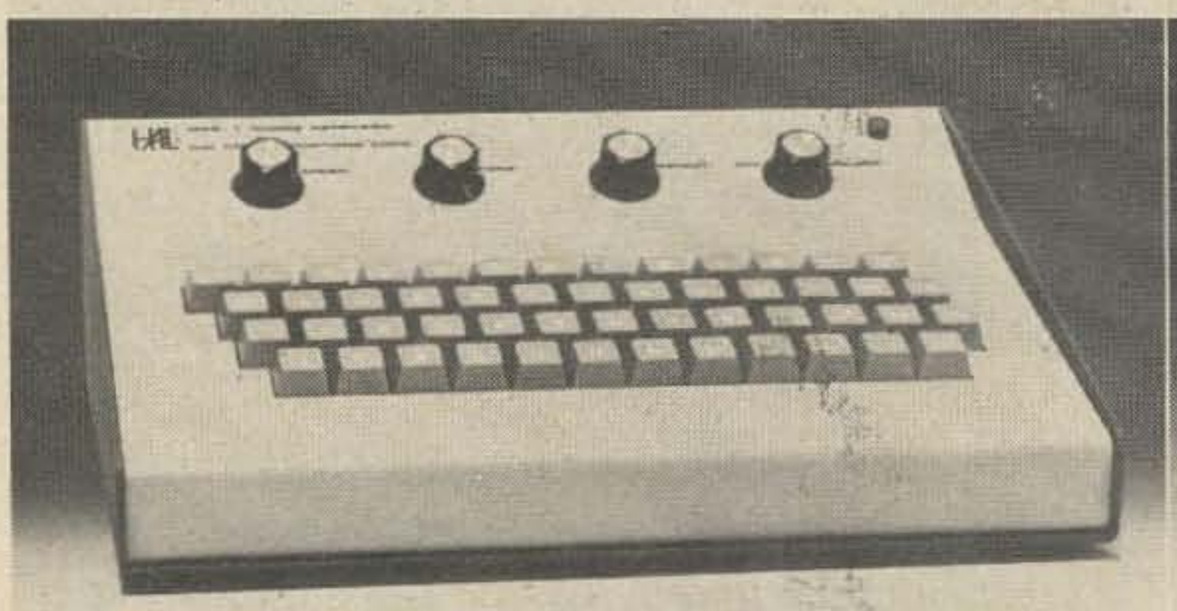
The easy-to-use 1550 keyer is your answer if you're looking for an electronic keyer that lets you send accurate CW effortlessly. Send from 8 to 60 WPM with conventional, iambic, and dot memory operation. Operates with dual or single lever keys. The optional 1550/ID automatically sends "DE" followed by your station call. For fast, accurate CW, order the HAL 1550/ID or 1550 today.

Price: 1550/ID, $95; 1550, $75; ppd USA. Air shipment, add $3.

ID-1A repeater identifier. Commercial quality, low price.

The HAL ID-1A brings the radio amateur a commercial-quality repeater identifier that complies with FCC ID requirements. It has a unique read-only-memory that you can easily reprogram yourself. Capacity of the ROM is 39 dots, dashes and spaces. TTL IC's assure immunity from noise and temperature. ID intervals available: 3, 6, 12 or 24 min. Specify call.

Price: $115, ppd USA. Air shipment, $3.



Send perfect CW every time with the MKB-1.

A complete Morse keyboard. Code speed variable from 10-60 WPM with variable dot-to-space ratio (weight). All solid-state, featuring computer-grade components. Complete alphanumeric and punctuation keys, plus an optional "DE-call sign" key factory programmed for you. Includes built-in speaker/oscillator monitor.

Price: $290 Assembled, $199 Kit, ppd USA. Without ID, $250 Assembled, $170 Kit. Air shipment, $5.

CW—and RTTY on one keyboard! The HAL DKB-2010.

All solid-state. Type out CW at 8-60 WPM. Adjustable dot-to-space ratio (weight). Complete alphanumeric keys, plus 11 punctuation marks. Five standard two-character keys, 2 shift keys, break-for-tuning key, 2 three-character function keys, and a "DE-call sign" key. We'll program your call right into the DKB-2010. Plus complete RTTY capabilities. Built-in three-character buffer. Optional 64 or 128 key buffer also available.

Price: $425 Assembled, $325 Kit, ppd USA. 64 key buffer $100, 128 key buffer $150. Air shipment, $10.

HAL Communications Corp.
Box 365, Urbana, Illinois 61801
Telephone: (217) 359-7373

Enclosed is $____ for: ☐ DKB-2010 ☐ MKB-1 ☐ 1550 ☐ ID-1A
Please specify ☐ Assembled ☐ Kit ☐ Options _____
Please send me more information on the following HAL products . . .
☐ DKB-2010 ☐ MKB-1 ☐ 1550/1550 ID ☐ ID-1A
☐ Complete HAL catalog

Name _____ Address _____ Call Sign _____

City/State/Zip _____

Illinois residents add 5% sales tax.

L

terminals 6 and 8 on TB-102, located behind the rear main chassis.

For DXing and normal ham use the 8 kHz and 16 kHz bandwidths are useless unless one desires to listen to hi-fi broadcast, or other applications that require these excessive bandwidths. To meet these bandwidths the 455 kHz transformers have hi-Q coils which haves been swamped with 15K resistors to broaden their bandwidths. This lowers their gain capabilities and contributes to additional noise. The second modification is for the removal of the 15K resistors and bridge the 455 kHz primary and secondary windings in each of the i-f transformers.

Locate the 455 kHz i-f cans labeled T-501, T-502 and T-503. To get at the 15K resistors loosen the nuts atop each i-f can and lift off the shield can. At this point it is a good idea to drill small holes in the center of each i-f can so that i-f alignment can be

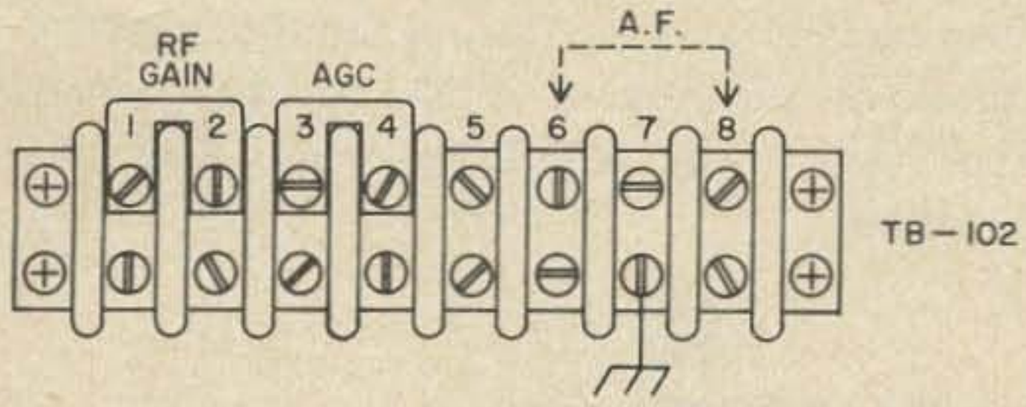


Fig. 1. Dotted line shows jumper to increase earphone volume from 1mW to 500mW.

performed later on. With the shield cans removed, the windings are visible and easy to get at. With the exception of T-503 secondary winding all other windings are bridged with a 15K resistor.

To prevent a shock and shorting of B+ voltages in the primary windings which could lead to a winding burn-out, be sure the receiver function switch is in the OFF position before attempting resistor removals. With small dikes, clip one end of each resistor from the most convenient terminal, and bend the resistor back out of the way. Before going too far it is suggested that only resistors in T-503 and T-502 be removed first, and that the set then be turned ON to the AGC position and checked for i-f ringing This can be accomplished by listening, or by the use of an oscilloscope connected across

the audio output terminals. In my set, with the rf gain control completely open, ringing did not occur until R-115 across the primary of T-501 had been disconnected. Enough pigtail wire had been left on this particular resistor so that reinstallation was an easy matter.

The increased gain and audio recovery as individual resistors are removed can be measured by use of the vu meter. Using the 100 kHz calibrator as a fixed signal source, turn the BFO pitch control for a maximum vu meter reading. The vu line meter control should be set at 0 dB, and the line gain control adjusted to show a vu meter reading of -5 vu. Approximately 2 vu units of gain was obtained as each resistor was removed. The overall audio recover increased approximately 7 vu units at the stopping point of resistor removal. The carrier level meter will also show an increase as T-501 and T-502 are modified.

A better means of measuring an increase or decrease of gain other than using the carrier level meter (AGC) which curtails accuracy because of AGC action is to remove the AGC jumper bridging terminals 3 and 4 on terminal strip TB-102. With a short jumper, ground terminal 4 to the main chassis. This grounds the whole AGC bus line to zero potential, just as the FUNCTION switch does in the MHz position. Connect a VTVM to terminal 3 to read the generated AGC voltage produced by the AGC system. The FUNCTION switch must be in the AGC position in order to get AGC voltage readings. After assurance that no ringing is present, and that the i-f shield cans have dead center holes for alignment, replace the shield cans and their associated hold down nuts. Now, realign the 455 kHz i-f system for peak AGC voltage as read on the VTVM. Maximum AGC voltage will be approximately 35V when using the 100 kHz calibrator as a signal source, when the BANDWIDTH switch is in the .1 kHz position. This AGC voltage will reduce to normalcy when the AGC system is loaded down by the removal of ground from terminal 4 and restoration of the jumper between terminals 3 and 4. During alignment do not overlook peaking of Z-503 located between the AGC i-f amplifier and the AGC rectifier.

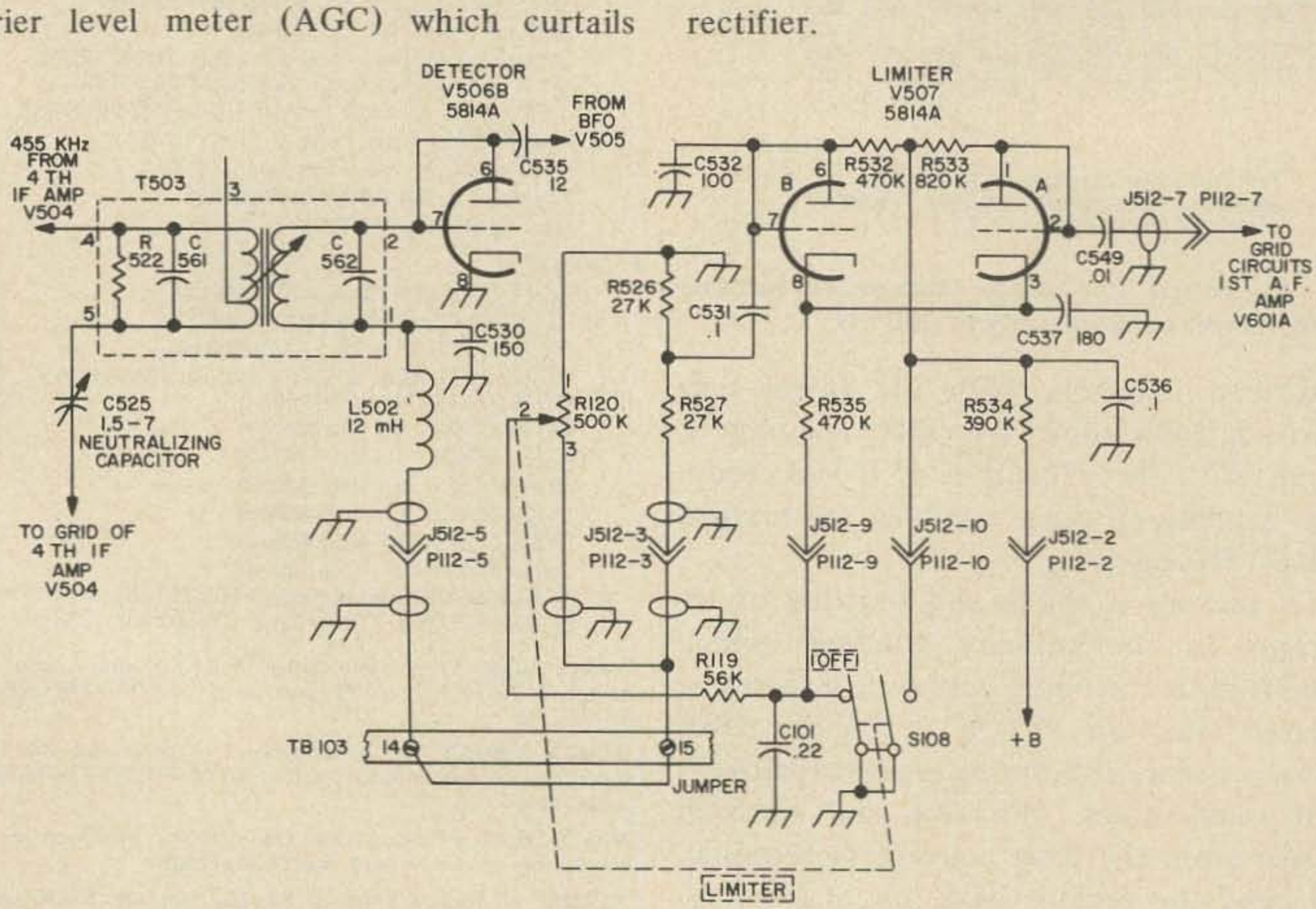


Fig. 2a. Detector V50613 and Limiter V507, original schematic diagram before modification

Product Detector

See Fig. 2a (before modification) and 2b (after modification) for the following instructions.

tempo/... a proven name a proven value

Now, when your dollar buys less and less . . . value received for your money becomes more and more important. In only three years Tempo has established a solid reputation for first rate performance at a reasonable price.

THE TEMPO ONE SSB TRANSCEIVER

Look at the specifications . . . look at the price tag . . . ask any of the thousands of Tempo ONE owners about its reliability . . . and the reason for its unparalleled popularity will be obvious. The Tempo ONE is now the proven ONE.

FREQUENCY RANGE: All amateur bands 80 through 10 meters, in five 500 khz, ranges: 3.5-4 mhz., 7-7.5 mhz., 14-14.5 mhz., 21-21.5 mhz., 28.5-29 mhz. (Crystals optionally available for ranges 28-28.5, 29-29.5, 29.5-30 mhz.)
SOLID STATE VFO: Very stable Colpitts circuit with transistor buffer provides linear tuning over the range 5-5.5 mhz. A passband filter at output is tuned to pass the 5-5.5 mhz. range.
RECEIVER OFFSET TUNING (CLARIFIER): Provides ±5 khz. variation of receiver tuning when switched ON.
DIAL CALIBRATION: Vernier scale marked with one kilohertz divisions. Main tuning dial calibrated 0-500 with 50 khz. points.
FREQUENCY STABILITY: Less than 100 cycles after warm-up, and less than 100 cycles for plus or minus 10% line voltage change.
MODES OF OPERATION: SSB upper and lower sideband, CW and AM.
INPUT POWER: 300 watts PEP, 240 watts CW
ANTENNA IMPEDANCE: 50-75 ohms
CARRIER SUPPRESSION: −40 dB or better
SIDEBAND SUPPRESSION: −50 dB at 1000 CPS
THIRD ORDER INTERMODULATION PRODUCTS: -30 dB (PEP)
AF BANDWIDTH: 300-2700 cps
RECEIVER SENSITIVITY: ½μv input S/N 10 dB
AGC: Fast attack slow decay for SSB and CW.
SELECTIVITY: 2.3 khz. (−6 dB), 4 khz. (−60 dB)
IMAGE REJECTION: More than 50 dB.
AUDIO OUTPUT: 1 watt at 10% distortion.
AUDIO OUTPUT IMPEDANCE: 8 ohms and 600 ohms
POWER SUPPLY: Separate AC or DC required. See AC "ONE" and DC1-A.
TUBES AND SEMICONDUCTORS: 16 tubes, 15 diodes, 7 transistors

TEMPO "ONE" TRANSCEIVER	$369.00
AC/ONE POWER SUPPLY 117/230 volt 50/60 cycle	$ 99.00
DC/1-A POWER SUPPLY 12 volts DC	$120.00
VF-ONE EXTERNAL VFO	$109.00

THE TEMPO 2001 LINEAR AMPLIFIER

Small but powerful, reliable but inexpensive, this amplifier is another top value from Henry Radio. Using two 8874 grounded grid triodes from Eimac, the Tempo 2001 offers a full 2 KW PEP input for SSB operation in an unbelievably compact package (total volume is .8 cu. ft.). The 2001 has a built-in solid state power supply, a built-in antenna relay, and built-in quality to match much more expensive amplifiers. This equipment is totally compatible with the Tempo One as well as most other amateur transceivers. Completely wired and ready for operation, the 2001 includes an internal blower, a relative RF power indicator, and full amateur band coverage from 80-10 meters. $595.00

YAESU

... a name proven through world-wide use. ... now available at Henry Radio. Come in, phone or write for complete specifications. We ship almost every where.

FT-101B	Transceiver	649.00
FTdx-401	Transceiver	599.00
FL-2100	Linear Amp with tubes	339.00
YC-355D	Digital Counter	289.00
FV-101	External VFO	99.00
SP-101P	Speaker/patch	59.00
SP-101	Speaker	19.00
FV-401	External VFO	99.00
SP-401P	Speaker/patch	59.00
SP-401	Speaker	19.00
YD-844	Dynamic microphone	29.00
XF-3C/30C	C.W. filter	40.00
FA-9	Fan	19.00
MMB-1	Mobile bracket	9.00

Prices subject to change without notice.

Henry Radio

11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

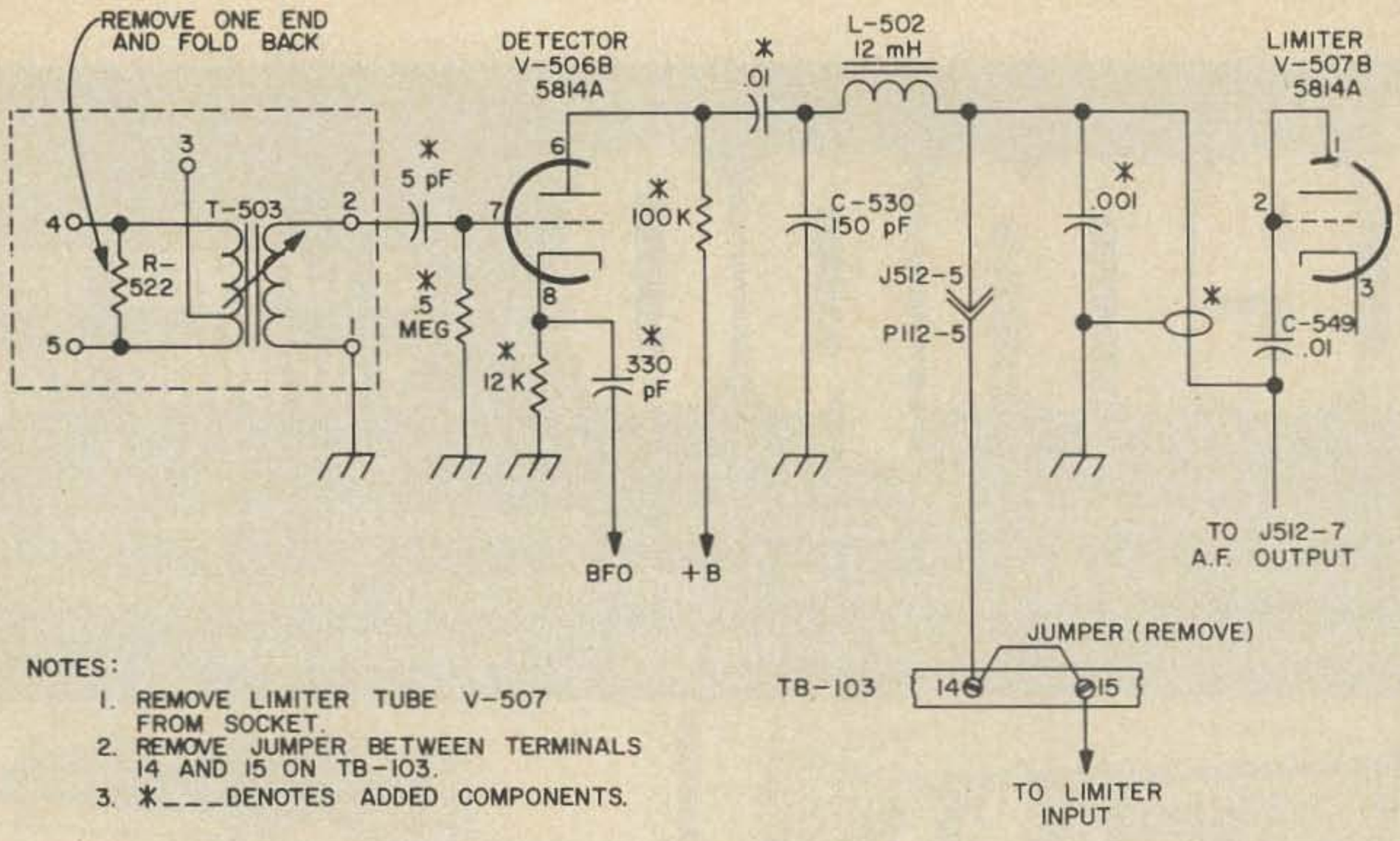


Fig. 2b. Diode detector modifications for product detection.

The last detector (V-506B) has pins 6 and 7 of the 5814 tube connected together to form a diode detector. Both the i-f signals and the BFO are injected at this point. This serves quite well for the reception of all emission modes and matches the voltage levels needed at the limiter input circuit. However, since little A3 or MCW is ever copied, and the limiter is seldom used and had a certain amount of attenuation, I felt that a product detector would best serve my needs. The diode detector was converted to a product detector by lifting the cathode at pin 8 from ground and using the cathode for BFO injection. The BFO coupling capacitor (C-535, 12pF) was replaced with a 330pF capacitor tied to pin 8. The BFO voltage measured 9V at pin 8. Readjustment of the BFO to zero beat the 455 kHz may be required because of this additional loading.

To break the diode feature remove the jumper between pins 6 and 7 of the detector. To pin 6 add a 100K resistor and a .01μF capacitor. Connect the 100K resistor to a source of B+ which can be found nearby on a standoff binding post. From the secondary of T-503, terminal 1, remove C-530 (150pF) and L-502 (12mH). To L-502 connect the 0.01μF capacitor that was attached to pin 6. Leave C-530 (150pF) attached at this point. The other end of rfc L-502 runs through connecting leads to terminal 14 (diode load) on TB-103, jumpered to terminal 15, and back to the limiter on the same chassis. To this end of the rfc install a .001μF, 600V dc capacitor to ground. The center post of the tube socket is grounded and makes a convenient grounding point. Also, to this end of the rfc run a shielded wire to C-549. which is con-

nected to pins 1 and 2 of the limiter tube. Connection to C-549 should be on the side opposite to the C-549 connection to the limiter tube. Remove the jumper between terminals 14 and 15 (diode load) on TB-103 behind the receiver.

Now for the product detector grid circuit. With a short jumper ground terminal 1 of T-503. Remove the lead from terminal 2 of T-503 that goes to pin 6 of the original (V506B) a small .47MΩ resistor to ground, and a 5pF capacitor to terminal 2 of T-503. That completes the product detector modification, except for repeaking of transformer T-503 and removing the limiter tube from its socket.

As before, with the 100 kHz calibrator as a signal source, the measured i-f voltage at the grid of the product detector was 3V. This is only a 3 to 1 ratio, which is a far cry from the 10 to 1 or better ratios normally expected for best linearity. Many different ratios were experimented with and the end result is a detector that produces both AM and SSB with only moderate distortion on AM. The amount of audio recovery also proved best with this ratio. The added conversion gain also added a few more dBs to the output.

Power Supply

The original power supply incorporated a pair of 26Z5W rectifiers tubes. Some conservation of power and a great reduction of heat was gained by replacing the tubes with solid state rectifiers. 1000 PIV units at 2.5A only cost 35¢ each, which is a wise investment. The voltage increase through the conversion to solid state was slight, and no effort was made to change it.

Antenna Input Alignment

The nominal antenna input impedance is 125Ω. This can be maintained and matched to a 50Ω antenna system using any of the various forms of antenna tuners. Lacking a tuner, better performance can be accomplished by realigning the antenna input circuits to match your antenna system. I happened to have a small battery operated 100 kHz oscillator that I've used for antenna work that is set on the far side of my antenna. Its output is sufficient for signal pickup on all the ham bands up to 30 MHz. This steady fixed signal source is invaluable for antenna adjustments, and for matching my receivers to the antennas for best sensitivity. by this means of starting at the antenna and working through to the receiver a matched system is achieved.

Using this system with the R-390A receiver is simple. With the antenna trimmer set at zero, adjust the slugs and trimmer capacitors in the rf antenna input stages for all of the ham bands for maximum AGC voltage, as outlined previously, or for maximum carrier level meter readings. The antenna trimmer does tune out the reactances encountered at this QTH using trap vertical antennas. The improved signal to noise ratios are well worth the work involved.

Performance

First, let me stress the importance of any receiver that has a fixed frequency calibrator and an "S" meter indicator, as a means for judging receiver performance over prolonged periods. As time progresses a receiver's performance can be expected to fall off as tubes and components age. When I first received my R-390A I recorded the carrier level readings of the 100 kHz calibrator every 100 kHz from 500 kHz through 30 MHz. When atmospheric conditions prevail to a point that you begin to doubt whether or not your receiver has lost its sensitivity, it's then only a matter of referring to the original list of level readings to make this determination. With the R-390A these readings will average approximately 50 dB throughout its spectrum range. Lacking suitable test equipment, such as a calibrated signal generator and a distortion analyzer, performance could only be judged against before and after modifications, and against a comparative performance of other receivers that have been in the shack from time to time. Splitting and swapping antennas between the two receivers, and peaking each set to the same signal has shown that the R-390A has better sensitivity, better selectivity and is more versatile than anything compared with so far.

... **W6ONL**

The New Hy-Gain 270 brings state-of-the-art design to 2 meter mobile.

The Hy-Gain 270 is specifically designed to solve the problems of gain 2 meter mobile antennas...hard tuning, high VSWR, poor pattern due to irregular ground plane, and fade from whip flex.

The all white fiberglass and chrome design develops 6 db gain through the use of 2 stacked 5/8 wave radiators with a self-contained 1/4 wave decoupling system. Because the Hy-Gain 270 operates independent of the car body ground, you get minimum pattern distortion for maximum range in all directions. Independence from the car body also means the end to tune-up problems. The fiberglass design solves the fading problem due to upper whip flex. Since the antenna and feedpoint are sealed in fiberglass, the Hy-Gain 270 will deliver top performance year after year without loss due to corrosion. The Hy-Gain 270 can be mounted anywhere ...bumper, cowl, deck or mast...for fixed, land mobile or marine service using Hy-Gain mounts listed below.

- 6.0 db gain.
- 250 watt rated.
- 144-148 MHz.
- VSWR less than 1.5:1 at resonance, 6 MHz Bandwidth.
- 96″ whip height.
- No pruning required, completely factory tuned!
- 50 ohm input.
- 3/8 x 24 standard mobile thread.
- Comes with 18′ coax and PL-259 connector.

Order No. 270

Mounts – Universal No. 271
Flush Body No. 499
Bumper No. 415

Get maximum range...get a Hy-Gain 270!

For prices and information, contact your local Hy-Gain distributor or write Hy-Gain.

hy-gain

Hy-Gain Electronics Corporation; 8601 Northeast Highway Six; Lincoln, NE 68507; 402/464-9151; Telex 48-6424.
Branch Office and Warehouse; 6100 Sepulveda Blvd., #322; Van Nuys, CA 91401; 213/785-4532; Telex 65-1359.
Distributed in Canada by Lectron Radio Sales, Ltd.; 211 Hunter Street West; Peterborough, Ontario.

THE R-392 ON THE AIR

Jack Spillane W7UGV
2010 N.W. 60th
Seattle WA 98107

I recently purchased an R-392 and have been using it as a second receiver for several months.

The R-392 is a triple conversion receiver with a tuning range from 500 kHz to 32 MHz. This range is covered in one megahertz steps except for the first band which covers 500 kHz to 1 MHz. The calibration accuracy is 300 Hz.

Power Supply

The R-392 requires 28V dc approximately for both the filaments and plate supply. The total current required is 3 amps.

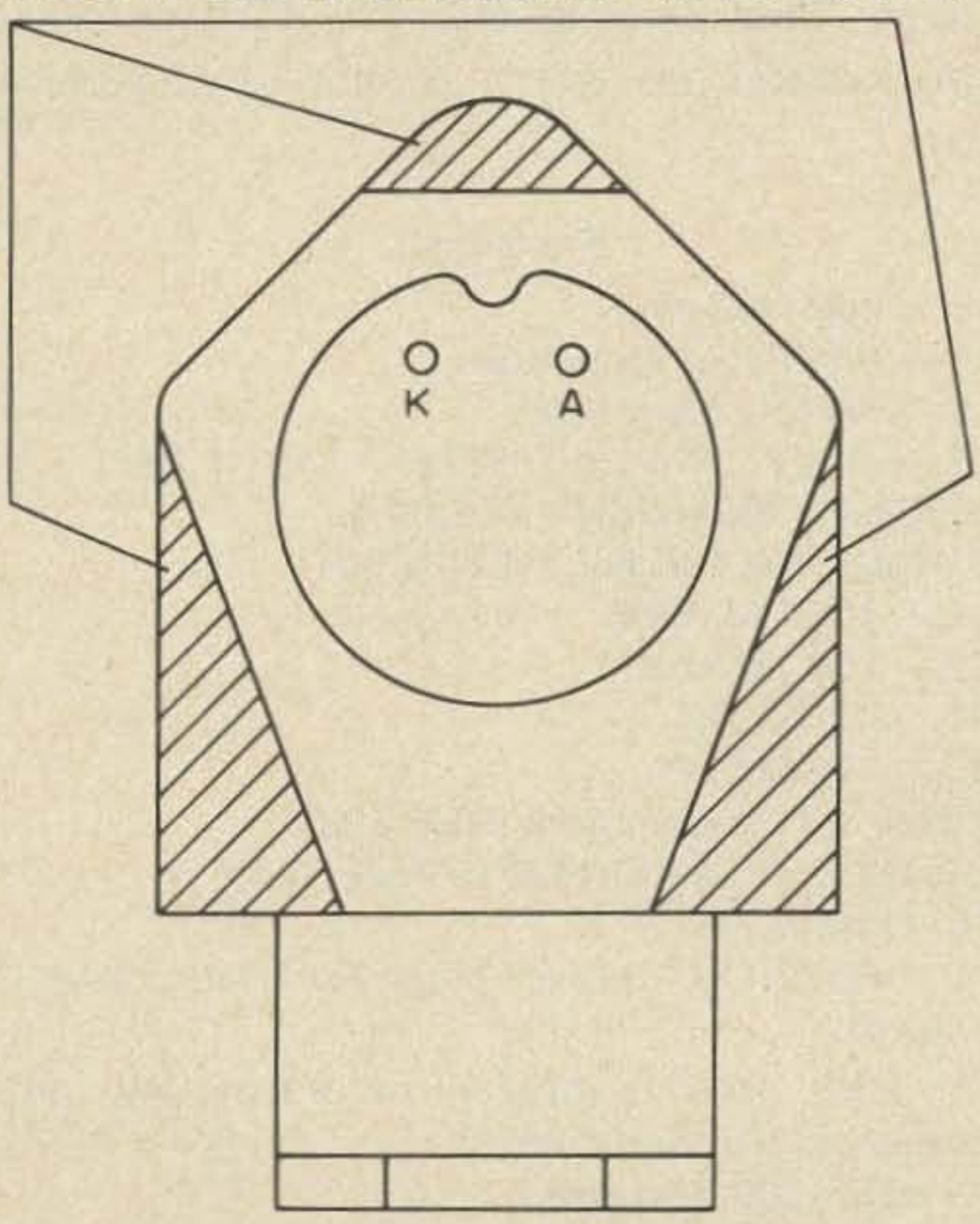


Fig. 1. Modification to power plug marked FRANK UW1320FA13.

The power supply uses a 27V transformer with a rating of at least 3 amps.

The regulator is a Darlington pair consisting of Q1 and Q2. The base of Q1 is controlled by a 27V zener diode. This sets the output voltage at the emitter of Q2 at somewhat less than 27V. Q2 is heat sunk to the chassis using a mica washer. Q2 is mounted with a mica washer on its own heat sink (a Motorola HEP 500 unit). This heat sink should be mounted in a vertical position with the fins at right angles to the top of the chassis. Mount Q1 and Q2 using silicone grease.

Power Plug

The power plug I purchased would not fit the receiver. I modified the plug by filing away part of the lower part of the case as seen in Fig. 1. The plug is labeled FRANK UW13020Fal3.

Audio

The audio output impedance is 600Ω. I use a speaker system with a 500Ω to 4Ω transformer installed in the speaker cabinet. Fair Radio Sales Co., P.O. Box 1105, 1016 E. Eureka St., Lima, Ohio 45802, sells the LS-166/U speaker recommended by the R-392/URR manual.

Controls

Most of the controls are standard on any communications receiver. The controls covered here are peculiar in the R-392.

FUNCTION SWITCH

Off – Power off.
Normal – Power on.
Limiter – Noise limiter on.
Net – Defeats transmit/receive relay.
SQ – Squelch. Received carrier trips relay to turn on receiver audio. The squelch level is controlled by the rf gain squelch thresh.

AGC SWITCH

Off – Removes AGC voltage from receiver grids.
On – Places automatic gain voltage on the receiver grids.
Cal – In the CAL position the 100 kHz calibration signal is turned on and the receiver input is removed from the antenna input connectors by a relay.

DIAL LOCK

Locks the kHz dial.

DIAL ZERO

When pushed in and turned this allows the kiloHertz dial to be moved a small amount when the dial lock is on.

I-F OUT

455 kHz out for i-f type FSK RTTY converter (possibly the CV 278 frequency converter) this output could feed an external i-f amplifier with a 455 kHz filter and a product detector.

TUNING

Example:
Let us say we want to receive on the 40m band on 7.250 MHz.
1. Set the MegaHertz dial to 7.
2. Set the kiloHertz dial to 250.

CALIBRATION

Example:
Calibrate to the nearest 100 kHz the frequency of 7.200 MHz.

1. Turn AGC switch to CAL.
2. Turn on BFO and set BFO to 0.
3. Set MegaHertz dial to 7.
4. Set kiloHertz dial to 200.
5. Zero beat the 100 kHz signal with the kiloHertz dial.
6. Lock the kiloHertz dial.
7. Push in and adjust the dial zero to the nearest 100 kiloHertz.
8. Unlock dial zero.
9. Turn AGC switch to AGC.

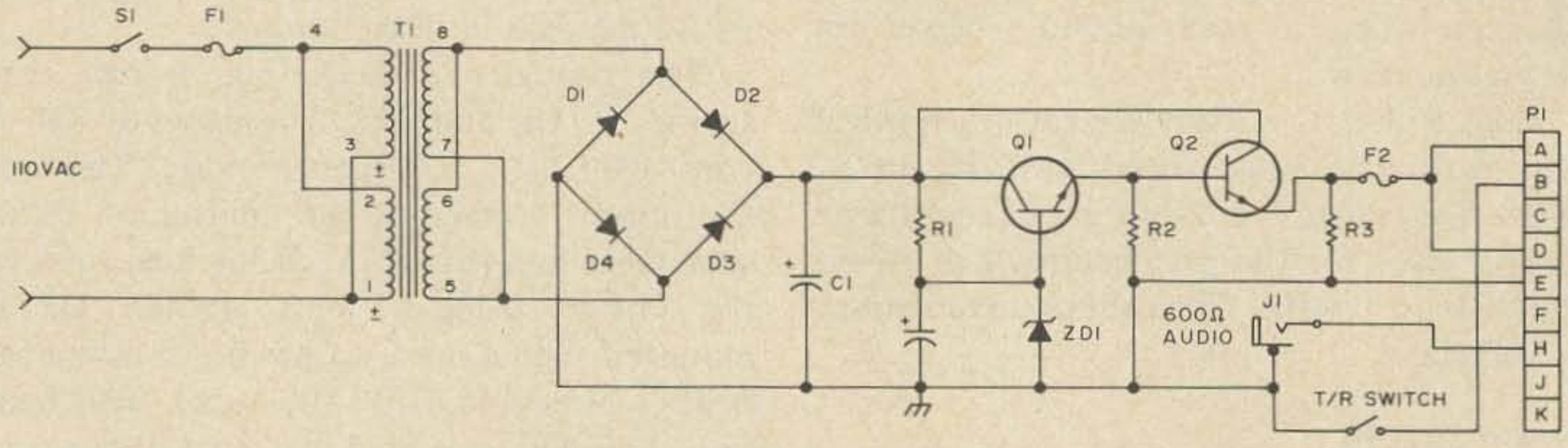


Fig. 2. R-392/URR power supply.

I would recommend the purchase of an instruction book for the R-392/URR receiver. This manual will give you complete information on repair, alignment and operation.

Parts List

S1 – toggle switch.
F1 – 1.5A slow blow fuse.
F2 – 5A fast blow fuse.
T1 – Fair Radio Sales Co., Part No. 5950-645-3854. 26.4V @ 3.04A.
D1-D4 – 6A 100 Piv. HEP R0101
C1 – 4000 μF 50V.
C2 – 100 μF 50V.
R1 – 470Ω 2W.
R3 – 1000Ω 2W.
ZD1 – 27V zener diode HEP 608.
Q1, Q2 – RCA SK 3027 or HEP 704.
J1 – Phone jack.
P1 – R392/URR power plug. Fair Radio Sales Co.
Quantity
2 – HEP 450 transistor mounting kit (mica washer, socket and screws).
1 – HEP 500 heat sink.
1 – Tube of silicone grease.

. . . W7UGV

Walter S. Schopfer W2FSO
108 Ellsworth Avenue
Harrison NY 10528

A SUPER SELECTIVE CW TRACKING FILTER

Cut down drift, enhance your signal-to-noise ratio and reduce QRM – all in one package.

For years, the most widely used method of obtaining selectivity for the reception of CW has been the reliable and effective single crystal filter. Versions of these filters are found on most quality CW receivers. A CW crystal filter can provide a 3 dB bandwidth of between 20 and 400 Hz at 455 kHz. The usefulness of this narrow band characteristics of a crystal has been well proven during the course of modern ham radio. By limiting the bandwidth to the amount necessary for optimum signal readability, the signal-to-noise ratio can be greatly enhanced and QRM drastically reduced. In order to keep the CW station tuned in at maximum strength, the receiver must be stable and the operator must retune to compensate for the slight drifting present in most ham receivers. Older receivers using vacuum tubes must be warmed up for 15 minutes or so to obtain low drift. The diagram in Figures 1a and 1b, show the effect of slight mistuning or receiver drift on the strength of a CW station.

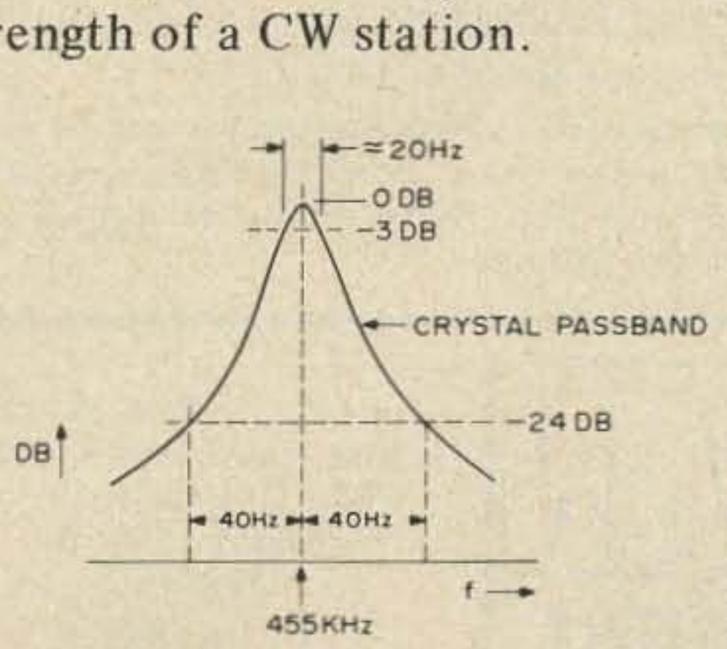


Fig. 1a. The effect of slight mistuning or receiver drift on the strength of a CW station.

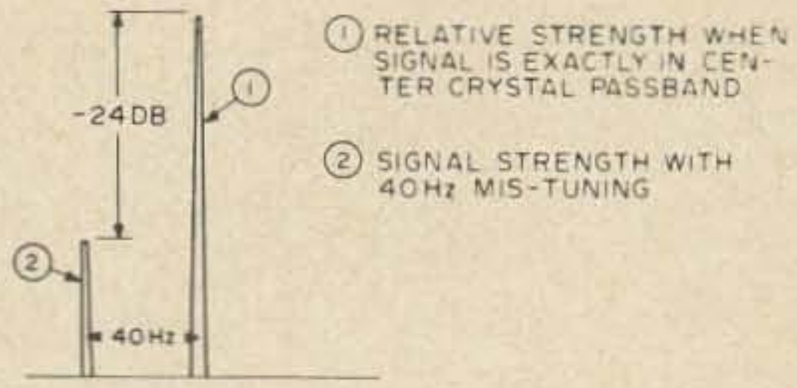


Fig. 1b. Results of mistuning or receiver drift causing 24 dB signal strength reduction.

Fig. 1a, shows a representation of a typical single crystal filter bandpass characteristic. Note that on either side of the peak, the response falls rather rapidly (12 dB per octave). At plus or minus 40 Hz, the response is down 24 dB. Consequently, a slight mistuning or receiver drift causes a 24 dB signal strength reduction as shown in Fig. 1b. The operator must then adjust the receiver tuning in order to move the 40 Hz up into the maximum response of the crystal.

One can now ask the question: How can the signal be automatically positioned at the maximum response point of the filter regardless of receiver drift?

One rather infrequently used technique for obtaining high selectivity which has been known for some time, is the capacitor

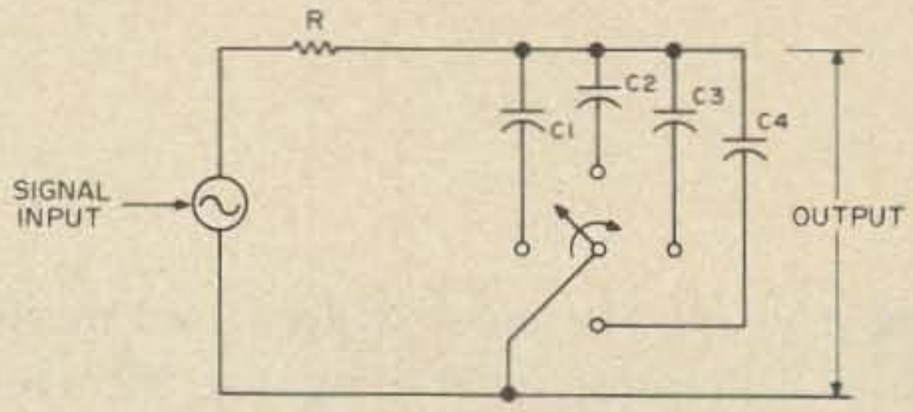


Fig. 2. Network.

sampling technique . Fig. 2, shows a network consisting of a resistor, 4 capacitors, and rotary switch. (Any number of capacitors greater than 2 can be used.)

The rotary switch is only a convenient representation of electronic switching.

Assume that the switch is rotating at a frequency of say 1000 Hz. Let us look at the output of the network when the input frequency matches the frequency of switch rotation.

If the R and C's are large enough, a capacitor will charge up to the average value

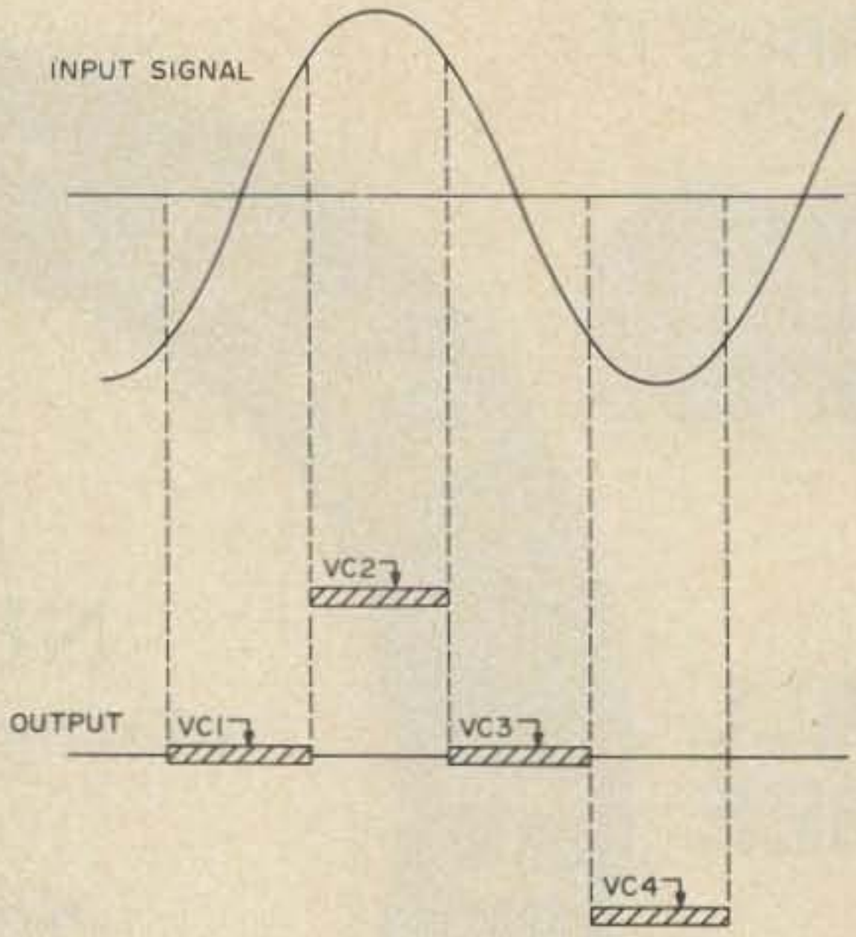


Fig. 3. Complete cycle of switching.

of signal voltage it sees when it is connected. This C1 charges to zero volts because it always sees an equal amount of positive and negative voltage when it is connected. C2 charges to nearly the peak value of the sine wave. The resultant of complete cycle of switching is shown in Fig. 3. When the switch rotation frequency or the input signal frequency is changed, the response falls off at a rate of 6dB per octave. The bandwidth of this type of filter is determined by the RC time constant. The greater the R and/or C, the narrower the bandwidth. Extremely narrow bandwidth can be obtained as low as 1 Hz at 1 kHz. The center frequency of the pass band is equal to the frequency of rotation of the switch.

It now becomes clear as to how the tracking capability is obtained. One merely has to use a voltage controlled oscillator (VCO) to drive the capacitor switch and phase lock the VCO to the input signal as shown by the block diagram of Fig. 4.

The dual flip flop and the 7402 decoder turn transistors Q1 through Q4 on in sequence and thereby connect the capacitors in the circuit in sequence. The action as explained earlier forms a narrow band network between the receiver af output and the headsets. A small amount of signal is picked off at the filter output by resistor network R1 and R2 and is compared to the flip flop divider output by the phase detector FET. The resultant difference dc

voltage is amplified and slaves the VCO frequency to be exactly 4 times the input signal frequency. Capacitor C1 is used to hold the VCO on frequency between dots and dashes. Thus, any slight drifting of the input signal frequency will pull the VCO (and the pass band) along with it.

Refinements can be added. Resistor R can be varied to adjust the filter bandwidth for optimum readability. The filter peak can be swept up and down by feeding a positive or negative current into point A. This feature is handy for

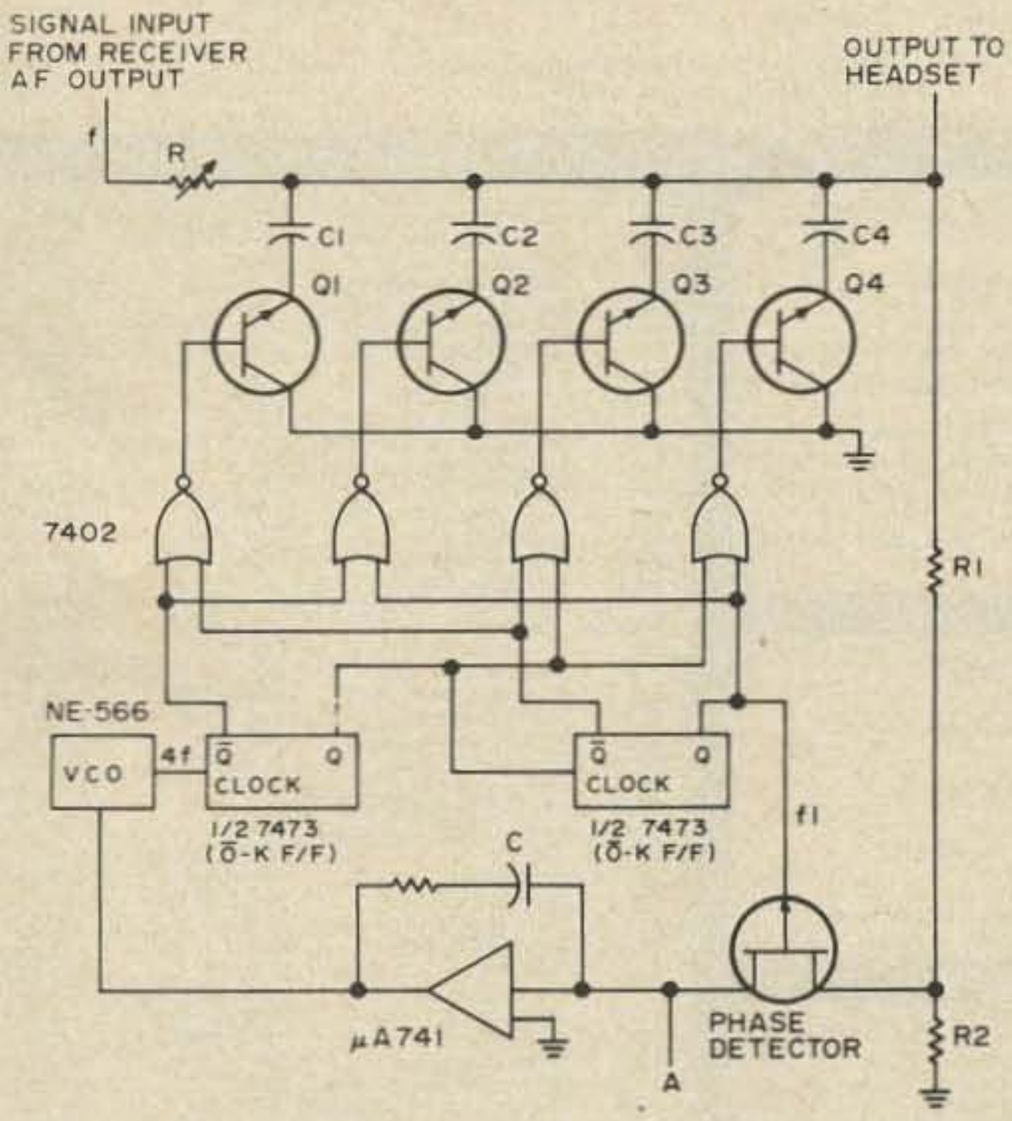


Fig. 4. Phase locked VCO to the input signal.

roundtable QSO's where the other stations may be on slightly different frequencies.

The filter network has a tendency to respond to harmonics of the desired frequency. To minimize this effect, low pass filters can be used ahead of and after the switched capacitors network. The output low pass filter can also be used to smooth the output shown in Fig. 3, into a sine wave.

An experimental unit was constructed and the results were excellent. This is the first CW filter I've seen where the pass band can be made as narrow as desired *without* oscillation. It can be made narrow to a point where the dots and dashes actually run together even at slow speeds. Perfect tuning is always maintained by the phase locked loop.

. . . W2FSO

INTERNATIONAL ELECTRONICS UNLIMITED

AUGUST SPECIALS

DIGITAL INTEGRATED CIRCUITS

7400	.25	7447	1.45	74141	1.25
7401	.25	7448	1.50	74145	1.25
7402	.25	7450	.29	74150	1.25
7403	.25	7451	.32	74151	1.05
7404	.29	7452	.32	74153	1.45
7405	.27	7453	.32	74154	1.75
7406	.55	7454	.45	74155	1.35
7407	.53	7460	.30	74156	1.50
7408	.29	7464	.45	74157	1.50
7409	.29	7465	.45	74161	1.65
7410	.25	7472	.45	74163	1.80
7411	.35	7473	.55	74164	2.95
7413	.95	7474	.55	74165	2.95
7415	.50	7475	.95	74166	1.95
7416	.50	7476	.55	74173	1.95
7417	.50	7483	1.25	74175	1.95
7420	.25	7486	.55	74176	.95
7422	.32	7489	3.25	74177	.95
7423	.37	7490	1.25	74180	1.15
7425	.39	7491	1.40	74181	4.25
7426	.35	7492	1.05	74182	1.10
7427	.39	7493	1.05	74185	2.50
7430	.25	7494	1.10	74190	1.65
7432	.30	7495	1.05	74191	1.65
7437	.50	7496	1.05	74192	1.65
7438	.55	74100	1.65	74193	1.65
7440	.25	74105	.55	74194	1.65
7441	1.25	74107	.55	74195	1.15
7442	1.15	74121	.65	74196	1.35
7443	1.25	74122	.55	74197	1.15
7444	1.30	74123	1.15	74198	2.50
7445	1.25	74125	.69	74199	2.50
7446	1.45	74126	.95		

LOW POWER TTL

74L00	.40	74L51	.40	74L90	1.75
74L02	.40	74L55	.60	74L91	1.50
74L03	.40	74L71	.60	74L93	1.75
74L04	.40	74L72	.60	74L95	1.75
74L06	.40	74L73	.80	74L164	2.95
74L10	.40	74L74	.80	74L165	2.95
74L20	.40	74L78	.80	74L98	2.95
74L30	.40	74L85	1.25		
74L42	1.75	74L86	.95		

HIGH SPEED TTL

74H00	.37	74H21	.37	74H55	.45
74H01	.37	74H22	.37	74H60	.45
74H04	.37	74H30	.37	74H61	.45
74H08	.37	74H40	.37	74H62	.45
74H10	.37	74H50	.37	74H72	.60
74H11	.37	74H52	.37	74H74	.70
74H20	.37	74H53	.45	74H76	.70

8000 SERIES TTL

8091	.69	8214	1.95	8810	.95
8092	.69	8220	1.95	8811	.75
8093	.69	8230	2.95	8812	1.25
8094	.69	8301	1.25	8822	2.95
8095	1.55	8309	1.05	8830	2.95
8121	1.05	8312	1.05	8831	2.95
8123	1.75	8520	1.45	8836	.69
8130	2.50	8551	1.95	8830	1.50
8200	2.95	8552	2.95		
8210	3.95	8554	2.95		

CMOS

74C00	.85	74C74	1.50	74C162	3.25
74C02	.85	74C76	1.70	74C163	3.25
74C04	.95	74C107	1.50	74C164	3.50
74C08	.95	74C151	2.90	74C173	2.90
74C10	.85	74C154	3.50	74C192	3.25
74C20	.85	74C157	2.25	74C195	3.00
74C42	2.15	74C160	3.30	80C97	1.50
74C73	1.70	74C161	3.25		

4000 SERIES RCA-EQUIVALENT

CD4001	.65	CD4013	1.50	CD4025	.65
CD4002	.65	CD4016	1.50	CD4027	1.35
CD4009	1.00	CD4017	2.95	CD4030	.65
CD4010	.65	CD4019	1.35	CD4035	2.85
CD4011	.65	CD4022	2.75		
CD4012	.65	CD4023	.65		

MEMORIES

1101	256 bit RAM MOS	2.50
1103	1024 bit RAM MOS	7.95
5260	1024 bit RAM Low Power	7.95
7489	64 bit RAM TTL	3.25
8223	Programmable ROM	6.95

TTL

7400	Quad 2 input NAND gate	$.22 ea.
7404	Hex inverter	.25 ea.
7410	Triple 3 input NAND gate	.22 ea.
7420	Dual 4 input NAND gate	.22 ea.
7438	Quad 2 input NAND buffer O.C.	.35 ea.
7440	Dual 4 input buffer	.22 ea.
7445	BCD-to-decml decoder/driv. O.C.	.89 ea.
7453	Expandable AND-OR INVERT gate	.25 ea.
7460	Dual 4 input expander	.20 ea.
74123	Retrig. monostable multivib w/clr	.89 ea.

LED DISPLAYS

MAN 2 type	.32" Red Alpha Numeric	5.95 ea.
MAN 7 type	.27" Red 7 Segment	1.95 ea.

LINEAR

324	Quad op amp (4-741's) DIP	$1.89 ea.
351	Dual peripheral driver mDIP	.39 ea.
380	2 watt audio amp DIP	1.49 ea.
565	Phase locked loop DIP	2.49 ea.
3900	Quad amp DIP	.65 ea.
8223	Programmable ROM TTL DIP	5.95 ea.
8038	Voltage controlled oscillator - sine-square-triangle output DIP	5.95 ea.
MCD2	Opto isolator - diode	1.19 ea.
MCT2	Opto isolator - transistor	.89 ea.

5001 LSI Calculator Chip (40 pin) add, subtract, multiply & divide
With data — $3.95 ea.

CALCULATOR CHIPS

5001	LSI (40-Pin) Add, subtr., mult. & div., 12-dig. Data supplied with chip	$6.95 ea.
	Data only — Refundable with purchase	1.00
5002	LSI similar to 5001 exc. des. for battery operated - Data supplied with chip	8.95 ea.
—	Data only — Refundable with purchase	1.00
5005	LSI (28 pin) Full 4 funct. mem. 12-dig. displ. & calc. 7 seg. mltplx. outp. Data suppl. w/chip	10.95 ea.
	Data only — Refundable with purchase	1.00
MM5736	18 Pin, 6-dig., add, subtr., mult., div.	4.95 ea

DIGITAL CLOCK CHIPS

MM 5311	28-pin any readout 6-dig. BCD with spec. sheet	11.95 ea.
MM 5312	24-pin any readout 4 digit lpps output BCD with spec. sheet	8.95 ea.
MM 5313	28-pin any readout 6 digit lpps BCD with spec. sheet	10.95 ea.
MM 5314	24-pin LED-Incandescent readout 6-digit with spec. sheet	10.95 ea.
MM 5316	40-pin norm. alarm set snooze alarm-timer 12 or 24-hr. operat. with spec. sheet	15.95 ea.

LED'S

MV108	Visible red TO 18		.25 ea.
MV50	Axial leads micromini dome	.25 ea	5/1.00
MV5020	Jumbo clear dome visible red	.35 ea	3/1.00
ME4	Infra red (invisible) diff. dome		.60 ea.

DISPLAYS

MAN1	Type red, 7 segment .270	3.95 ea	
MAN3M	Type red 7 seg .127"	1.75 ea	4/4.85
MAN4	Type red, 7 seg .190"	2.35 ea	4/ 7.95
MAN5	Type grn. 7 seg. .270"	4.75 ea	4/15.75
MAN 7	Type (SLA1), red 7 seg	2.50 ea	4/ 7.95
MAN8	Type yel. 7 seg. .270"	5.50 ea	4/18.95
DL707	Type (MAN 1Repl.)	3.50 ea	4/13.00

OPTO ISOLATORS

MCA 2-30	Darlington	.95 ea
MCD 2	Diodes	1.95 ea.
MCT 2	Transistor	1.45 ea.

PHASE LOCKED LOOPS

560 Phase locked Loop	DIP	2.95 ea
561 Phase Locked Loop	DIP	2.95 ea
562 Phase Locked Loop	DIP	2.95 ea
565 Phase Locked Loop	DIP	2.95 ea
566 Function Generator	MINI-DIP	2.95 ea
567 Tone Generator	MINI-DIP	2.95 ea

LINEAR INTEGRATED CIRCUITS

300	Pos V Reg (super 723)	TO-5	$ .95 ea
301	Hi performance AMP	MINI-DIP, TO-5	45 ea
302	Voltage Follower	TO-5	.95 ea
304	Negative Voltage Regul.	TO-5	1.25 ea
305	Positive Voltage Regul.	TO-5	1.25 ea
307	Op AMP (super 741)	MINI-DIP, TO-5	45 ea
308	Micro Power Op Amp	MINI-DIP	1.25 ea
309H	5 V Regulator	TO-5	1.25 ea
309K	5 V 1A Regulator	TO-3	1.95 ea
310	Voltage Follwer Op Amp	TO-5	1.45 ea
311	He perf. Volt. Compartr.	MINI-DIP, TO-5	1.25 ea
319	Hi-Speed Dual Compartr.	DIP	1.65 ea
320	-5.2 V Neg. Regulator	TO-3	1.95 ea
320	-15 V Neg. Regulator	TO-3	1.95 ea
324	Quad Op Amp	DIP	2.25 ea
339	Quad Comparator	DIP	2.50 ea
340T	Pos. Volt. Reg. (6V-8V-12V-15V-18V-24V)	TO-220	2.25 ea
370	AGC/Squelch AMPL	TO-5 or DIP	1.65 ea
372	AF-IF Strip-detector	DIP	.85 ea
373	AM/FM/SSB Strip	DIP	3.60 ea
376	Pos. Volt. Regulator	MINI-DIP	.65 ea
377	2W Stereo amp	DIP	2.75 ea
380	2 Watt Audio amp	DIP	1.75 ea
380-8	.6W Audio amp	MINI-DIP	1.75 ea
381	Low-Noise Dual Pre-Amp	DIP	2.25 ea
382	Low-Noise Dual Pre-Amp	DIP	2.25 ea
550	Prec. Voltage Regulator	DIP	.95 ea
555	Timer	MINI-DIP	1.25 ea
703	RF-IF Amp	MINI-DIP	.59 ea
709	Operational AMPL	TO-5 or DIP	.45 ea
711	Dual Different. Compar.	DIP	.39 ea
723	Voltage Regulator	DIP	.75 ea
739	Dual Hi Perf. Op AMP	DIP	1.25 ea
741	Comp. Op AMP	MINI-DIP, TO-5	.45 ea
747	Dual 741 Op Amp	TO-5 or DIP	.95 ea
748	Freq. Adj. 741	MINI-DIP	.45 ea
1303	Stereo Pre-Amp	DIP	.95 ea
1304	FM Mulpx Stereo Demod	DIP	1.50 ea
1307	FM Mulpx Stereo Demod	DIP	.95 ea
1458	Dual Com. Op. Amp.	MINI-DIP	.75 ea
LH2111	Dual LM 211 Volt. Comp.	DIP	2.95 ea
3065	TV-FM Sound System	DIP	.75 ea
3075	FM Det.-LMTR & Audio Pre-Amp	DIP	.85 ea
3900	Quad Amplifier	DIP	.75 ea
3905	Precision Timer	DIP	.75 ea
7524	Core Mem Sense AMPL	DIP	1.95 ea
7525	Core Mem Sense AMPL	DIP	.95 ea
7534	Core Mem Sense Amp	DIP	2.75 ea
7535	Core Mem Sense Amp	DIP	1.25 ea
8038	Function Generator	DIP	8.95 ea
9601	Retriggerable One-Shot	DIP	.95 ea
75451	Dual Peripheral Driver	MINI-DIP	.49 ea
75452	Dual Peripheral Driver	MINI-DIP	.49 ea
75453	(351) Dual Periph. Driver	MINI-DIP	.69 ea
75491	Quad. seg. driver for LED readout	DIP	1.60 ea
75492	Hex digit driver	DIP	1.75 ea

Please specify which data sheets are required with order. Add $.50 per data sheet for items priced less than $1.00 each.

MASTER CHARGE AND BANKAMERICARD ACCEPTED BY MAIL OR PHONE

Supply all card numbers and bank name. Minimum charge order $10.00. Phone orders Monday through Friday — 10:00 a.m. - 4:00 p.m. (408) 659-4773

ON ORDERS OVER $25.00 DEDUCT 10%

All items are new, unused surplus parts—tested functional. Satisfaction is guaranteed. Shipment will be made via first class mail — postage paid — in U.S., Canada and Mexico within three days from receipt of order. Minimum order — $5.00. California residents add sales tax.

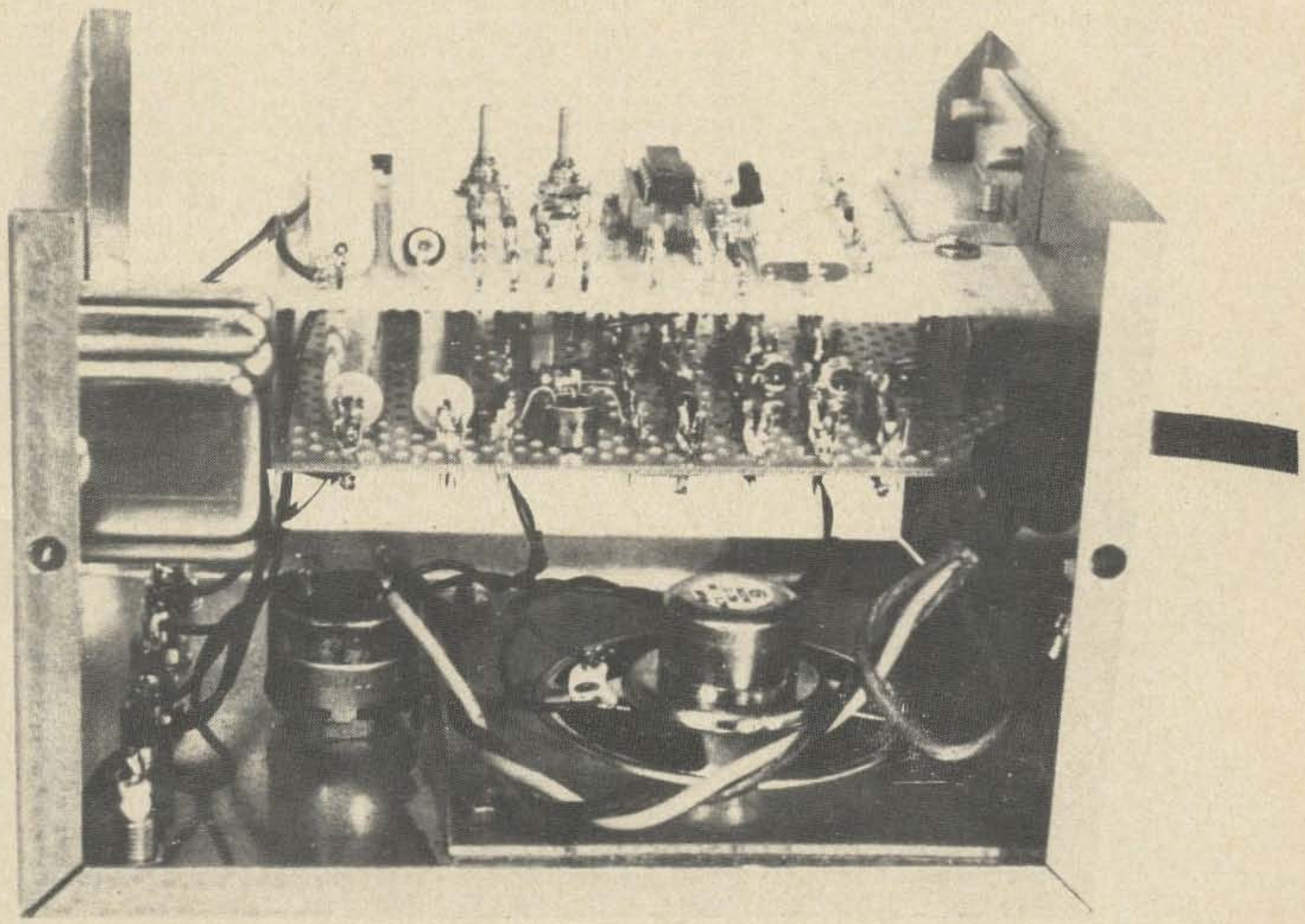
INTERNATIONAL ELECTRONICS UNLIMITED
P.O. BOX 1708 MONTEREY, CALIF. 93940 USA

— TRANSISTOR SPECIAL —

High Voltage Power Transistors	400 v	$2.45 ea	$200/100
Prime quality, 10 watt, 1 amp max, TO-5	300 v	1.20 ea	100/100
Typically 40 beta at 50 mHz, PNP	200 v	.75 ea	65/100

AN AUDIBLE VOLTMETER

Stan Johnson WA0AQC/9
215 N. River
North Aurora IL 60542



Introduction

What trouble shooting ham, while looking at his voltmeter, hasn't had the test probe slip and occasionally short to the chassis or a nearby terminal? Not only are wayfaring test probes a nuisance but to unforgiving semiconductor devices they can be a terminal affliction. Through the use of a voltage-controlled audio oscillator voltages can be approximately measured by listening to the oscillator frequency. This allows one to keep his eyes on the circuit being tested and the test probe, minimizing the tendency for the probe to wander.

Operation

The audible voltmeter of Fig. 1, can measure voltages up to 10V dc with an accuracy limited almost exclusively to the resolution of the ear. The voltmeter circuit has an input impedance of 100,000Ω per volt and has three ranges through the use of three separate input jacks: 0 to 0.1V, 0 to 1V and 0 to 10V. In each case, a "full-scale" voltage applied to the appropriate input jack will produce a 1000 Hz tone from the voltmeter speaker. Voltages less than the "full-scale" voltage will produce a correspondingly lower frequency which is directly proportional to the voltage applied.

A test jack is provided to conveniently supply +1V for using the voltmeter as a continuity checker. The test jack also can be used to calibrate the ear to 1000 Hz by

WIERNU AUGUST CLOSEOUT SALE

Linear Price Schedule

300	Pos. V Reg. (Super 723)	T05	.80
301	Hi performance Ampl.	T05 or mini	.30
302	Voltage follower	T05	.80
304	Negative Regulator	T05	1.00
305	Voltage Regulator	T05	1.00
306	Voltage Comparator/Buffer	T05	4.00
307	Op Amp (Super 741)	T05 or mini	.30
308	Micro power op Amp.	T05	1.00
309	5V 1A Regulator	T03	1.50
310	Voltage follower Op. Amp.	T05 or mini	1.00
311	Hi performance Voltage Comparator	T05 or mini	1.00
320 - 5.0V	Negative Regulator	T03	1.75
- 5.2V	Negative Regulator	T03	1.75
- 12V	Negative Regulator	T03	2.00
- 15V	Negative Regulator	T03	1.75
324	Quad Op. Amp.	DIP	1.75
339	Quad Comparator	DIP	2.00
340 +5V	Positive V Regulator	T03	1.75
+6V	Positive V Regulator	T03	1.75
+8V	Positive V Regulator	T03	1.75
+12V	Positive V Regulator	T03	1.75
+15V	Positive V Regulator	T03	1.75
+18V	Positive V Regulator	T03	1.75
+24V	Positive V Regulator	T03	1.75
370	AGC/Squelch Amp.	DIP	1.00
371	Integrated RF/IF Amp.	T05	1.75
372	AF - IF strip - detector	DIP	.75
373	AM/FMI SSB strip	DIP	3.00
376	Pos. Volt Regulator	Mini	.50
380	2 Watt Audio Amp.	DIP	1.50
380-8	.6V Audio Amp.	Mini	1.25
381	Low Noise Duel Pre Amp	DIP	1.75
382	Low Noise Stereo Pre Amp	DIP	1.75
550	Precision Voltage Regulator	DIP	1.50
555	Timer	Mini	1.00
565	Phase Lock Loop	T05 or Dip	2.50
566	Function Generator	Mini	2.50
567	Tone Decoder	Mini	2.50
703	RF – IF Amp.	T05	.40
709	Op Amp.	T05 or Dip	.30
710	Voltage Comparator	T05 or Dip	.30
711	Dual Diff. Comparator	T05 or Dip	.30
723	V Regulator	T05 or Dip	.60
741	Comp Op Amp.	T05, Mini, or Dip	.40
747	Dual 741 Op Amp.	T05 or Dip	.80
748	Freq. Adj. 741	Mini	.40
1303	Stereo Pre Amp.	Dip	.75
1304	FM Multiplex Stereo Demod.	Dip	1.00
1305	FM Multiplex Stereo Demod.	Dip	1.50
1307	FM Multiplex Stereo Demod.	Dip	.75
1458	Dual Comp. Op Amp.	T05 or Mini	.70
3065	TV - FM Sound System	Dip	.60
3075	FM Detector - LMTR and Audio Pre Amp.	DIP	.70
3900	Quad Amp.	DIP	.70
75491	Quad seg driver for LED readout	DIP	1.25
75492	Hex digit driver	DIP	1.25
113	Reference Diode	T05	5.00

7400 series Price Schedule

00	.20	132	2.25	89	2.75	7489	2.75
01	.20	141	1.50	90	1.00	8223	6.00
02	.20	145	1.50	91	1.20	8225	3.75
03	.20	150	1.00	92	.90	74200	9.25
04	.20	151	.90	93	.90	DM8599	3.75
05	.20	152	4.25	94	.90	p2102	15.00
06	.40	153	1.00	95	.90		
07	.40	154	1.25	96	.90		
08	.20	155	1.00	100	2.00		
09	.20	156	1.25	107	.40		
10	.20	157	1.25	121	.50		
11	.20	158	2.50	122	.75		
12	.50	160	1.50	123	1.00		
13	.80	161	1.50	125	.50		
14	2.00	162	1.50	126	.50		
15	.40	163	1.50				
16	.40	164	2.50				
17	.40	165	2.50				
20	.20	166	1.75				
23	.30	170	4.25				
25	.30	173	1.75				
26	.30	174	2.25				
27	.40	175	2.25				
30	.20	176	.80				
32	.30	177	.80				
37	.35	180	1.00				
38	.40	181	4.00				
40	.20	182	1.00				
41	1.00	184	3.00				
42	.90	185	3.00				
43	1.50	189	5.00				
44	1.50	190	1.50				
45	1.00	191	2.00				
46	1.50	192	1.50				
47	1.50	193	1.50				
48	1.50	194	1.50				
50	.20	195	1.00				
51	.20	196	2.00				
53	.25	197	2.00				
54	.25	198	2.50				
60	.25	199	2.50				
64	.40	200	9.25				
65	.40						
70	.40						
72	.40						
73	.45						
74	.50						
75	.90						
76	.45						

74H00 series

H00	.30	L72	.50
H01	.30	L73	.60
H04	.30	L74	.65
H05	.40	L78	.70
H08	.30	L85	1.25
H10	.30	L86	.75
H11	.30	L90	1.25
H20	.30	L91	1.50
H21	.40	L93	1.25
H22	.40	L95	1.25
H30	.30	L98	2.00
H40	.30	L154	2.00
H50	.40	L157	2.00
H51	.40	L164	3.00
H53	.40	L165	3.00
H54	.40	L173	3.00
H55	.40	L192	2.50
H60	.40	L193	2.50
H61	.40	L195	2.00
H62	.40		
H72	.50		
H73	.55		
H74	.55		
H76	.60		
H78	.60		

74L00 series

L00	.30	L42	1.25
L02	.30	L51	.30
L03	.30	L71	.50
L04	.30		
L06	.50		
L10	.30		
L20	.30		
L30	.30		

74S00 series

S00	.50	S74	1.00
S03	.50	S86	1.00
S04	.50	S112	2.00
S05	.50	S114	2.00
S10	.50	S153	2.50
S11	.50	S174	3.25
S16	.50	S175	3.25
S20	.50		
S22	.50		
S40	.50		
S64	.50		
S65	.50		

Clock Chips—(no guarantee - no returns!)

MM5311	10.00	These units are too easy to blow
MM5312	8.00	up for us to accept returns and
MM5313	9.00	expect to make any money, so
MM5314	9.00	through we do test them, we offer
MM5316	12.00	no guarantee & accept no returns.

Memories

MM 5260	1024 bit RAM (2nd generation 1103)	5.00
p1101	256 bit RAM	2.00
p1103[a]	1024 bit RAM	7.00

Notes . . .

a. even the factory can't test the 1103 properly, so if you get a bad one please bear with us, send it back for immediate replacement.

b. 7400 series parts available at 25% of list untested. No guarantee! 10pcs/type min. order.

Request orders . . .

We sell many items not listed, & can obtain many not kept in stock. If you need any odd or hard to find ICs, odds are we can get them. Please write.

WEIRNU
Box 1307
Colton, CA 92324
ph #(714) 882-5387
(ask for FANNIE!)

—spec sheets .25¢ each
—our complete catalog $2.00, free with order of $100.00
—Calif. residents add 6% sales tax
—add $1 postage on orders under $10

Satisfaction guaranteed. All items except as noted have been precision tested by the latest equipment. We're so certain you'll keep coming back once you've tried our quality that we make this amazing first order offer: BUY $100.00 worth of merchandise, choose $100.00 worth free.

connecting it to the 1V jack and to calibrate the ear to 100 Hz by connecting it to the 10V jack.

Circuit

The schematic diagram of Fig. 1 can be divided into four sections: the dc amplifier, the oscillator, the audio amplifier and the power supply.

The dc voltage being measured is scaled by op amp A1 and its associated circuitry. The voltages indicated on the input jacks produce a dc amplifier output voltage of -2.25V. To prevent the op amp offset voltage from causing a continuous audio tone or nonlinearity at low voltages, offset null pot R6 is adjusted for 0V on IC terminal 12 with no input voltage applied.

A simple, linear, voltage-controlled audio oscillator circuit is composed of op amp A2 and the adjoining components. The circuit is basically an op amp integrator with a programmable unijunction transistor to discharge the capacitor. To calibrate the audible voltmeter, variable resistor R7 is adjusted for an oscillator frequency of 1000 Hz with +1.0V applied to the +1.0 voltmeter input jack. The audio oscillator output is a sawtooth wave and has an output frequency versus dc input voltage relationship which is extremely linear. Because the voltage controlled oscillator has possible applications where different input voltage versus output frequency relationships or different output amplitudes are required, a detailed description of the oscillator circuit and its characteristics follows.

Oscillator

The voltage controlled oscillator or voltage-to-frequency converter used in the audible voltmeter provides a linear output with a minimum of parts. Because the circuit may be easily adapted to a variety of ham projects from an audible SWR bridge for mobile operation to instruments for the visually handicapped, a detailed description of circuit operation is given.

Circuit Description

The voltage controlled oscillator shown in Fig. 3, is basically an op amp integrator and a discharge circuit. Some component values have been changed from the oscillator in Fig. 1, to simplify plotting the graph of Fig. 3. A negative voltage at E_{in} causes the op amp output to go positive, charging C1 with a current equal to the current caused by E_{in}. When the output voltage on capacitor C1 reaches the threshold voltage of Q1, the programmable unijunction transistor (Q1) turns on and remains on until C1 is discharged. (Resistor, R_c, limits the peak current through Q1.) The op amp output then returns to 0V and the cycle repeats, thus generating a sawtooth output waveform.

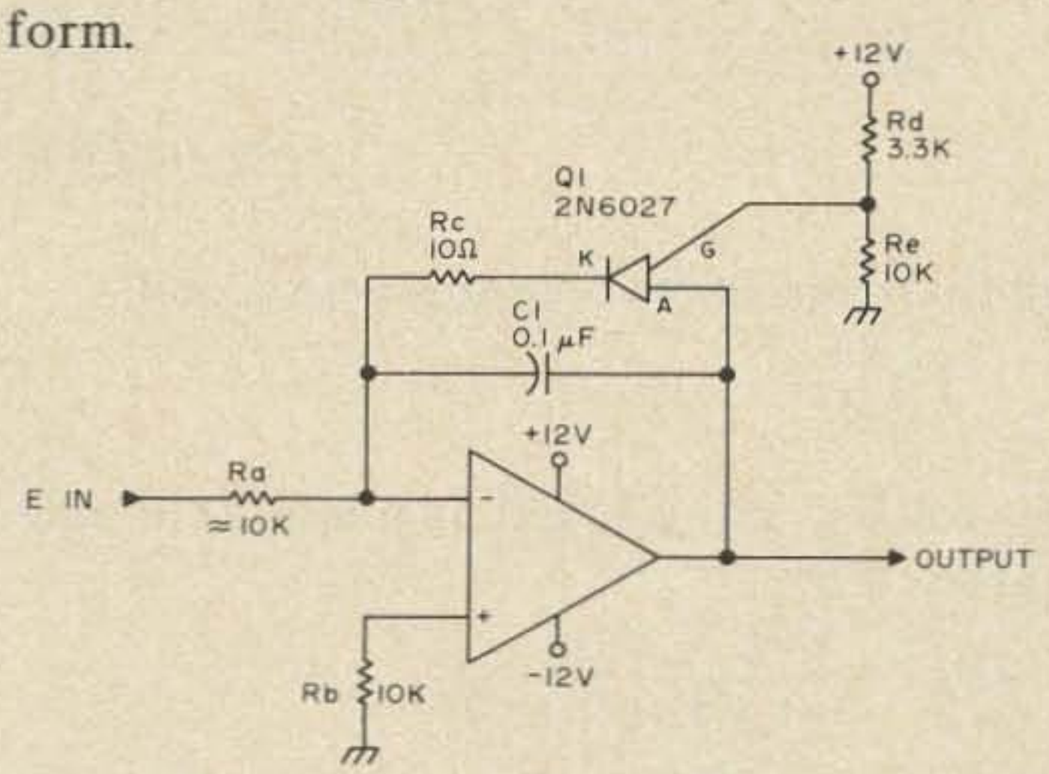


Fig. 2. Voltage controlled oscillator circuit.

Output Amplitude

The peak amplitude of the output waveshape is determined by the programmable unijunction transistor threshold voltage and is equal to the gate voltage plus 0.6V. Since the gate voltage is entirely determined by R_d, R_e, and the +12V supply of Fig. 2, the output sawtooth amplitude may be varied over a wide range by changing the resistor values or the supply voltage.

Output Frequency

The voltage-to-frequency converter output frequency is a function of the input current and the value of C1, once the peak output voltage has been chosen. Since the op amp inputs are at ground potential and draw negligible current,

$$Iin = \frac{Ein}{Ra}$$

Therefore, the current charging C1 will equal E_{in}/R_a. Given that the voltage on a capacitor is equal to the charge in coulombs divided by the capacitance in farads,

$$V = \frac{Q}{C}$$

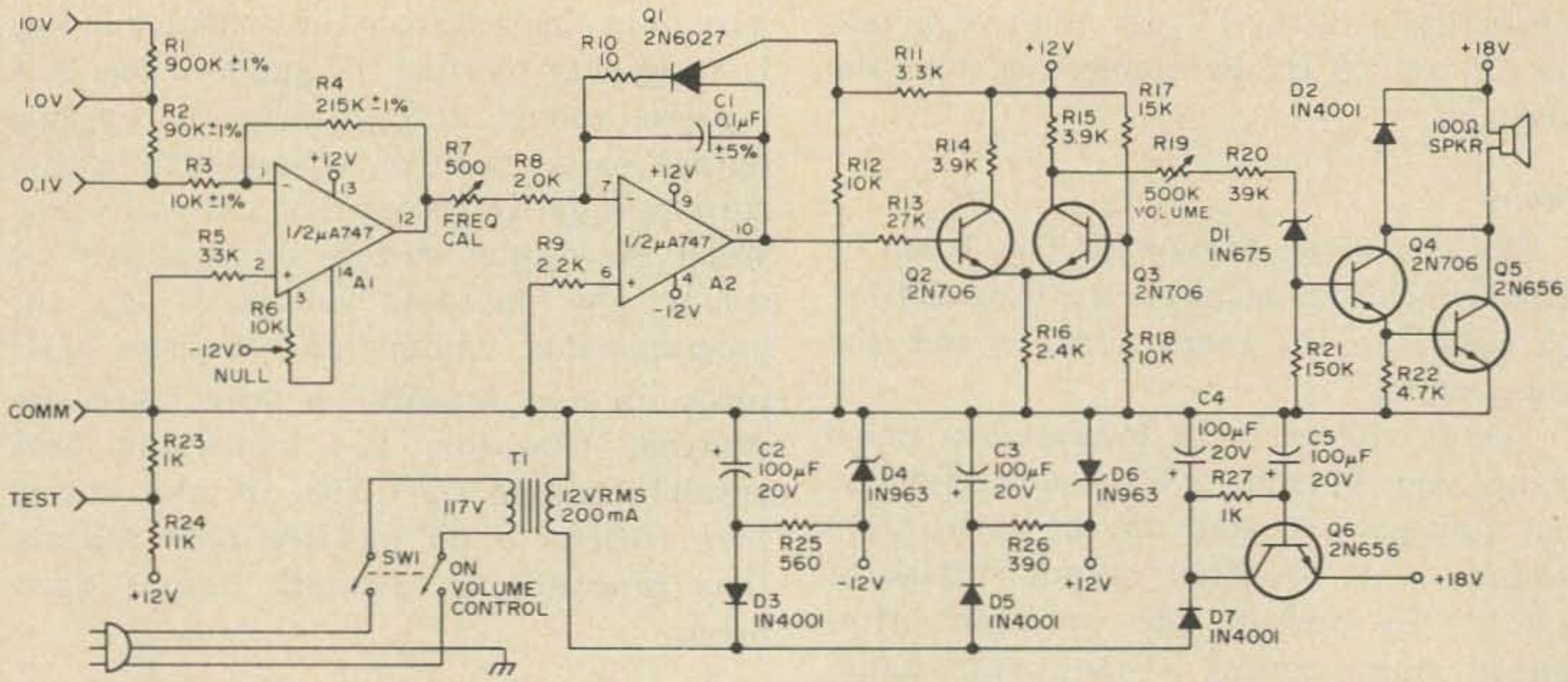


Fig. 1. Construction of voltmeter.

and that current is coulombs per second,

$$I = \frac{Q}{S}$$

the voltage on C1 will increase at a rate expressed by,

$$\triangle Vc1 = \frac{Ein \quad volts}{Ra\ C1\ second}$$

When C1 has charged to the Q1 threshold, the programmable unijunction transistor discharges the capacitor and the cycle repeats. The time for one pulse can be found from the threshold voltage and the charging rate.

$$T = \frac{V\ threshold}{\triangle Vc1\ \frac{volts}{second}}$$

The time for one cycle is the capacitor charging time found above plus the C1

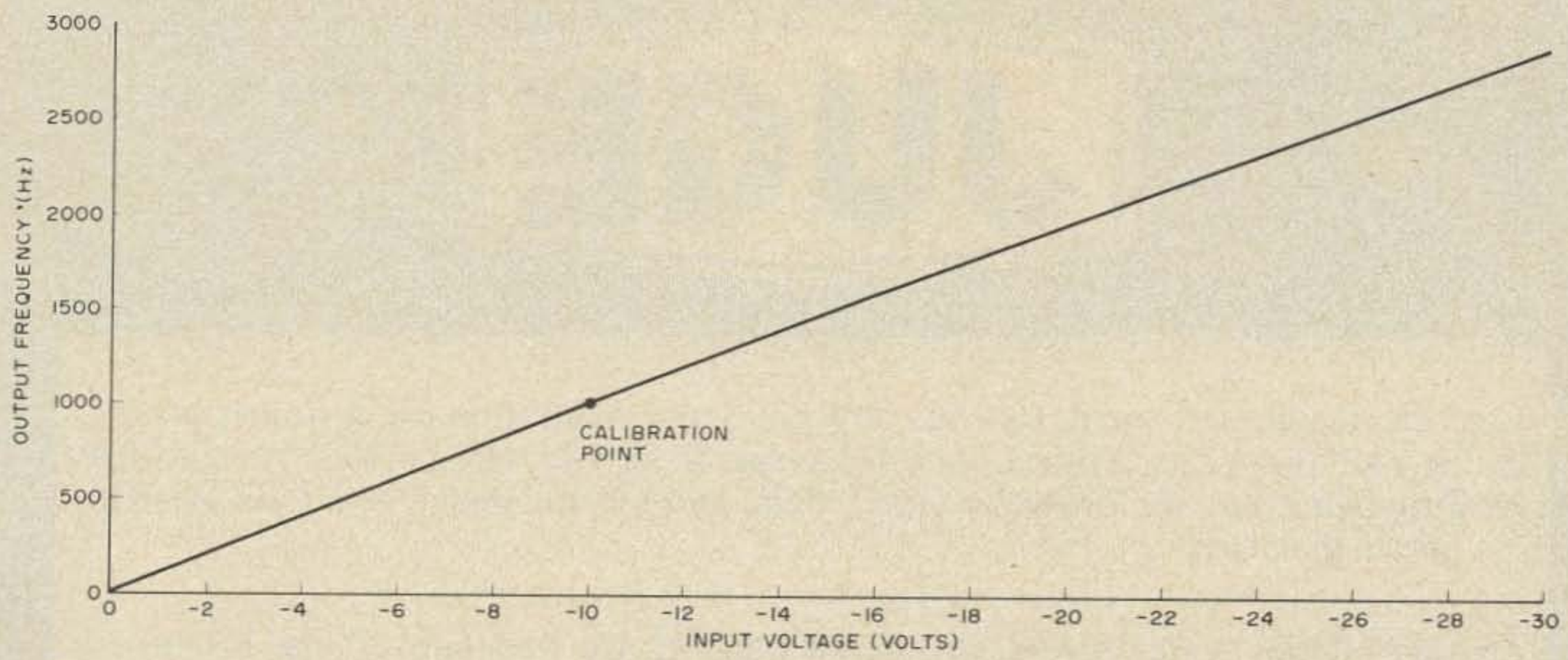


Fig. 3. Graph of input voltage versus output frequency for the circuit of Fig. 3.

discharge time. Since C1 discharges in 15 μs for the values given, the discharge time can be considered insignificant in most cases and the following approximation for frequency be made.

$$F = \frac{1}{T} = \frac{\triangle Vc1 \frac{\text{volts}}{\text{second}}}{V \text{ threshold}}$$

Combining the preceding into one formula for frequency,

$$F = \frac{Ein}{(Ra)\,(C1)\,(V \text{ threshold})}$$

when E_{in} and $V_{threshold}$ are in volts, C1 is in farads, and R_a is in ohms.

Linearity

The circuit of Fig. 2, was constructed using the component values shown and was calibrated (by adjusting R_a) for 10V E_{in} equals 1000 Hz out. With the input voltage monitored by a FLUKE 8100 digital voltmeter and the output frequency measured with a Hewlet Packard 5223L frequency counter, an input voltage versus output frequency comparison was made. The data from that comparison is plotted in the graph of Fig. 3.

Between the input voltages of -0.1V and -10V, the largest frequency error was +0.3% of the calibration frequency (1000 Hz).

Audio Amplifier

The audio amplifier consists of a differential amplifier (Q2 and Q3) to shape the sawtooth waveform into a square wave and a Darlington pair (Q4 and Q5) current amplifier to drive the speaker. Variable resistor R19 is located on the front of the voltmeter and controls the voltmeter volume. Induced voltages from the speaker which could damage Q4 and Q5 are discharge; by D2. To minimize a drop in volume at low frequencies, direct coupling is used throughout the audio amplifier.

Power Supply

The power supply is made up of one +12V and one -12V zener regulated source and one +18V source. The plus and minus 12V power, the op amps, the test circuit, and the differential audio amplifier. The +18V supplies the audio power amplifier. In the +18V supply, Q6 acts as an electronic filter to eliminate 60 Hz hum from the audio output stage. If a 3-wire power cord is not used, the voltmeter case should be grounded by other means to insure hum free operation.

Conclusion

Frequently in troubleshooting, the presence or absence of a dc voltage provides sufficient test information to diagnose the circuit. The audible voltmeter aids the trouble shooter by eliminating the need to keep looking at the test instrument to determine if the desired voltage is present.

...WAØAQC/9

Walter W. Pinner WB4MYL
7304 Lorenzo Ln.
Louisville KY 40228

MIDLAND 2 METER BASE OR PORTABLE

The Midland 13-500 144 MHz transceiver is an excellent low priced rig. The transmitter features 1W and 15W power selections as well as automatic SWR shutdown to protect the final. Transmit crystals for 16, 34 and 94 are supplied. On the air audio reports are excellent. Deviation is adjustable and was factory preset to 5 kHz on the unit tested. The front panel incorporates a small transmit indicator lamp, illuminated channel indicator (there are 12 available) and lighted S/rf output meter which is large enough to be read easily. A rear mounted accessory jack is provided for connection to a discriminator meter, tone input, keyed +12V for linear control and ground. A rear mounted external speaker jack is provided which when used disables the internal speaker. Power connections are via a pigtail which incorporates an in-line

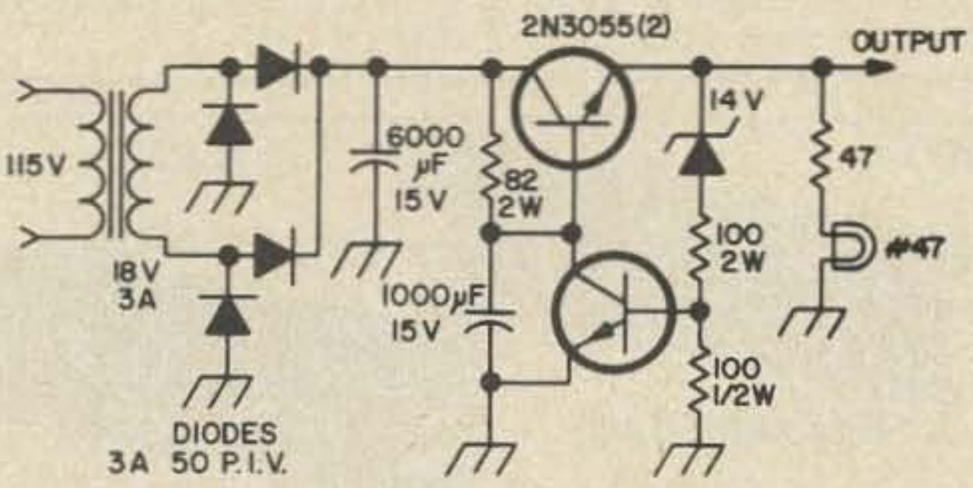


Fig. 1. Base station supply for the Midland 13-500.

fuse holder. Also supplied is a mobile mounting bracket and hardware, plus mic hanger clip, speaker plug, accessory plug and two extra fuses. The owner's manual sup-

plied contains a complete schematic and voltage check chart as well as a complete section by section circuit description.

The most exciting part of this little rig is the receiver which boasts a two stage FET rf amplifier, a five section helical resonator filter and a FET mixer. Trimmers are provided on all crystals (transmit and receive) and all oscillators are zener regulated for stability. Receive crystals are provided for 76 and 94.

As unpacked the sensitivity of the receiver was found to be .2μV usable and .3μV for complete quieting. Although the unit is small, the dual back to back circuit board

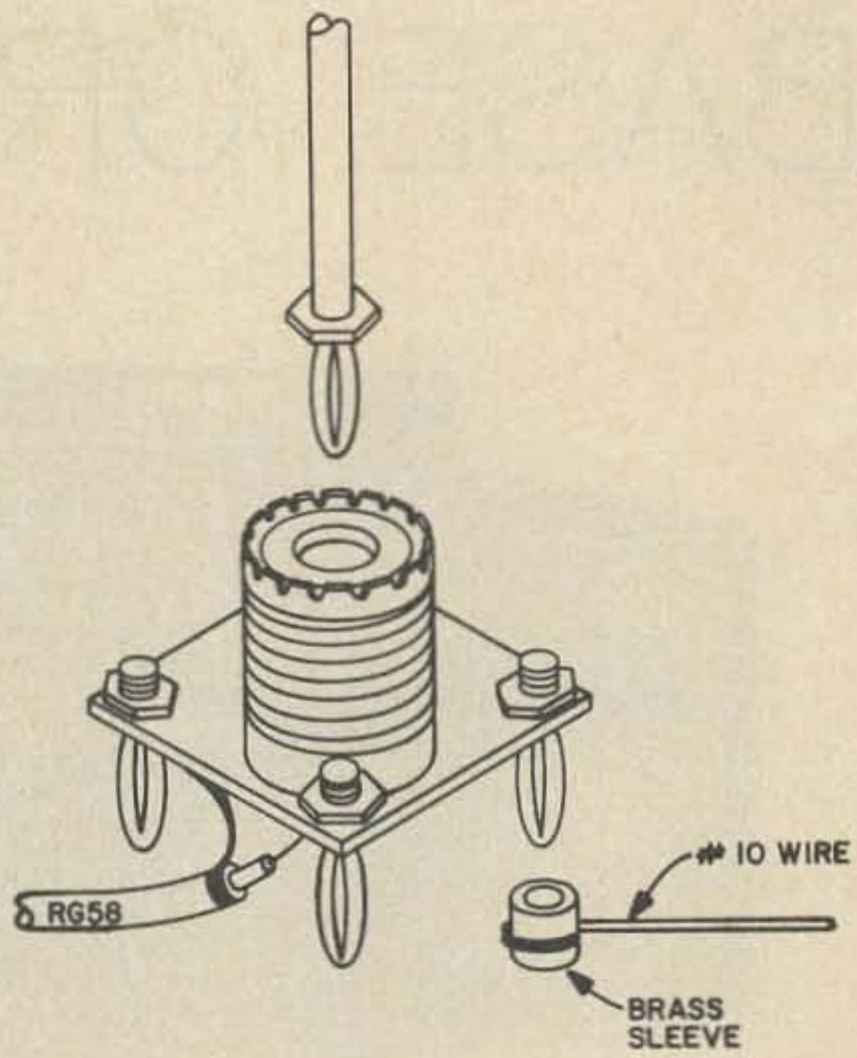


Fig. 2. Antenna for the Midland 13-500.

layout is uncluttered and mechanically sound. The small side mounted speaker has acceptable audio quality and is not hidden when the unit is dash mounted or flat on a table.

An inexpensive base station supply is shown in Fig. 1.

A transformer delivering 18V at 3 amperes is not a common item. Therefore a 12V 3 ampere unit was modified as follows. Select a transformer that has small spaces at the corners of the frame window around the original winding. Add approximately 26 turns of No.20 teflon coated wire by threading it through these spaces. My transformer accepted 13 turns on the top and bottom with no difficulty and when this additional

winding was properly phased the output voltage was 18V ac. My power supply was housed in a small cabinet which also contained a 4 inch speaker and a 50-0-50 μA

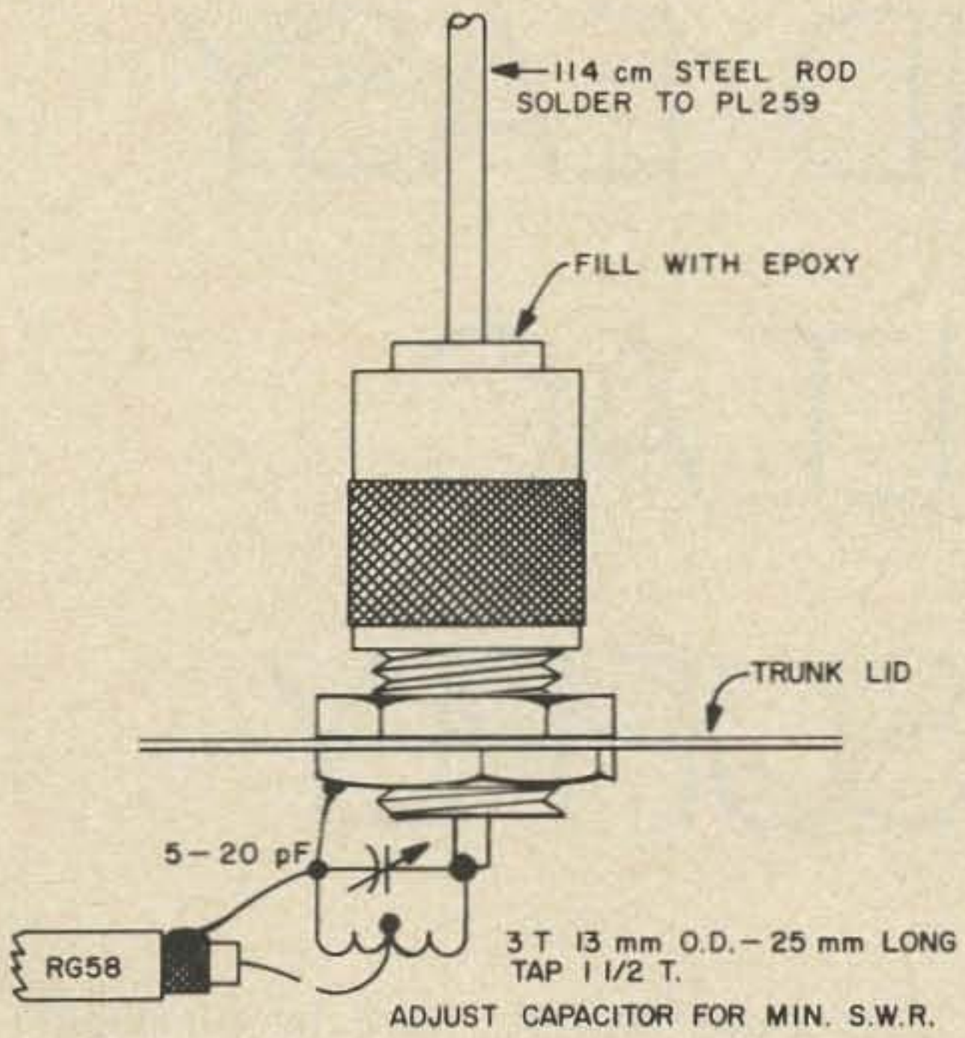


Fig. 3. A 5/8 λ mobile antenna.

discriminator meter. The dial light shown not only illuminates the meter but provides some low load regulation for the supply. Power supply output on receive is 13.2V and 13.0V on low power transmit. High power transmit voltage was 12.7 (measurements made at 117V ac input).

Fold Up Suitcase Groundplane Antenna

Portable operation from motels, etc., may be a little more convenient with the antenna shown in Fig. 2. The elements are No. 10 solid copper wire. These are looped around a 3/8 long piece of 3/16 in. brass tubing. The tubing may be found at most hobby stores. Solder the radials to the tubing. An S0239 connector is fitted to a 2 in. square plate and fitted with four banana plugs as shown. The radials are merely pushed on to the plugs to assemble. The driven element is a piece of No. 10 wire soldered to a banana plug which is then inserted in the center of the connector. A loop in the top of the driven element and a piece of nylon cord will serve to hang the antenna from any convenient location.

Fig. 3. shows details of a 5/8λ mobile antenna constructed from common materials.

. . .WB4MYL

A.E. McGee, Jr. K5LLI
2815 Materhorn Drive
Dallas TX 75228

CHEAP AND EASY 230 VOLT AC POWER SUPPLY

Occasionally you may find that some otherwise desirable piece of surplus electronic equipment is designed for use on 230 volts ac. Unless your ham shack has been especially wired for 230 volts, it will probably not be available at a wall socket. You will have to either replace the 230 volt power transformer with the similar 115 volt unit, or use a step-up transformer to raise the line voltage to 230 volts.

The use of a step-up transformer is by far the simpler method, but unfortunately these transformers are seldom found in junk boxes or at surplus sales. However, a good substitute can be made from readily available junk box type parts by wiring two filament transformers as shown in Fig. 1. In this circuit the isolated 115 volts induced in T2 is added in series with a 115 volt line to get an output of 230 volts (less a slight voltage drop).

The transformer secondary voltage ratings may be any value, but they must be equal. The current ratings probably need not be the same, although the only transformers that I have tried have had identical ratings. The 230 volt output power rating will be somewhat less than twice the power (E x I) rating of the lowest rated filament transformer. For example, if 6.3V, 10A transformers are used, the power rating would be equal to 2 x 6.3 x 10, or 126 watts (or about 100 watts to allow for transformer losses).

The transformers must be phased properly. This is easy to check because if it is wrong the output voltage will be zero. If this happens, reverse the connections to either the primary or the secondary of T2. Since the high-voltage winding of T2 may operate at twice its intended voltage above ground (depending on how the line cord plug is inserted) it would be a good idea to isolate the core of T2 from ground by mounting it on insulated washers or standoffs.

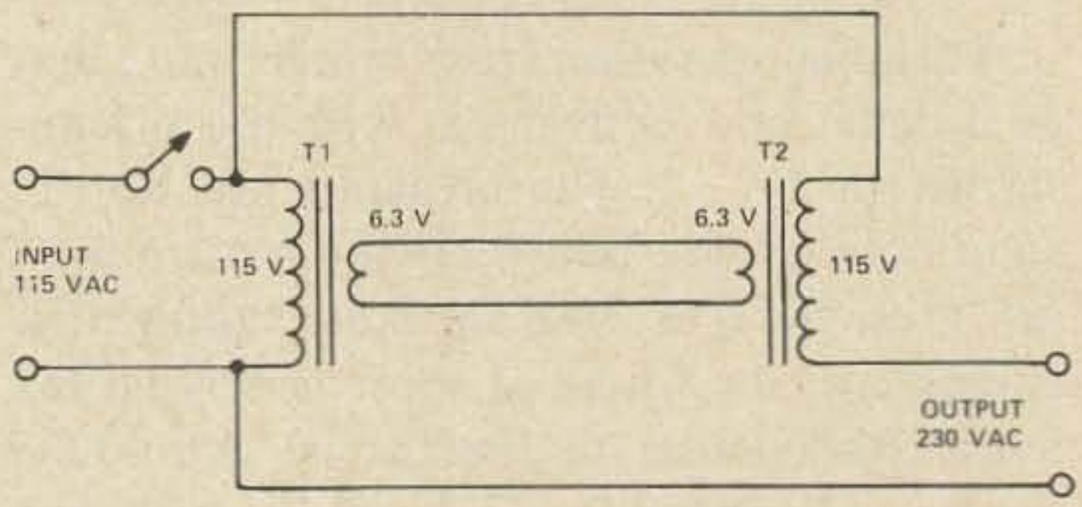
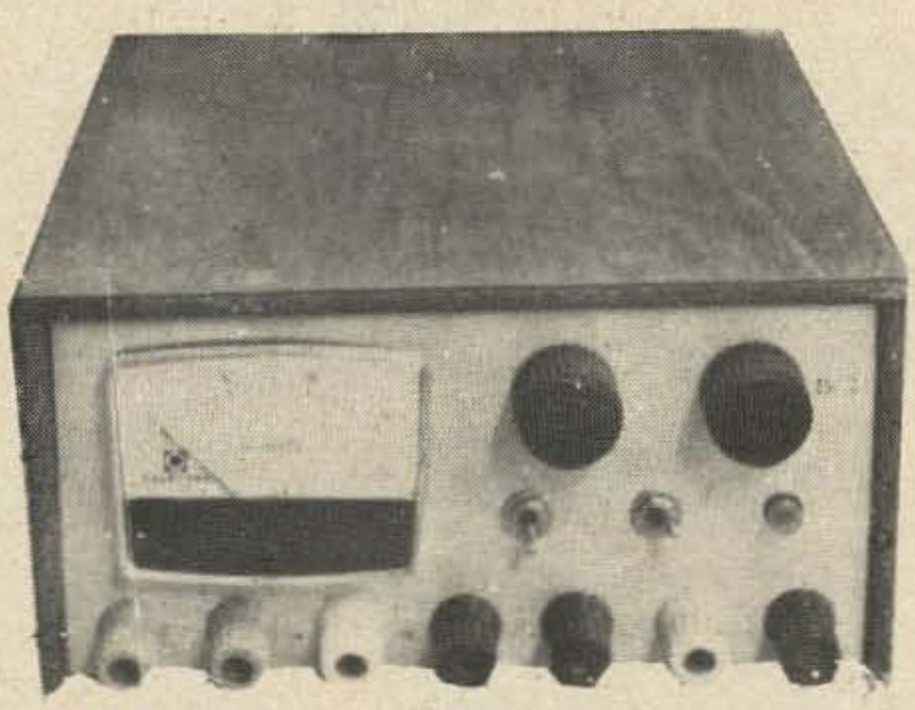


Fig. 1. Circuit diagram of the 115V to 230V step-up transformer.

A switch could be included in the 115 volt ac line, because some current will be drawn from T1 by T2 even with no external load. In my own case, using two 6.3V, 10A transformers, the no-load secondary current of T1 is 3.5A. The transformers supply 210 volts to a 65 watt load, and run only warm to the touch.

. . .K5LLI

Noel Calvin
2683 Buena Vista Way
Berkeley CA 94708



UNIVERSAL POWER SUPPLY

For a long time the line operated power supply has been part of the basic equipment of the experimenter's bench. And up until now a single variable supply has been adequate for most purposes.

But now even the most novice experimenter uses integrated circuits, both digital and linear. And most ICs will operate properly off only certain closely defined voltages. TTL requires +5, op amps ±15, comparators +12, -6. Even for simple circuits using a single op amp a single voltage power supply is inadequate. For more complex circuits combining several types of IC and discrete components, the situation can become impossible if you have only a single voltage power supply to work with.

So what do you do? You can spend a fortune on batteries – you can find another hobby – or you can build the Universal Power Supply for under $50.

The Universal Power Supply is really five power supplies in one: 3 fixed voltage, 2 variable, each one regulated, and each one current limited at 1.5A. The voltages available are +15, +5, -15, variable 0 to -18, and

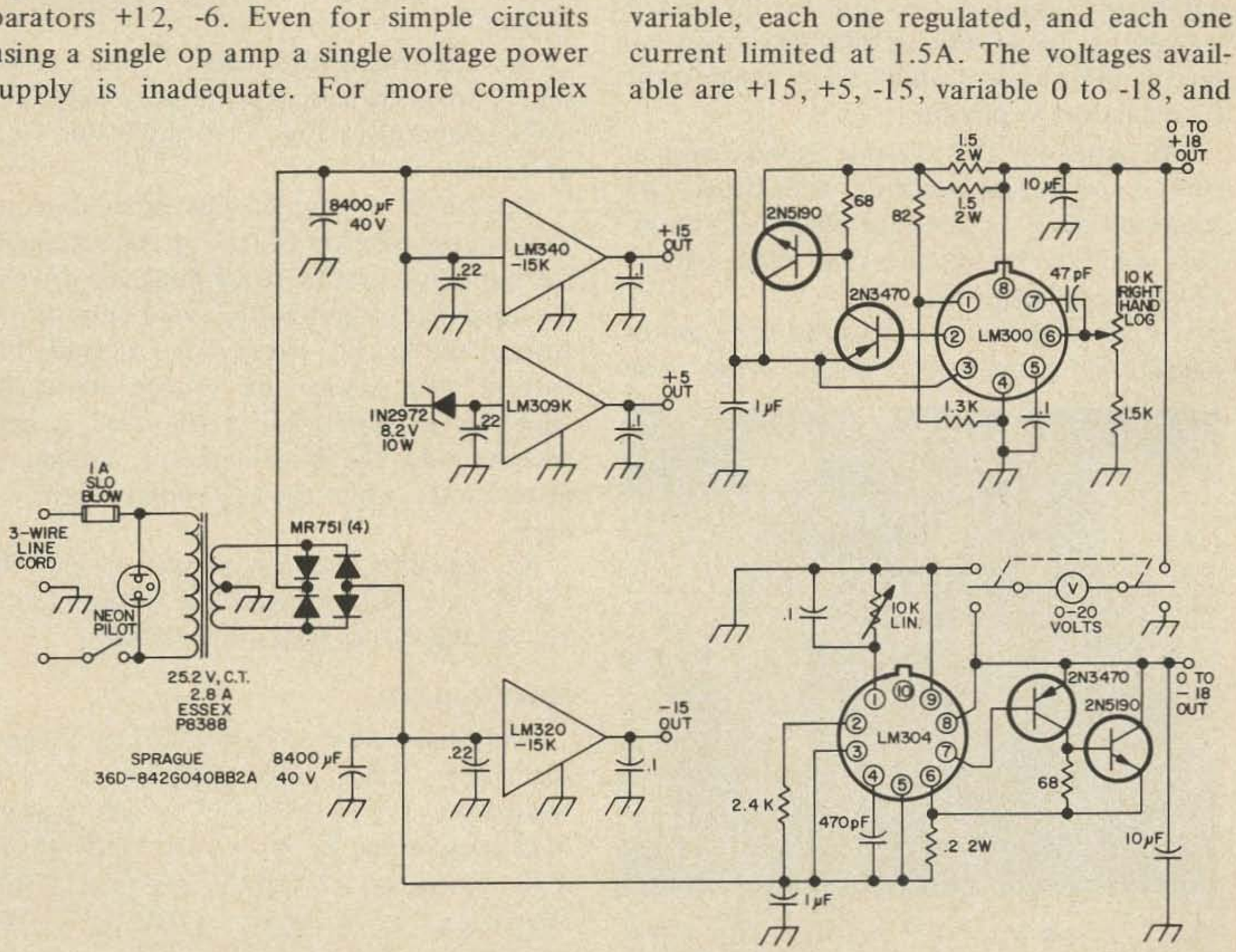
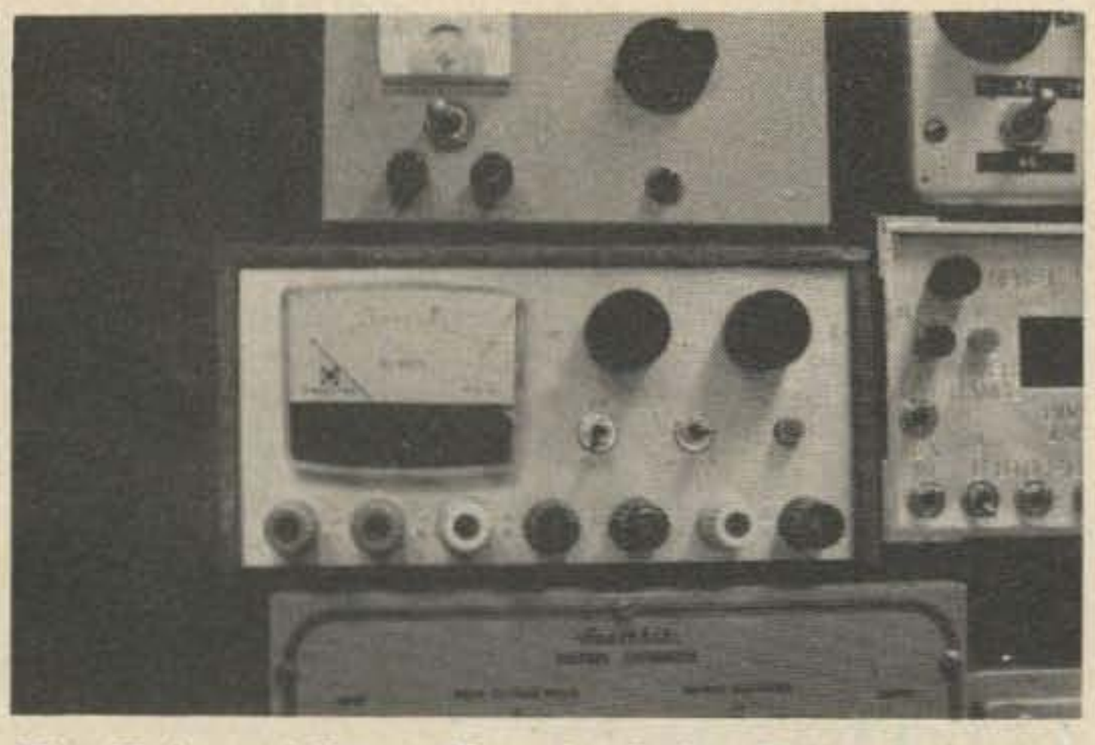


Fig. 1. Universal Power Supply



The Universal Power Supply. It has 3 fixed voltages and 2 regulated. See text for details.

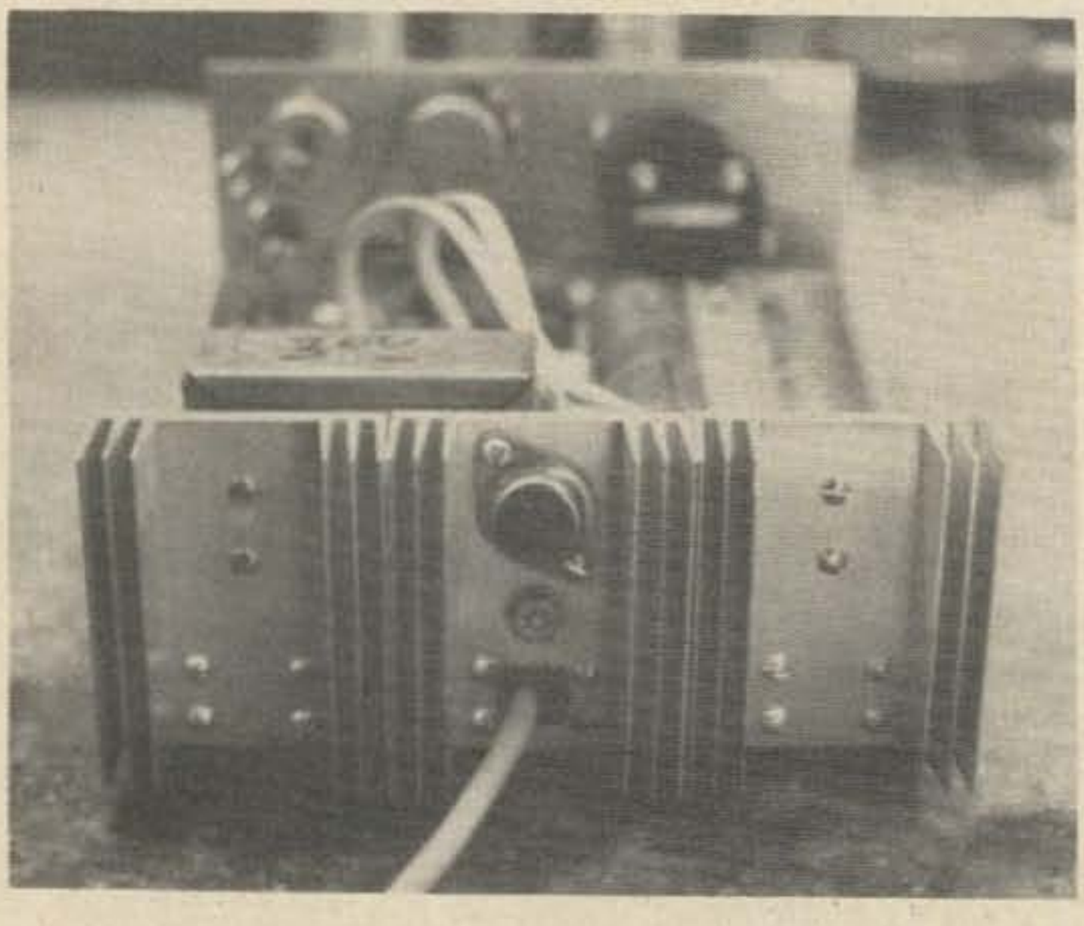
variable +2 to +18. The circuitry uses state-of-the-art integrated regulators so the Universal Power Supply is probably simpler to build than that old single voltage regulated power supply was.

Construction

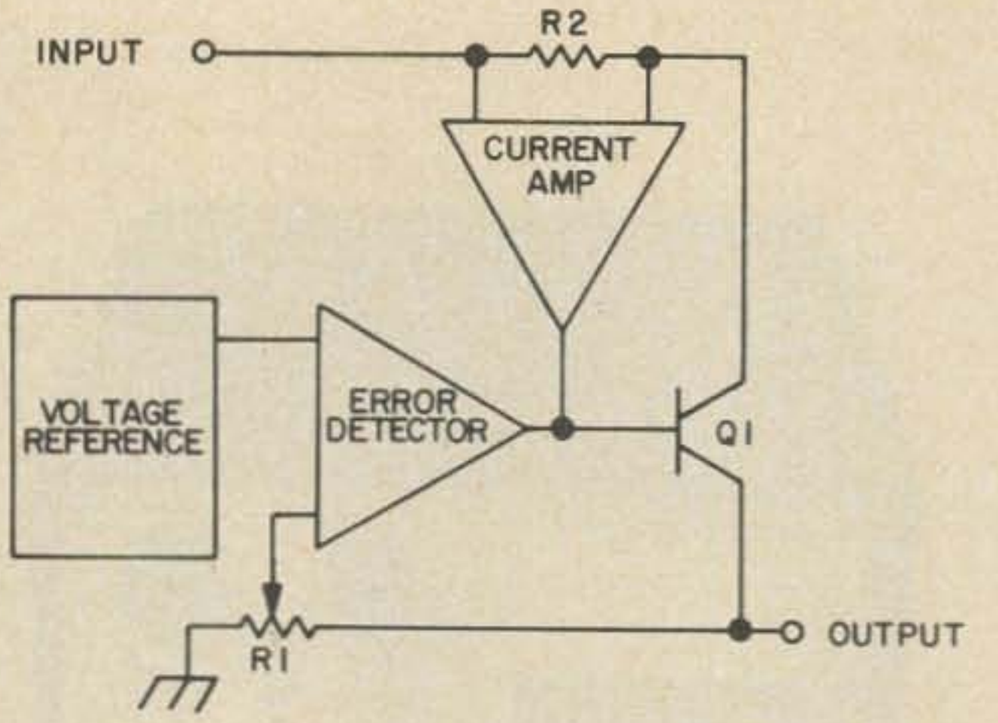
There are only two rules that need be observed when building the power supply: 1) Provide approximately 60–100 cm of externally mounted heat sink for each fixed voltage regulator and output transistors. 2) Mount the output transistors as close to the IC regulators as possible.

All parts for the variable voltage regulators except the output transistors are mounted on a vectorboard with T-28 terminals, and the interconnections made on the bottom side with wire.

I made the case for the prototype out of aluminum L-brackets, sheet metal and plywood, but any commercial case will do. You may even want to build the power supply into your bench.



The TO-3 case is the 309 regulator. Other regulators were K package and are mounted on the reverse side of heat sink.



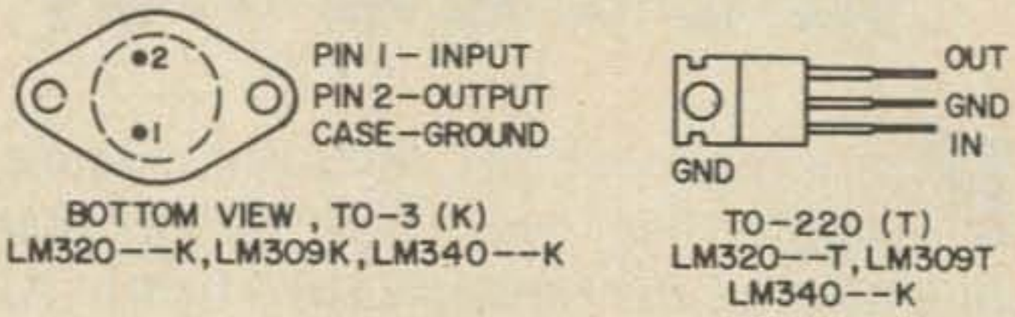


Fig. 2. Block diagram of integrated regulator.

Theory

All the regulators used in the power supply work in basically the same way. The block diagram in Fig. 2, is applicable to all of them.

Operation is simple. The error detector compares a fraction of the output voltage to the reference, and by controlling the drive to Q_1 keeps the output voltage very close to the voltage set by R_1, irrespective of load. The current amp senses the voltage across R_2 which is proportional to the load current and overrides the error detector, cutting the drive to Q_1 when the load current gets too high.

In the fixed voltage regulators Q_1, R_1 and R_2 are all internal, while in the variable voltage regulators they are external.

Specifications

Outputs: +15V ±5% @ less than 1% load regulation, 1.5A; +5V ±4% @ .1% load regulation, 1.5A; -15V ±5% @ less than 1% load regulation, 1.5A; +2 to +18V @ .1% load regulation, 1.5A; 0 to -18V @ .01% load regulation, 1.5A. Input: 115V ac @ 75W maximum.

. . .Calvin

REVIEW OF GROUNDED CATHODE LINEARS

Robert Baird W7CSD
3740 Summers Lane
Klamath Fall, OR 97601

For the past several years grounded grid linear amplifiers have been all the rage. A grounded grid linear assumes that you have 50 or 100 watts of rf drive available. Lots of hams do have such an exciter. On the other hand, some of the less fortunate ones may have an old 10A or 20A or perhaps they have picked up a bargain SB 10 on the used market. And even others may have picked up a used rig for next to nothing and modified it to DSB. Then there is the QRP ham who has invested in an Argonaut or a single band Justin which doesn't pack quite enough wallop for long haul consistently from home base. All of these point to the need for a linear requiring minimum drive.

With the above in mind, I decided to make a general investigation of grounded cathode amplifiers. I decided to build a skeleton amplifier from an aluminum chassis and two ancient National all-band tuners resurrected from the junk box. The center of the chassis was a hole which would accept a rectangular piece of aluminum on which were mounted different sockets. The National all-band tuners are not at all a must. A simplified circuit with changeable coils will work just as well. Two tubes in parallel could be used instead of two tubes in push-pull and a pi network output circuit might be better than the all-band tuner. If you are going to change bands you either have to have switching or plug-in coils. I hate both and already had the all-band tuners. If triodes are to be used with a pi netowrk output, a split grid circuit would be highly desirable from the standpoint of neutralization.

The Push Pull Triode Linear

Triode tubes in the grounded cathode configuration do not require very much drive even in class B. Class AB requires even less and if you want to go all the way to Class A you don't need any power at all, just voltage. Since I had an SB10 I went the class AB route. Fig. 1, is the circuit diagram used for three different sets of triodes. I used a pair of 25Ts (at least 20 years old), a pair of 100THs and a pair of 811As. If you are old enough to have some 35Ts or Taylor T20s or T40s in the junk box they would work equally well.

The subject of neutralization seems to be a no no with the younger generation. Actually, neutralization shouldn't be this frightening. It's a simple process and once performed on the highest frequency you expect to use will suffice on all lower frequencies. A well neutralized amplifier is very very stable. Look in any handbook for the simple neutralization procedure.

I used a couple of tubular glass trimmers of the screw-in piston variety for neutralizing capacitors. I was a bit doubtful, but at less than 2000 volts they didn't blow up. A couple of metal plates movable with respect to each other will work equally well. Using the SB10 for a driver, I was able to run the 25Ts up to about 200 watts dc (400 watts PEP) with no flattening on the wave shape

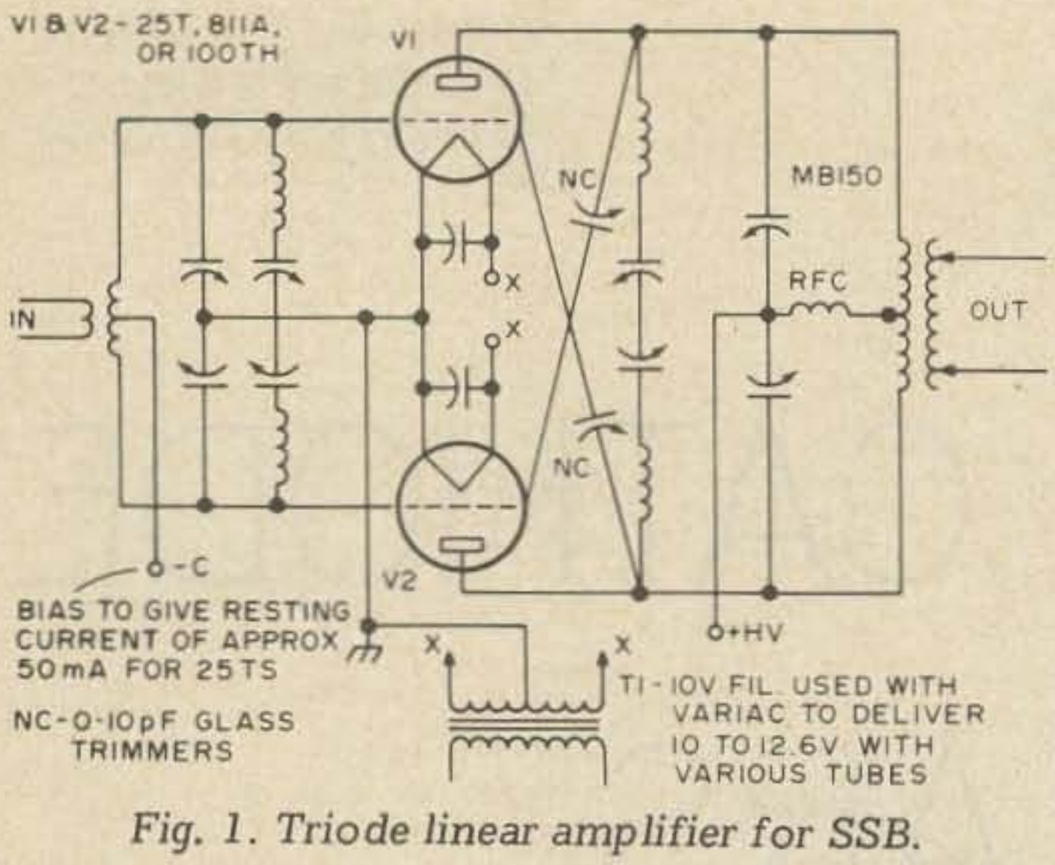


Fig. 1. Triode linear amplifier for SSB.

pattern on the scope. They did get pretty red. Both the 811s and the 100THs could be driven very well to 300 watt dc without flattening. No doubt the 100THs could have gone much higher with a higher voltage. For reasons of economy, as will be seen later, I was limited to 1500 volts.

I never got around to a two tone test with the triodes but the linear waveshape pattern (horizontal Christmas trees) looked great and reports from other amateurs were excellent. Since I was merely repeating that which had been done many times before I had no reason to be in doubt about the linearity of such an amplifier.

I was actually using batteries for bias and certainly a good stable bias supply is required for this kind of operation, not shown in schematic. The parasitic chokes were about five turns of wire 1/2" diameter around a 47Ω 1 watt resistor and were necessary only in the case of the 811As. There was no sign of a VHF parasitic using the 25Ts or 100THs. Of course some other physical arrangement might yield something different.

Tetrode or Pentode Linears

If you jerk out the plate with the triode sockets and replace them with sockets for a couple of tetrodes or pentodes using fixed bias for class AB or class B and with much reduced neutralizing capacity (maybe none at all with certain tubes), the same kind of linear results are to be expected. A pair of 4-65A's, WE 212A'S, RK 20's, or some other similar might be in order. But I do not want to bore you to tears. And I did want to inject something new and different.

The Class "X" Linear

Here's one I ran into down in ZL land. A chap down there told me, "This is really great." "It can't be," I said, "if ever there was a rule its the one that says you must have a rock solid fixed bias supply for a linear amplifier. Whoever heard of grid-leak bias for a linear amplifier?" Well the fact of the matter was that it sounded pretty good. When I got back stateside I discovered the same circuit in Shrader's *Electronic Communication* textbook. Shrader states: *It is interesting to note that the clamp tube circuit can also be used as a linear amplifier for SSB. With no signal there is no drive on the tetrode or pentode amplifier and no grid-leak bias, and the clamp tube clamps the screen voltage to nearly zero. With weak SSB signals applied to the amplifier grid, a little grid-leak bias is produced. This begins to unclamp the clamp tube and the amplifier begins to amplify the input. With strong input signals the clamp tube is completely unclamped and the amplifier is free to amplify normally using grid-leak bias. The clamp tube follows the SSB signal, acting as a gating circuit for the amplifier. This linear amplifier does not require well regulated screen and bias supplies, as do all other rf linear amplifiers.*

I began thinking about this strange combination of grid-leak bias and the clamp tube

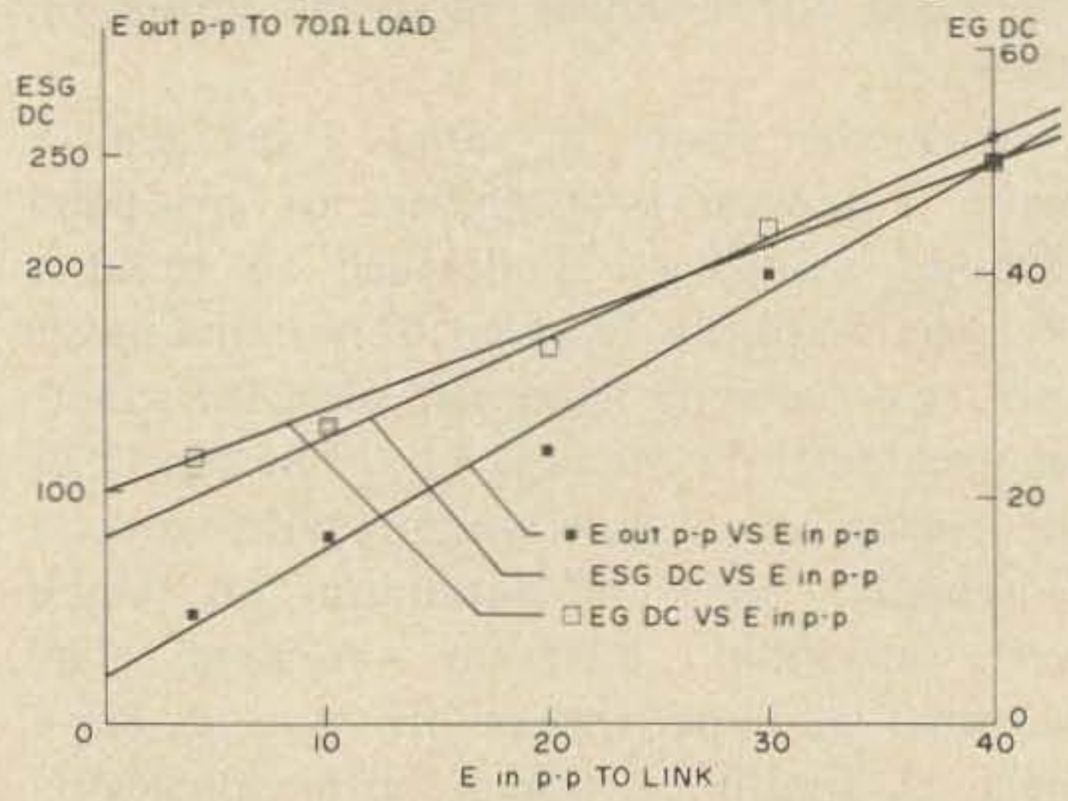


Fig. 2. Class "X" 813 linear amplifier.

and finally decided to give it a try. With a few minor modifications to Shrader's circuit, the results were very encouraging. You cannot call this a class B linear or a class A linear or even a class AB linear since the bias is different for every level of signal. So I

decided to call it the class X linear. The secret to its success is that as the rf input voltage changes the dc grid bias and the dc screen voltages change in a nearly linear manner with it. The result is a reasonably linear power amplifier When I say linear, I refer to the E-out vs E-in curve of Fig. 2, and the fact that the two tone test pattern is pretty good and on the air voice quality is quite acceptable. It is not as linear as a class AB triode. On the other hand it sounds a lot better than a class AB triode with 20 dB of compression as used by many hams on the air today. First of all you get along without a special bias supply. Second you can get along with pretty poor voltage regulation of the HV power supply. Last, but not least, it is a grounded cathode pentode or tetrode amplifier which requires very little drive.

The 813 Class X Amplifier

Since I had an 813 in the junk box and the 813 has had a pretty good reputation since World War II, I decided to make my class X amplifier using this tube. I pulled out the plate with the four pin sockets and put in another with an 813 socket and an ostal socket for the clamp tube, Fig. 3.

Again, the all-band tuners are not necessary and could be replaced with simple tuned circuits that are switchable or plug-inable. I removed the former neutralizing capacitors and replaced one of them with a couple of pieces of bus bar (#10 wire). Neutralizing was accomplished by bending the pieces of wire with respect to each other. If you just want to work 75 and 40 meters (possibly 20 meters) you could probably get along without neutralizing at all. The value of R2 and R3 were found by trial and error. These make things a little more linear by providing higher resting current. If you use some other tube you will have to do likewise. Maybe you have 803s in your junk box, or even a 4-250A or something else.

Results

Driving the class X amplifier with an SB 10 (which I scrounged for $20) and an old HT18 exciter which I borrowed (also available for less than $20) I can run the dc milliameter up to cover 200 mA without any flattening on the wave shape pettern. On voice inflections this means about 1500 volts with my power supply. So we have about 300 W dc input which you can translate to 600 W PEP if you like. Even if you discount ham politeness in reporting a little, it is still a pretty respectable signal from the junk box.

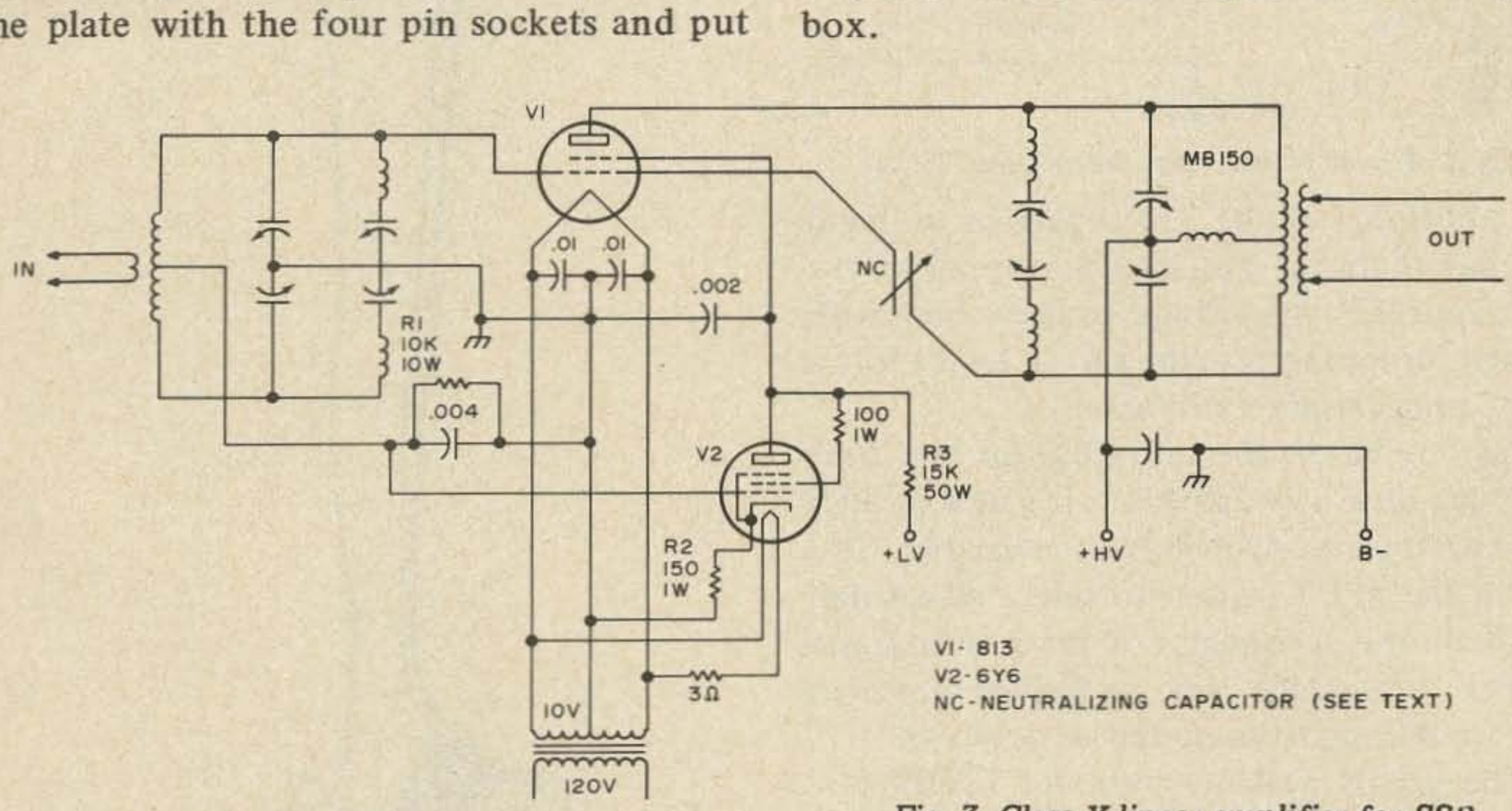


Fig. 3. Class X linear amplifier for SSB.

Power Supply

I have left the power supply (Fig. 4) for last because any 1500 volt supply you might have on hand will work very well. It would be necessary to use a larger screen dropping resistor for the Class X amplifier if you drop all the way from 1500 V. In my case I cobbled up a high voltage supply from

a power transformer liberated from a defunct TV set. A full wave voltage doubler is used with a screen grid take-off from the first half. I am well aware of the practice of building a "stack" rectifier composed of diodes and voltage dividing resistors and capacitors, but in this day and age when you can buy a 1000 PIV diode rated at an amp for 18¢, it is cheaper to put in twice as many diodes as you need and forget about the resistors and capacitors. With a 700 volt secondary the peak voltage is 1000V; so you have 2000V PIV. I just stuck in four 1000V PIV diodes on each side of the doubler and called it good. Filter capacitors and chokes came from the junk box. The 25 μF 2500V job is frosting on the cake and came from surplus some years back. Probably 10 μF would be enough. The spin-off at half voltage for the screen grid seemed like a good idea but is not entirely necessary. I had

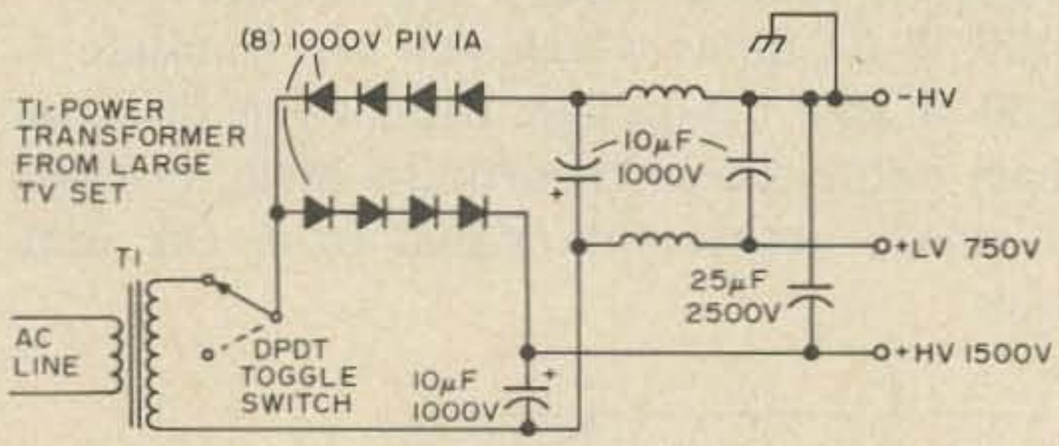


Fig. 4. Power transformer from large TV set.

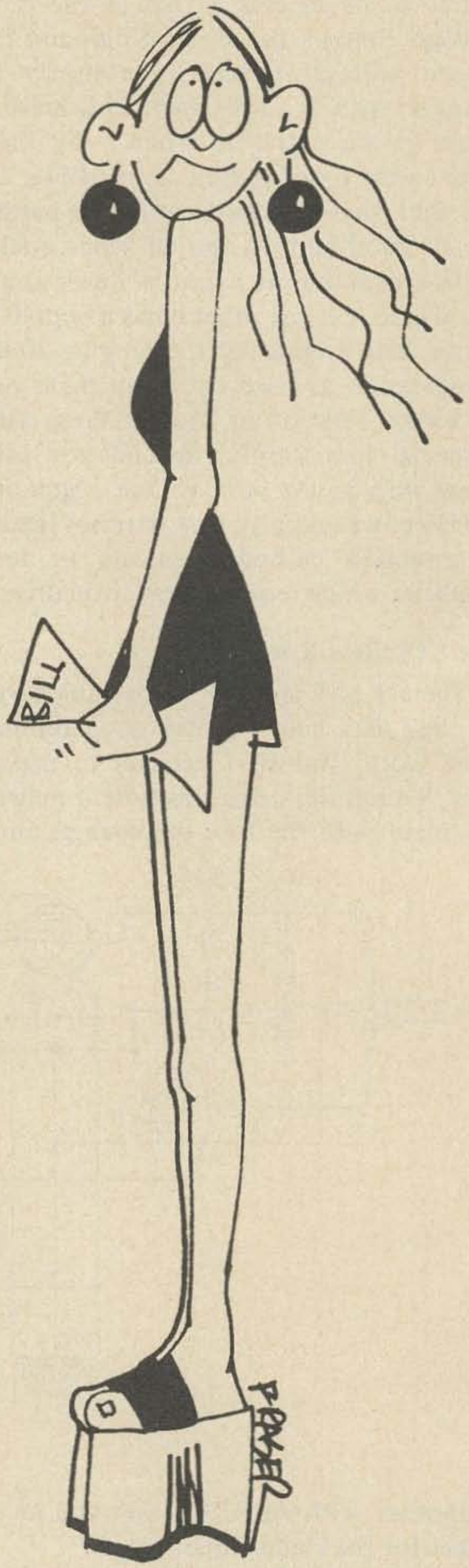
the additional choke and capacitor on hand so I put them in. You could drop all of the way from the high voltage to the screen with a single dropping resistor but it seems like a lot of unnecessary heat loss.

Just to be on the safe side the first time you turn on a new amplifier, it's nice to have a lower than normal voltage avialable. So I put in the SPDT switch to select either half or all of the secondary of the power transformer. It's a nice way to reduce power if you are talking to someone across town.

The supply actually puts out 1750V at a resting current of about 74 mA (plate current plus clamp tube current). It ran a little higher yet with the triode amplifiers, drawing less than 50 mA resting current. With a 250 mA load, voltage drops to something like 1400V. But with the duty cycle of speech, voltage will be 1500V or more.

If you have a low power exciter, try a class X linear.

. . .W7CSD



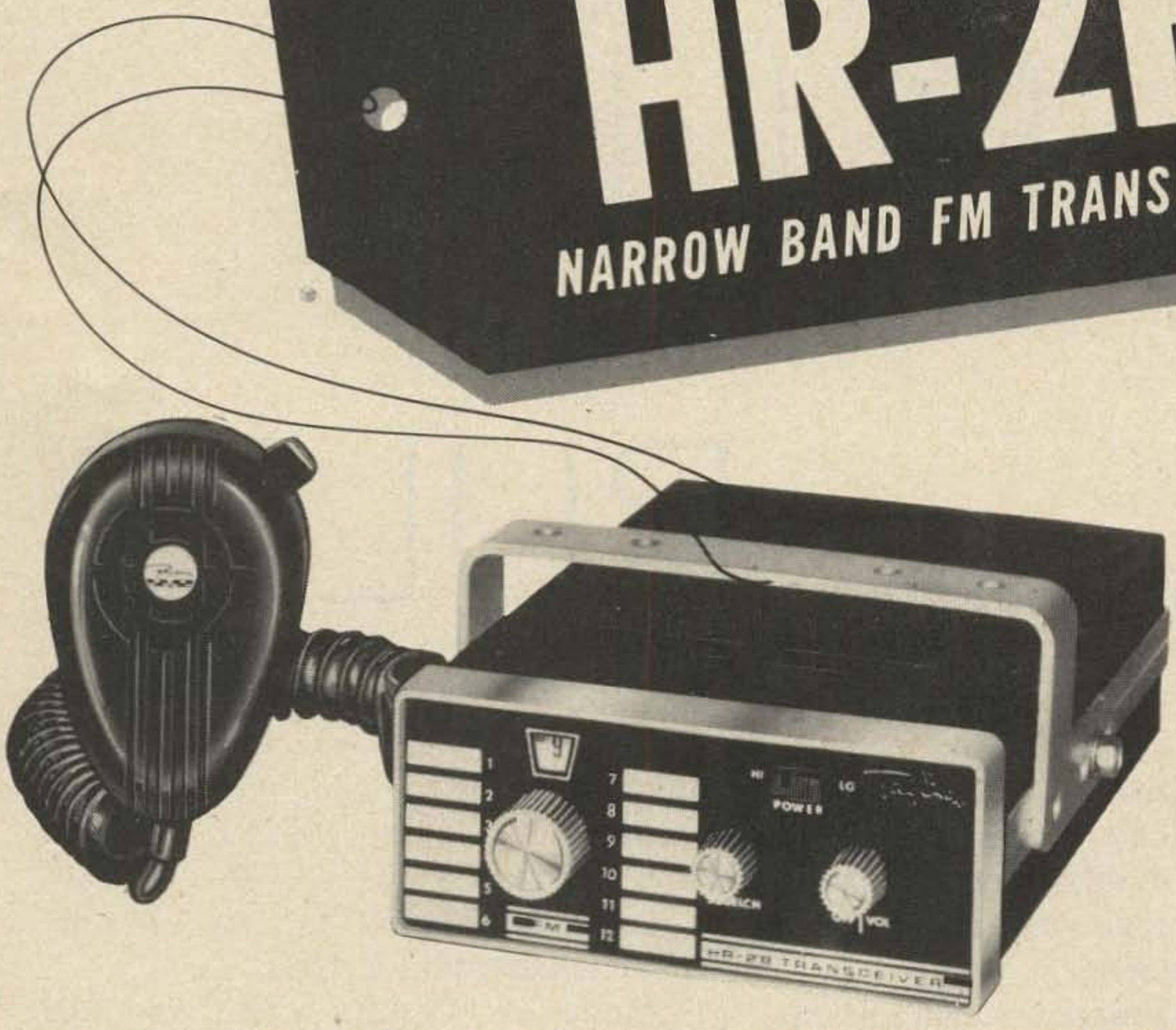
Be able to smile and look like you believe it when he tells you what a bargain it was !

If you like 2 METERS . . .

YOU'LL LOVE OUR

ALL NEW HR-2B

NARROW BAND FM TRANSCEIVER.



15 OR 1 WATT POWER OUT/SWITCH SELECTABLE/
FULL 12 CHANNEL TRANSMIT AND RECEIVE CAPABILITY

You'll like the crystal clear transmit and receive performance of this compact, 2 meter unit and so will those listening. The 12 transmit channels are provided with individual trimmer capacitors for the optimum in point-to-point and repeater applications. A HI/LO power switch provides 1 watt output or full rated output. The receiver has an audio output of 3 watts at excellent sensitivity. Solid state, American made quality at a low price.

$229.00 AMATEUR NET

includes plug-in ceramic mike, mounting bracket and transmit and receive crystals for 146.94 MHz.

Regency
the first name in solid state

THE FM LEADER IN 2 METER AND 6 METER... AND NOW 220 MHz

Don Van Sickle K8GOU
20295 Westpointe Ct.
Southfield MI 48075

SLIDE RULE RULES

Amateurs can and do find uses for the slide rule. Others shun the slide rule, because they find it difficult to deal with decimal points. The following table and rules will simplify this handicap.

Each number is assigned a characteristic as follows:

10000 to	99999	4
1000 to	9999	3
100 to	999	2
10 to	99	1
1 to	9	0
.9 to	.1	–1
.09 to	.01	–2
.009 to	.001	–3
.0009 to	.0001	–4

and so on.

To Place Decimal Point in Multiplication:

If the slide extends to the right of the rule add characteristics and place decimal point according to table.

Example 24 x 1.2 = 28.8
Characteristics 1 + 0 = 1

If slide extends to left of rule add characteristics plus 1, thus:

Example 2.3 x 9 = 20.7
Characteristics 0 + 0 =0+1=1

For Division:

If slide extends to right of rule subtract characteristics and place decimal according to table, thus:

Example 320 divided by 1.8 = 178
Characteristics 2 – 0 = 2

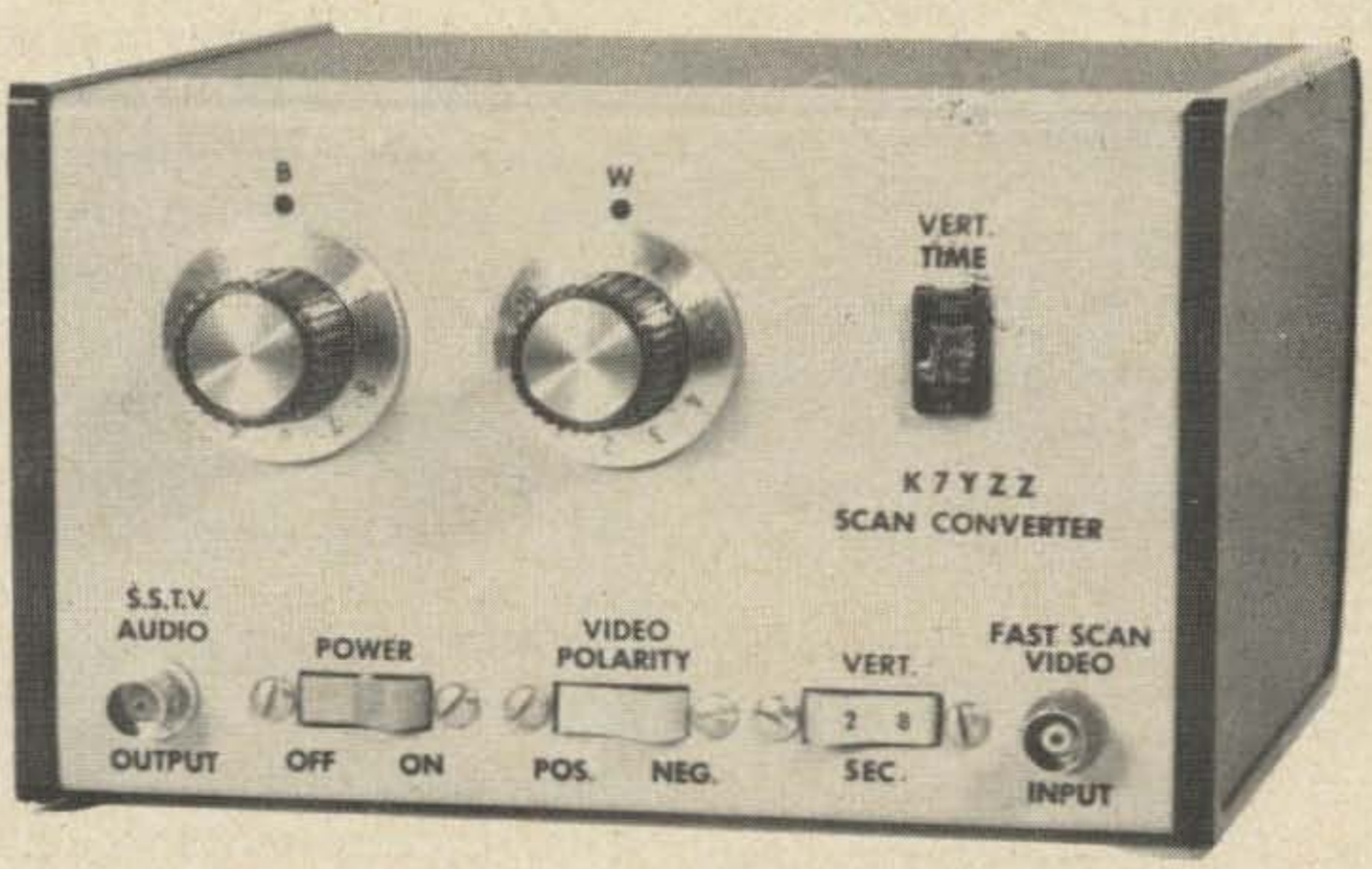
If slide extends to left of rule subtract characteristics and subtract 1, place decimal according to table, thus

Example 288 divided by 8 = 35
Characteristics 2 – 0 = 2–1 = 1

Don Van Sickle K8G0U

Robert Suding WØLMD
370 South Queen Street
Lakewood CO 80226

SSTV SCAN CONVERTER



WØLMD Scan Converter as built by K7YZZ.

The ultimate slow scan enjoyment comes from not just watching Ham TV pictures arriving at your house from across the nation or world, but actually being able to transmit your pictures back. This article describes a technique which allows a person to utilize almost any standard TV camera, from a $50 used surveillance camera to a several thousand dollar commercial camera and special effects generator, with no modification whatsoever to the camera, for transmitting SSTV.

Past Camera Designs

Several techniques have been used in the past to generate a SSTV signal from a camera. The initial effort utilized a special camera with a vidicon designed specifically for SSTV (MacDonald, QST June, July, August 1965). Other amateurs utilized plumbicon tubes in cameras designed to operate at SSTV speeds, with varying degrees of success (Briles, SSTV Handbook, 1972. Suding, Unpublished circuit). The plumbicons were generally used color TV camera tubes. Some even tried using standard vidicons operating at slow scan rates, but with rather disappointing results (Taggart, QST Dec. 1968. Hutton, 73 Feb. 1969).

The most popular method, however, has been the sampling camera. This has taken on several amateur designs (Miller, CQ August, 1969. Stone, Ham Radio July, 1971. Miller SSTV Handbook, 1972). and commercial designs (Robot Research. Venus Scientific). In a unit of this design, a conventional vidicon is operated near standard TV scan rates, and then the picture is progressively sampled for an 8 second period to build an almost identical picture at the SSTV rate (Miller, CQ July 1969).

Unfortunately, while each of these techniques has worked, each also presented problems in operation. Units which operate directly at a slow scan rate are quite difficult to focus and get the shading right. Those camera designs which sample can be viewed at a fast rate, making focusing and aiming simpler, if one is not annoyed by flicker or the need to continually switch scan rates. The "homebrew" sampler designs are particularly vulnerable to interface design problems when trying to connect them to cheaper cameras, and few wished to butcher their high quality industrial cameras for SSTV usage. The need to rotate the camera or TV monitor 90° is a nuisance.

Scan Conversion Concepts

A little discussion of the difference between standard "fast scan" and slow scan may help to clarify the principles of scan conversion. Fig. 1, shows the relationship of fast scan to slow scan.

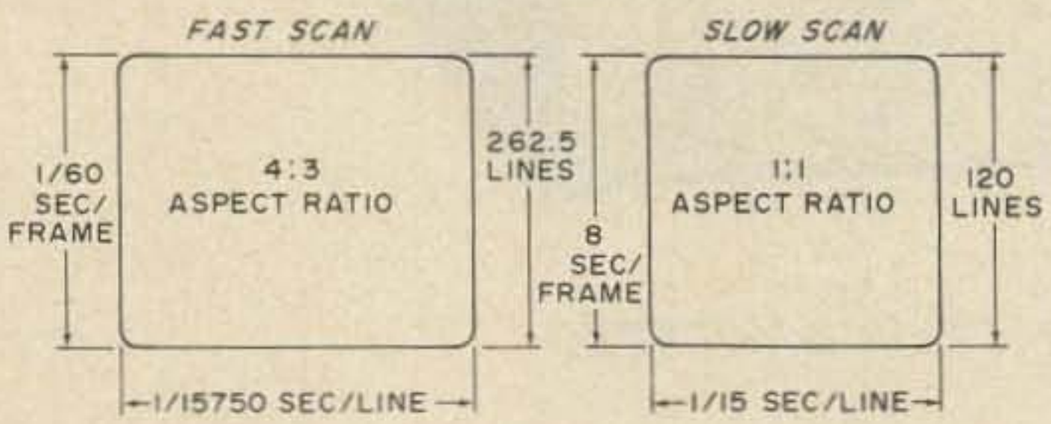


Fig. 1. Comparison of standard TV to SSTV.

SSTV is just TV in slow motion. Speed and resolution are traded off for the capability to transmit pictures on the HF bands due to the decreased bandwidth requirements. 480 complete fast scan frames (considering the interlacing frames as just another frame) will occur in the period of one slow scan picture. Fast scan has over twice as many lines as slow scan, and each of these fast scan lines shoots across the screen a thousand times faster than its SSTV cousin. To make the difference complete, the fast scan picture is wider than high, while the slow scan picture is square. What an incompatible mess for simple conversion!

A few years ago, several amateurs thought that perhaps things were not quite as incompatible as they might appear, and perhaps a special converter might be built which would take the output of the fast scan camera, exactly as it was designed, and, by use of this "scan converter" wind up with SSTV. A few designs were developed during 1972-73, and the resultant designs were explained at some SSTV "state of the art" hamventions in 1973 (Tallent, Dayton Hamvention, 1973. Suding, Cape Cod Hamvention, 1973).

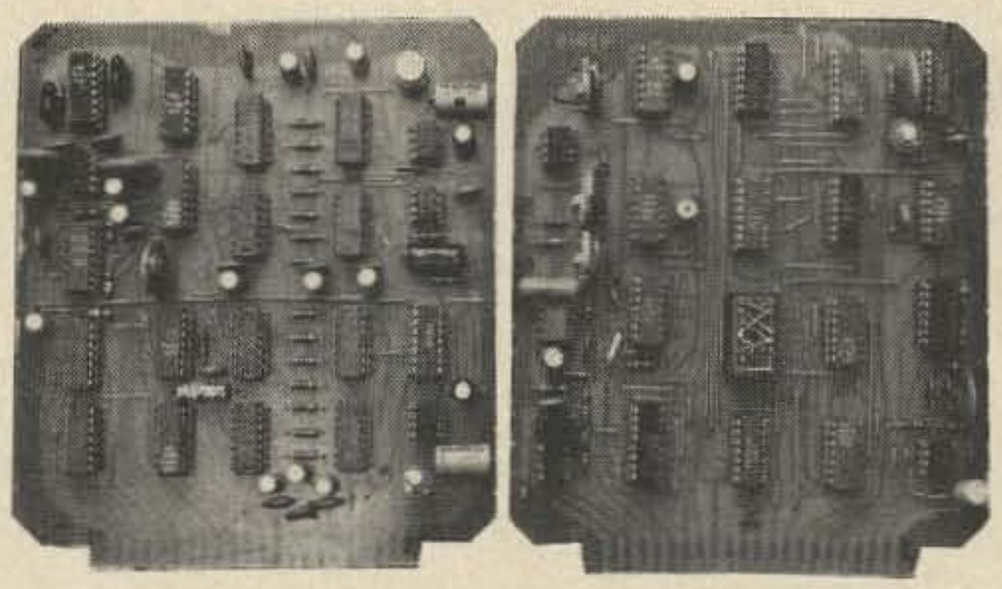
The design of these scan converters (or "line converters" as some prefer to call them) involved taking one complete fast scan line every four fast scan frames. Over an 8 second period, this resulted in the required 120 lines. Since the fast scan line was moving over 1000 times too fast, the video data was slowed down electronically by moving the line of video data rapidly into a small IC "computer memory" chip, and then slowly taking the line of video data out of the memory IC over the four frame interval (1/15 second) which would intervene before the next line sample. An aspect ratio difference was easily handled by electronically throwing away sufficient fast scan video data to have a square block of video data. The apparent incompatibility problems went away, since the conversion circuits simplified to a series of electronic video data disposal units.

Why You Will Now Want to Use Scan Conversion (Even though you used to think you didn't need it).

The major reason for scan conversion is that almost any TV camera can now be used for SSTV transmission with *no* modification whatsoever. The significance of this statement can only be appreciated by those who have tried to modify camera scan rates, eliminate hum, and read untranslated Japanese camera circuits. The video output of the TV camera is simply connected to the scan converter, and SSTV comes out of the scan converter.

Since the camera's scanning circuits have not been touched, the direct video output or the rf video output may be attached to some small TV set to show what the TV camera is pointed at, and allow the operator to make the usual focusing, centering, lighting, etc.,

Scan Converter K7OLO – front view.



Scan Converter boards K7OLO – board 2 on left, board 1 on right.

adjustments. Since there is a horizontal line to horizontal line relationship, the operator is now prevented from getting 90° rotation SSTV neck disease.

Several of us have been beating the bushes for TV cameras, and it appears that used but usable CCTV cameras can be obtained in most major cities for $50-$100. Those wishing to really go "1st Class" can even buy interlaced cameras with zoom lenses and use the same camera for both fast scan TV applications and SSTV. The cost of a complete fast and slow TV camera system, consisting of a used but good camera, the scan converter, and a small transistor TV set monitor can be built for less than the cost of a commercial SSTV camera alone. Besides, you get the pride, honor and glory of saying you did it yourself.

WØLMD Scan Converter

The essential elements of the scan converter are shown in Fig. 2.

The central design element of the scan converter is the one line memory. All of the other functional modules either supply input parameters, or utilize the memory's output, suitably converted. The memory is a single IC, a quad 256 bit shift register.

The video data are quickly loaded sequentially into one end of this IC memory chain and then slowly drawn out of the other end. Obviously the video data movement must be very carefully controlled, so a set of clocks, one running around 5MHz and the other at around 3.5kHz are selected to precisely control this video data movement.

This memory chain is not able to directly respond to analog signals, so special converters change the analog output of the TV camera to a digitized equivalent. The digitized equivalent is then passed down the memory chain like pushing over a string of dominoes, and following speed conversion, finally converted back to an analog signal. This resultant slowed down analog signal drives a voltage controlled oscillator producing the FM tones of SSTV.

A sync stripper separates the fast scan horizontal and vertical sync pulses from the composite video signal coming from the TV camera. These horizontal and vertical sync pulses could be directly brought out from the camera – that's a No-No. No fair taking the covers off the TV camera, remember. These recovered horizontal and vertical sync pulses then control the video data clocking and the conversion processes, and also produce the SSTV timings after suitable frequency division.

As a special bonus, earlier designs of this scan converter have been modified so that the scan converter will operate on either 50 or 60Hz power line TV standards. To select either, a simple jumper plug is utilized, though the jumpers can be hardwired if only 50Hz or only 60Hz operation is needed.

General Construction

Since the scan converter uses rather complex logic switching and ICs not usually seen in amateur designs, PC boards are highly recommended. Since I am definitely not a PC board giant, W8OZA and K7OLO volunterred to do the PC board layout and

production effort. Two different directions were taken on the PC board layouts. K7OLO made a 2 PC board design which he intended to mount horizontally in a small cabinet. W8OZA wished to mount his boards vertically, so he made a slightly smaller set of 3 PC boards. My own prototype is handwired, but I would recommend handwiring only to those possessing considerable IC design and construction experience. There is absolutely no operational difference between the three construction versions.

I would recommend that following a selected layout, the power supply be wired up first so that subsections can be individually tested if the builder so desires.

Most of the wiring is not particularly critical except for the sections running at rather high frequency, such as the clocking section and the A/D converter's output section's run over to the memory. These sections should have rather short lead lengths.

Many parts are not particularly critical such as bypassing 3.3μF and .01μF condensers, but others have been carefully selected. I have placed an asterisk next to those parts whose value should be closely adhered to unless the builder is very sure of what he is doing.

Supply lead bypassing has not been drawn into the circuit, but handwired versions of this unit should heavily bypass the supply lines to ground planes using .01 disk and 3.3μF tantalum condensers in parallel.

Power Supply

The suggested power supply is a simple, low cost unit which provides all of the regulated and short circuit protected voltages for the scan converter. A constructor could use zener diode regulators, etc., in an attempt to reduce cost, but I feel the extra protection given by the 3 terminal IC voltage regulators more than justifies the slight additional cost. Be aware that there is a slight pin difference between the LM340/LM309K and the LM320 as shown. The small 3.3μF tantalums prevent potential regulator oscillations.

Sync Stripper

The sync stripper removes the video component from the composite fast scan video, leaving the fast scan horizontal and vertical sync pulses. The MC1741SC, a high speed version of the standard 741 op amp, inverts the composite video and raises the sync level to a slightly positive level. The diode D101 charges the .047μF condenser to the peak value of the incoming sync pulse. The voltage divider following permits a level to be set which will allow the sync pulse to be cleanly separated from the video. The circuit has an automatic threshold setting ability, and no adjustment is required, even when changing cameras, unless the camera has an extremely poor sync pedestal.

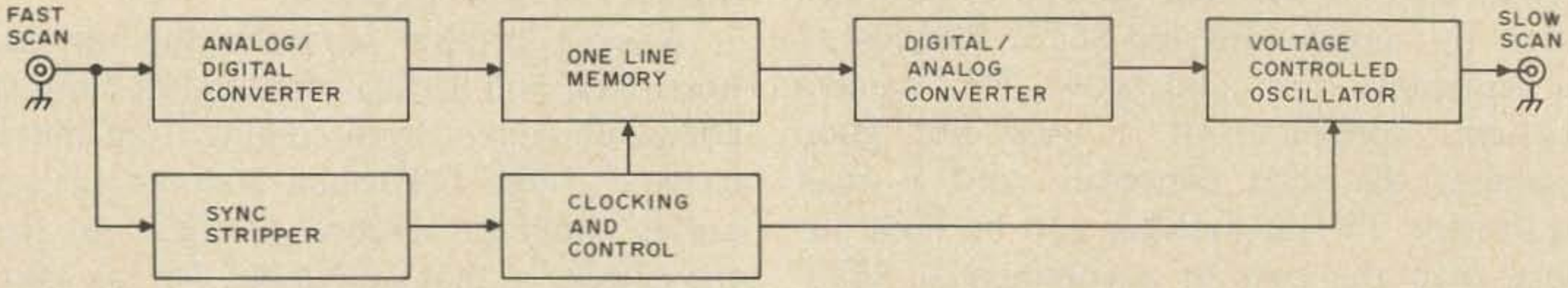


Fig. 2. WØLMD Scan Converter — block diagram.

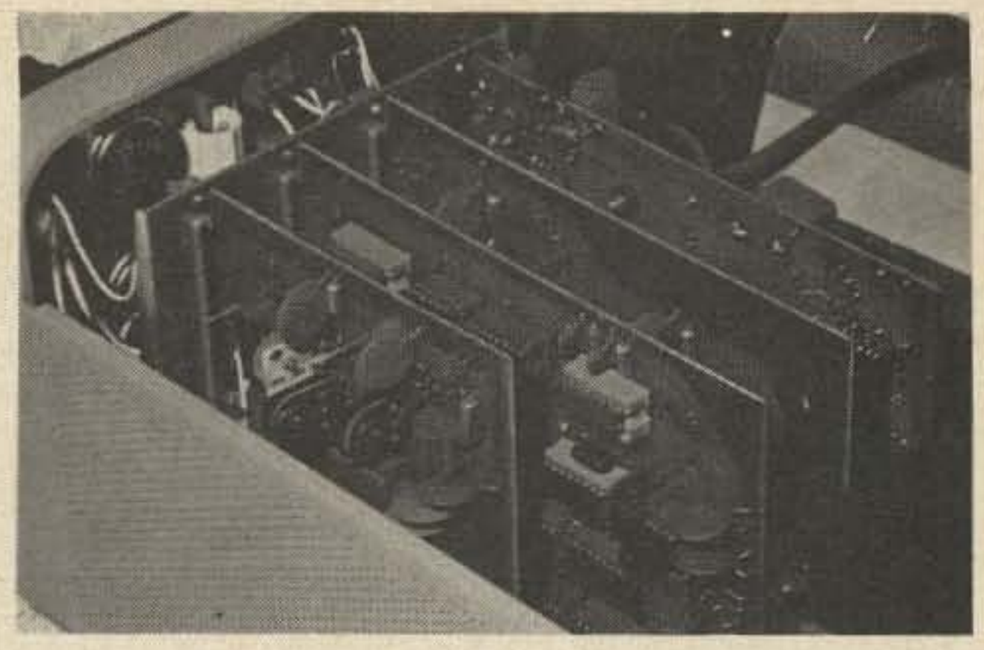
A pair of 74121's function as pulse regenerators and sync separator. The fast scan sync pulses come out clean regardless of the quality of the sync pulses coming from the fast scan camera.

Slow Scan Vertical, Horizontal and Sampling Logic

This digital section is designed so that a maximum of function is accomplished with a minimum of parts and complexity, along with no adjustments. After some critical reviews of previous circuit designs, the included circuitry evolved in such a way that the scan converter operates on 50Hz or 60Hz lines without major changes.

60Hz operation requires that one fast scan horizontal line be sampled every 4 fast scan frames. 50Hz operation will require one

Scan converter and Monitor (W9LUO Mark II) by W8OZA – front view.



Scan Converter and Monitor by W8OZA – side rear view.

fast scan line every 3 fast scan frames. Either way, each line sampled will be progressively lower then the previous line sampled by 2 lines, until slow scan vertical pulse time occurs, at which time the sampling process returns to the top of the fast scan screen. The slow scan horizontal sync pulse is fired at each sample time. The vertical sync pulse is switch selectable to occur after 32, 64, 120 or 128 samples.

The 7492 and the two 7493's function as up counters to detect when vertical sync pulse time occurs. In addition, they function as a "line to be sampled" loader. The pair of 74193's are wired as presettable down counters. Each fast scan vertical sync pulse loads the "line to be sampled" binary number into the down counters. Each fast scan horizontal sync pulse then reduces the count by 1, and when the count goes past the value of "Ø", the line to be sampled is present at the video input to the A/D section. Every fourth time the count goes to Ø for 60Hz or every third time for 50Hz, the sample gate will open for ≈1/15750 of a second to clock the "line to be sampled" into memory.

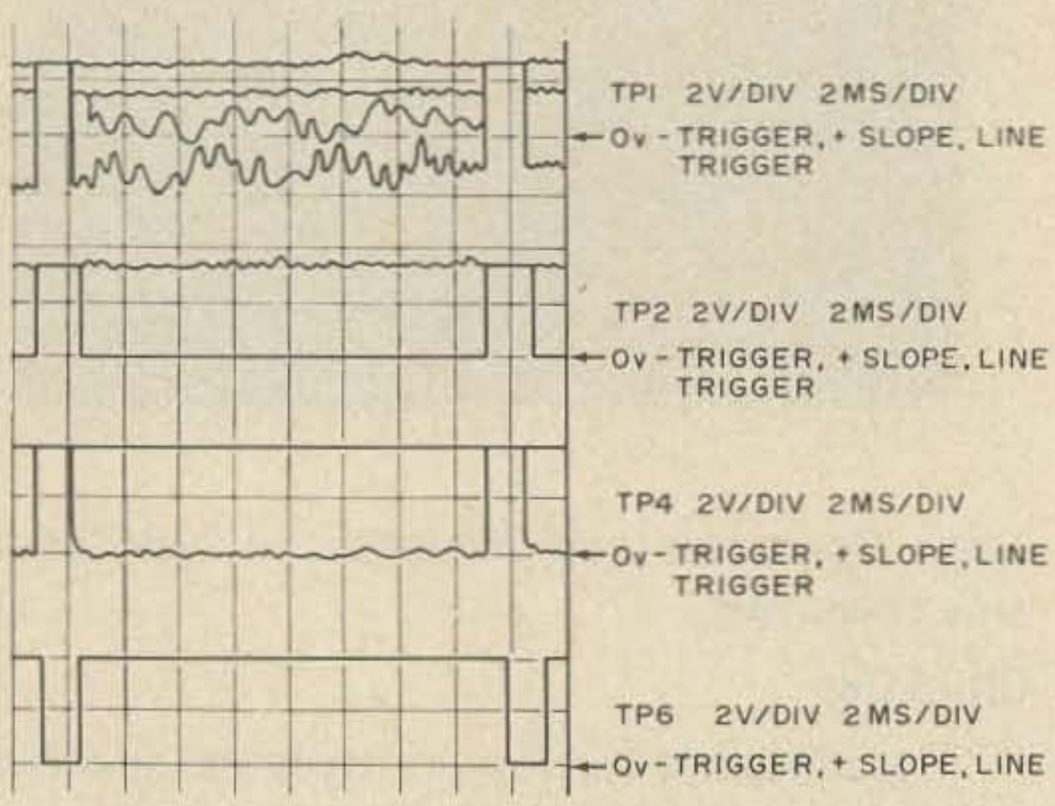
The horizontal and vertical sync pulses are set to about 7ms and 40ms respectively. These slightly lengthened pulses make a tremendous difference in marginal conditions.

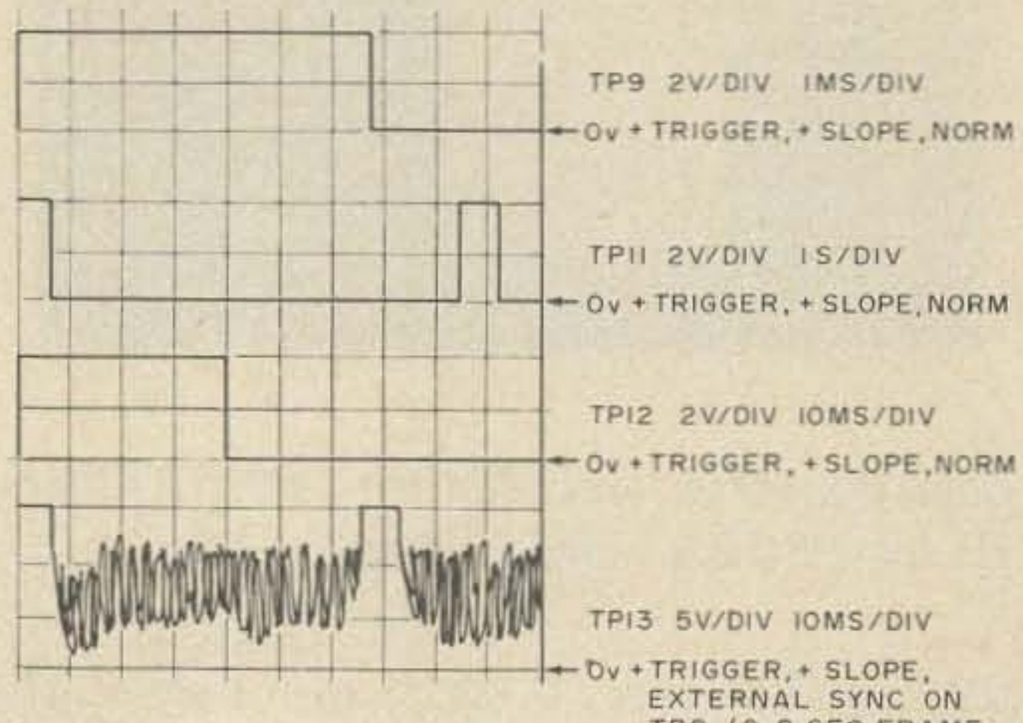
A digital readout may be included to show that the unit is, in fact, scan converting, and tell the operator what portion of the SSTV frame is being outputed, useful for starting tape recorders and movement between frames.

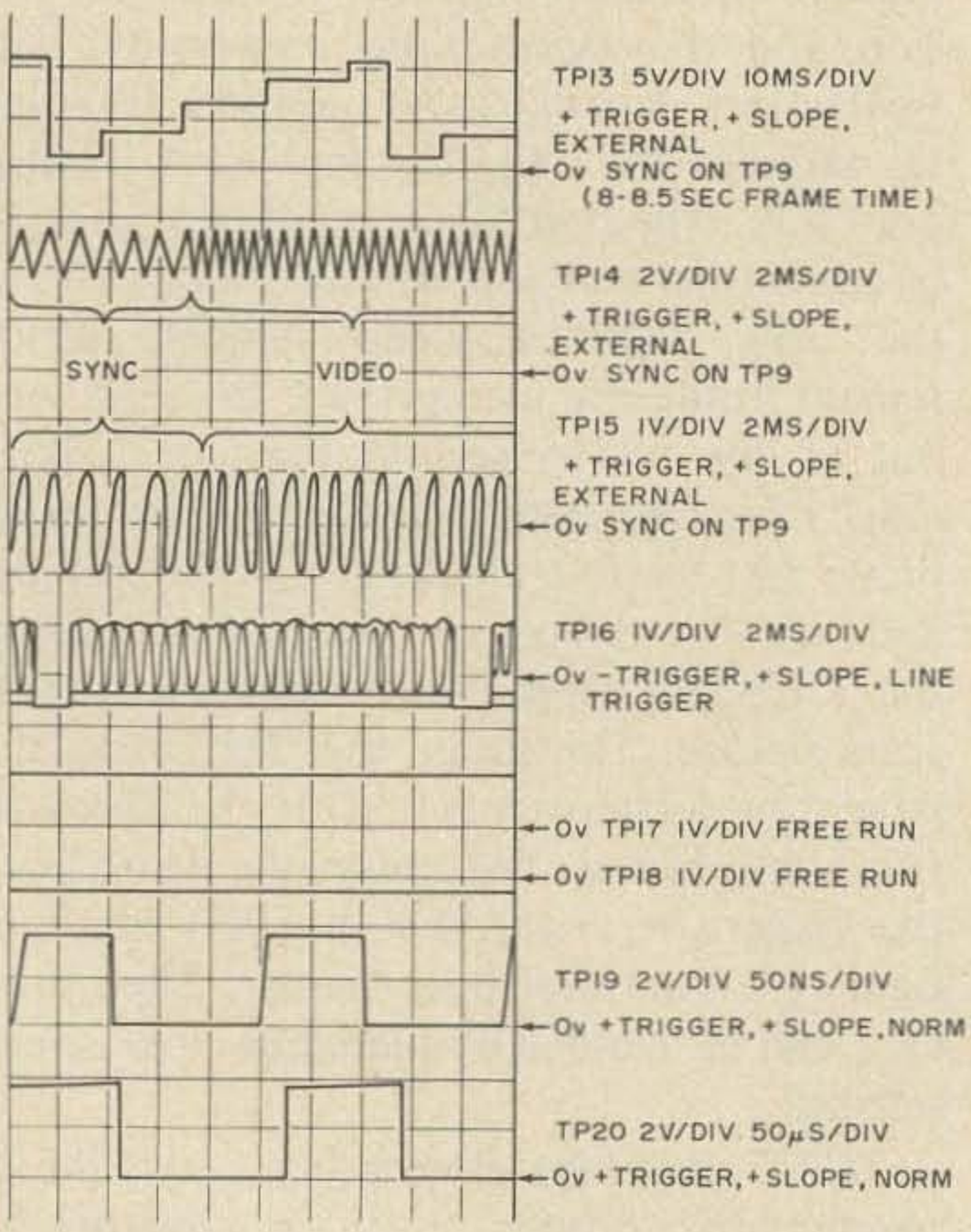
Clocking

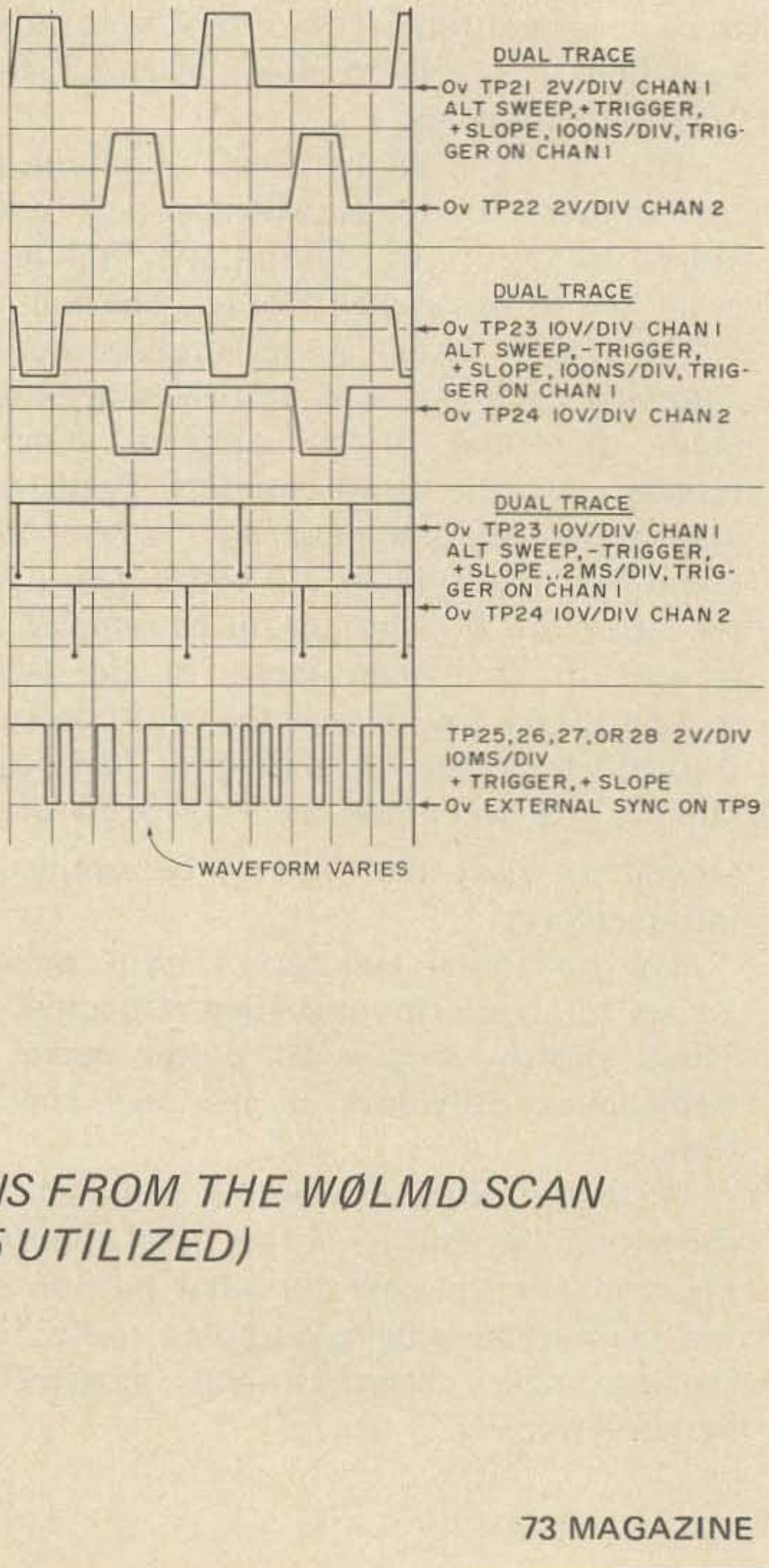
The clocking section controls the speed at which digitized video is moved in and out of the memory IC. Fast scan video is moved into memory at about a 5MHz rate, and moving this same video out at about a 3.5kHz rate accomplishes the scan conversion and the aspect ratio conversion. The ≈MHz rate actually moves around 300 digital samples into an IC capable of holding only 256. The first 50 or so actually go right out the other end and are lost. About 200 of the 256 digitized video samples which remain inside the memory are then pumped out in the ≈1/15 second that the 3.5kHz clock runs. Obviously, by selecting the appropriate fast to slow clock ratio, the rightmost and leftmost video bytes are lost to produce the 1:1 SSTV aspect ratio from the 4:3 fast scan picture. The faster the fast clock, the larger the leftmost portion of the fast scan frame is omitted. The slower the slow clock, the larger the rightmost portion omitted. Camera non-linearities, spots, blemishes, etc., can be avoided by judicious clock speed settings.

IC217 develops alternating 100ns pulses needed for proper 2 phase clocking of memory. The memory IC utilized requires two elements or "phases" for each clock cycle, one to move data into the memory cells and another to move the data out of the memory cells. The time between successive clock pulses is controlled by either the 5MHz clock or the 3.5kHz clock. The aspect ratio is set by carefully adjusting R224, the 100Ω potentiometer which controls the speed of the slow clock. Set the control so that a round test pattern seen by









OSCILLOSCOPE TEST PATTERNS FROM THE WØLMD SCAN CONVERTER. (TEKTRONIX 465 UTILIZED)

the TV camera comes out round on your SSTV monitor, assuming that the monitor is adjusted correctly, of course.

The ICs and circuits used in this section are a bit unusual. The 7413 is a dual 4 input Schmidt trigger IC which functions very well as an oscillator if a few hundred ohm resistor is tied from its output to one or more of its inputs. A condenser connected between these inputs and ground establishes the oscillation range. Logic circuits hooked to one or more of the input legs can syncronously control oscillation, by going high (>+2V) to allow oscillation.

The MH0026CN (IC216) is a special two phase clock driver by National which converts and inverts the TTL levels of the digital ICs to the MOS clock levels of +5, -12 negative going pulses.

A/D Converter

The analog to digital converter takes the fast scan video signal and converts it to four weighted digital bits, Ø sum value meaning a black signal, and 15 sum value a white signal. The conversion process must operate at a speed of ≈5MHz or better (200ns).

The greater the number of weighted bits, the higher the video quality after conversion. Experimentations by hams and commercial companies have concluded that at least 5 weighted bits (32 shades of grey) are needed for "high quality" video conversion. However, as each digital bit is added, the magnitude of the conversion process at least doubles. For SSTV transmission the quality potential of 5 weighted bits exceeds the potential of the transmission link, so 4 weighted bits (16 shades of grey) were used in this design. I feel the resultant savings in circuit complexity and cost more than justifies the very slight reduction in ideal picture quality.

The A/D converter encodes the video into the Gray code rather than a strict binary powers of 2 code. The Gray code is designed so that one and only one bit changes in any step in shading, thus making glitches caused by sampling at bit change time unnoticeable. The result is a simpler A/D circuit and a vastly improved picture. The 711's are so wired that one section will set the 711 output "on" when a certain input potential is reached, and the other section will turn the output "off" as the value continues to increase beyond a preset point. This 711 characteristic enables an encoding circuit to be built using only 1¼ gates for encoding. The Gray code is explained in most books about digital coding schemes.

The incoming video is fed to a MC1741SC high slew rate op amp (IC201) video driver which drives the 15 comparator stages in parallel. A voltage divider string of 10Ω resistors is tied at either end to a variable voltage source, + at the top end of the string, and - at the bottom. The front "WHITE" and "BLACK" controls are set so that the whitest component of the video will trip shade 15 and the blackest level just fails to trip shade 1. This will give the truest grey scale, but the "WHITE" and "BLACK" controls can be set so that video compression takes place, and an overly contrasty picture may be sent which comes through better under QRM conditions. The simplest way to precisely set the controls is to use the SSTV spectrum analyzer (Suding, 73 Dec. 1972, and SSTV Handbook). TP13 hooked to a dc oscilloscope will work fine too.

Memory, D/A and VCO

The memory section of the scan converter receives the high speed Gray code digitized video output of the A/D converter, and delivers a slowed down version. The output of the memory is converted back into a binary code by Exclusive OR IC213, and then goes through IC214 which allows positive or negative pictures to be sent. Inversion is appropriate to "menu board" operations, since black characters on a white background fare better under multipath conditions.

The D/A converter changes the binary video into an analog voltage. This simple circuit uses an "open collector IC (IC104), a 7405, which shorts a set of 4 resistors to ground, thereby controlling the gain and subsequent analog voltage output at pin 1 of IC105.

The VCO is an IC function generator which produces both a triangular wave and a square wave output. By utilizing the triangular wave output plus the low pass active filter following, an extremely clean sine

wave is generated, even at 1200Hz. The result is extremely "crisp" pictures with few transients, particularly in the zone between the sync and black frequencies.

I would advise using the exact R and C values specified with IC104, IC105, and IC106. Notice that R111 through R108 are in a binary value doubling sequence. The ideal sequence would be 5.5K, 11K, 22K and 44K, so a bit of value selection with an accurate ohmeter will produce a better D/A conversion.

Auto Grey Scale Pattern Generator

The biggest trouble with most SSTV stations is that they never use the full 800Hz video bandwidth that they should be using. A special circuit has been included in this scan converter which multiplexes in a grey scale over the 8 lines at the bottom of a 128 line frame. This grey scale facilitates not only monitor contrast/brightness adjustments, but also helps the scan converter user to adjust the BLACK and WHITE compression controls by comparing the blacks and whites in the picture displayed on his monitor with the grey scale displayed at the bottom of the screen. The grey scale also provides handy marker pulses on the spectrum analyzer or the dc oscilloscope hooked to TP14.

60Hz operation will have 4 shades of grey with the whitest shade appearing at the left side of the screen and the black shade on the right. 50Hz operation will have 3 shades of grey with the whitest shade on the left again, and the black shade on the right.

The circuit is wired so that it detects the last ½ second of each 128 line frame, establishes clock gating pulses, and multiplexes the grey scale with the converted video into the D/A converter. A 7420 (IC309) is used in the up counter section to detect the last ½ second of each 128 line frame, and drive the horizontal sync single shot during this period. The output of IC309 serves as a grey scale gate to the 74157.

The converted video feeds one set of 4 inputs to the 74157. Selected up counter clock pulses are fed to the other set of 4 inputs, designed so that their binary combination will produce the grey scale during the last ½ second period.

PARTS LIST

Capacitors

C1, C4 ..... 1000 µF, 35V Electrolytic
C2, C3, C5, C6 ..... 1000 µF, 15V Electrolytic
C7, C8 ..... 3.3 µF, 35V Tantalum – Mallory TAS335K035POC or equivalent.
C9, C10, C11, C12, C110, C111, C114, C210, C211, C212, C216, C217, C218, C222, C223, C224, C228, C229, C306, C307, C308, C309, C310 ..... 3.3 µF, 15V Tantalum – Mallory TAS335KO15POA or equivalent.
C13, C14, C15, C16 ..... .001 µF Disc Ceramic
C101, C102, C103 ..... .33 µF, 10V Tantalum – Mallory TAS336K010POC or Equivalent.
C104*, C106*, C303* ..... .047 µF Mylar
C105, C301* ..... .001 µF Mylar
C107 ..... Mallory TAS475K010POA or Equivalent.
C108* ..... .01 µF, Mylar
C112, C113, C115, C213, C214, C215, C219, C220, C221, C225, C226, C227, C230, C231, C311, C312, C313, C314, C315 ..... .01 µF Disc Ceramic
C109* ..... .003 µF Mylar
C210, C202, C203 ..... 22 µF, 15V tantalum Mallory TAS226KO15POC or equivalent.
C204, C205 ..... 560 pF Mica
C206*, C207* ..... 47 pF Mica
C208* ..... 1.8 µF, 15V Tantalum – Mallory TAS185K015POA or equivalent.
C209* ..... .800 pF Mica
C302 ..... .1µF Mylar or Equivalent.
C304* ..... 1 µF, 10V Tantalum – Mallory TAS105K010POA or equivalent.
C305* ..... 6.8 µF, 6V Tantalum – Mallory TAS685K006POA or equivalent.

Diodes

D1, D2, D3, D4, D5 ..... 1N4002 or equivalent,
D101, D102, D103 ..... 1N914

Integrated Circuits

IC1 ..... LM309K
IC2 ..... LM340/12
IC3 ..... LM320/12
IC4 ..... LM320/5
IC101, IC105 ..... 1458 or 5558
IC102, IC201 (Motorola) MC1741SC-P1
IC103 710
IC104 7405
IC106 ..... NE566
IC202, IC203, IC204, IC205, IC206, IC207, IC208, IC209 711
IC210, IC309 7420
IC211, IC303, IC310 7400
IC212 ..... 1402 or 2502
IC213, IC214 7486
IC215 74157
IC216 (National) MHOO26CN
IC217 74123
IC218 7473
IC219 7413
IC301, IC302, IC311, IC312 74121
IC304 7492
IC305, IC306 7493
IC307, IC308 74193
IC401 7447
IC402 ..... 7 segment LED Readout MAN-1, etc.

Xfmr, Led Readout and ICs available from Solid State in MO. IC 1-4 available from Godbout CA. IC102, IC201, IC212 and IC216 available from Hamilton/Avnet Electronics 340 E. Middlefield Rd., Mountain View CA 94041.

Transistors

Q101, Q301 ..... 2N5134etc.
Q102 ..... 2N5138etc.

Miscellaneous

F1 – 1A Fuse
S1 – SPDT Switch
S2 – SP 4 Position Rotary Switch
S3 – SPST Switch
T1 – 24V Center Tapped, 1A transformer
IC socket – as desired
* – Value considered somewhat critical for proper operation.
△ – See text for further explanation of precise value.

Resistors (¼ watt, 5%)

R1 ..... .2m
R2, R4 ..... .1M Pot
R3 ..... .47m
R101 ...
R102, R110△, R120*, R301* ..... .12k
R103, R117 ..... .2k
R104 ..... 3.3k
R105, R216, R303 ..... .470
R106, R221*, R222* 3.9k
R107, R124* 4.7k
R108△ ..... .43k
R109△ ..... .22k
R111△ R113, R126 ..... 5.6k
R112 ..... .1k
R114 ..... 5k PC Pot
R115 ..... 10k PC Pot
R116*, R305* 8.2k
R118 ..... 5k PC Pot
R119* 1.2k
R121*, R123* R125 ..... .10k
R122 ..... 4.3k
R201, R202, R203, R204, R205, R206, R207, R208, R209, R210, R211, R212, R213, R214 ..... .10
R215, R223 ..... .100
R217, R218, R219, R220, R226, R227, R228, R229, R230, R231, R232, R233 ..... 3.6k
R224 ..... .100 PC Pot
R225* ..... .160
R302, R306 ..... 1.8k
R304* ..... .27k
R307 ..... .220
R401, R402, R403, R404, R405, R406, R407, R408 ..... .200

PC boards:
3 board version – drilled – $30 ppd. W8OZA – Russ Sievert, 1411 Lonsdale Rd, Columbus OH 43227.

2 board version drilled – $30 ppd. Undrilled – $20 ppd. K7OLO – Jim Oldaker, 2930 Sorrel Way, Eugene OR 97401.

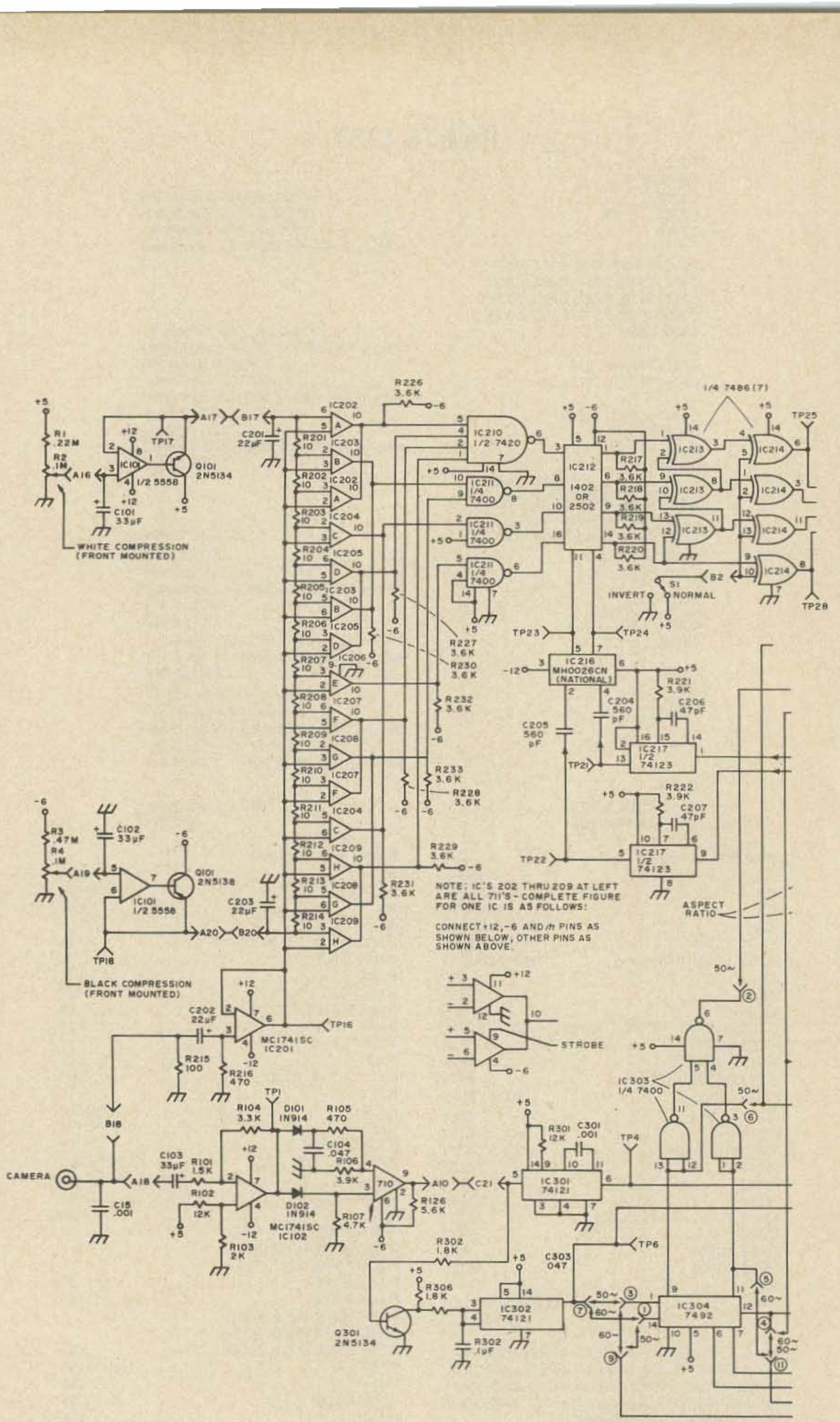
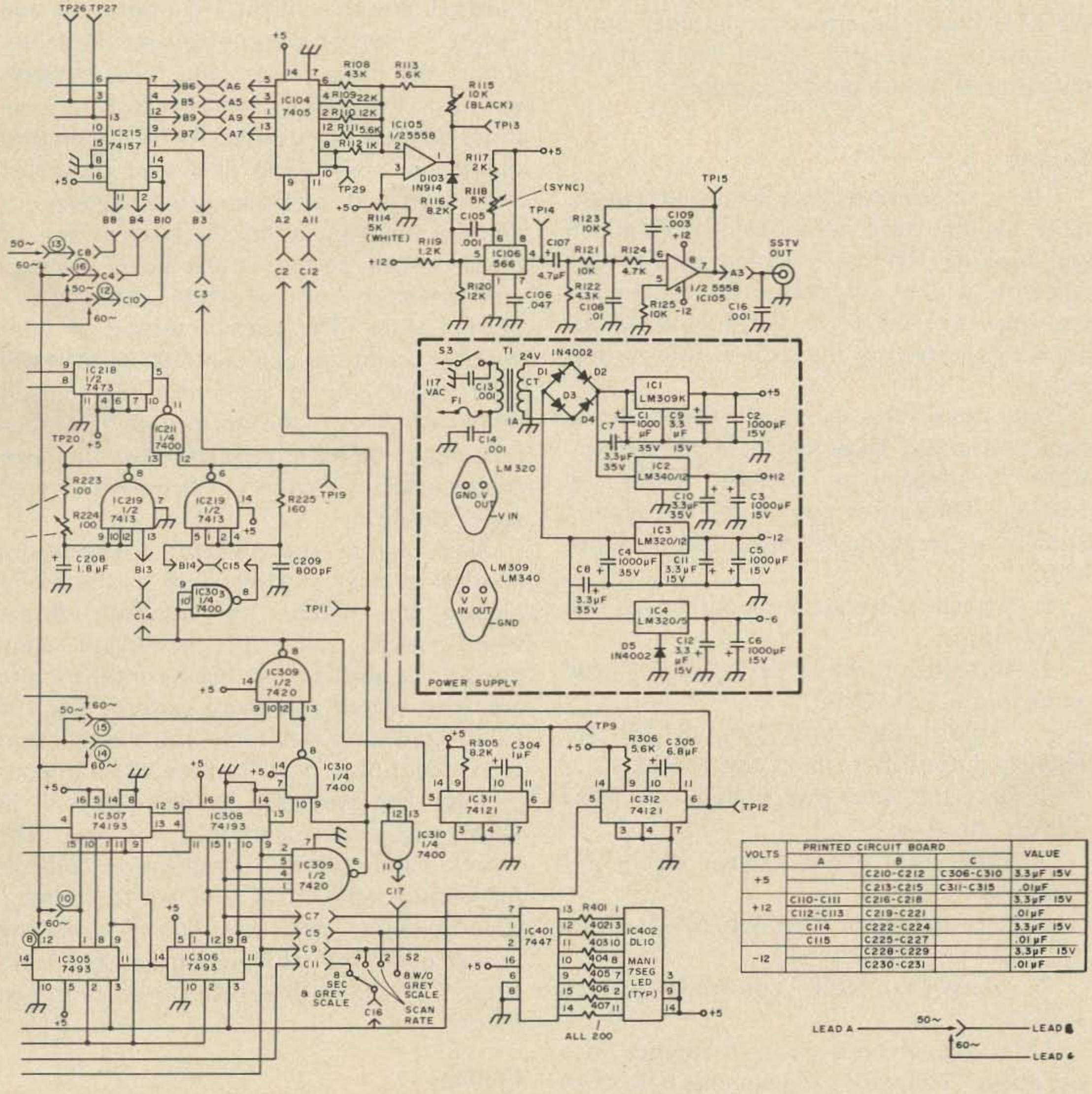


Fig. 3 WØLMD SCAN CONVERTER



VOLTS	PRINTED CIRCUIT BOARD			VALUE
	A	B	C	
+5		C210-C212	C306-C310	3.3µF 15V
		C213-C215	C311-C315	.01µF
+12	C110-C111	C216-C218		3.3µF 15V
	C112-C113	C219-C221		.01µF
	C114	C222-C224		3.3µF 15V
	C115	C225-C227		.01 µF
-12		C228-C229		3.3µF 15V
		C230-C231		.01 µF

50/60Hz Connections

A single schematic, Fig. 3, is included which uses special notation to show how jumpers are connected to run on either 50 or 60Hz lines. Obviously, connect only the labeled set which is appropriate to your situation. Be sure to put in all of the needed 50Hz or 60Hz jumpers associated with IC304, IC305, IC309 and IC215. The PC boards available through either K7OLO or W8OZA have the necessary jumper spots brought to a common socket, and a 16 pin plug is used for the needed jumpers.

Testing

The scan converter may be tested sequentially by inputting video from a TV camera and looking for the included oscilloscope patterns at the test points indicated. The sequence to follow is the functional sequence followed by the section titles of this article.

Only four adjustments are found in the scan converter. Three of these set the key VCO frequencies of 1200, 2300 and 1500Hz. The easiest way to get this section initially on frequency with no camera input is to:

1. Attach a frequency counter to the SSTV output.
2. Disconnect the 1N914 (D103) lead going to pin 1 of IC105.
3. Adjust the sync pot (R118) for 1200Hz output. Reconnect the 1N914.
4. Place the video inversion switch in the "invert" position.
5. Adjust the "white" control (R114) for 2300 Hz.
6. Place the video inversion switch in the "normal" position.
7. Adjust the "black" control (R115) for 1500Hz.

Later adjustments are even simpler once the above "ball park" adjustments have been made. With no video input, ground TP29. Adjust "sync to 1200Hz. Remove ground, switch to "invert" and adjust "white," then switch to "normal" and adjust "black." The sequence 1200, 2300 and then 1500 is necessary to avoid control interaction. The VCO circuit is designed so that once these video limits have been calibrated, no video excursion will exceed the allowed 1500-2300Hz video band.

.The remaining adjustment is the aspect ratio control which is adjusted for a resultant square SSTV picture with video input to the scan converter, as previously stated.

Operation

Once the scan converter is operating satisfactorily, the only adjustments ever touched are the "black" compression and "white" compression controls on the front. Adjust the beam, target and focus controls on your TV camera for as sharp and contrasty picture as possible. At this point you should see some kind of a scan converted picture on your SSTV monitor. Adjust your monitor controls so that the black section of the grey scale pattern is just barely black on your monitor, and the white section is not overly white. The correct setting of your monitor brightness and contrast controls will then allow you to very clearly see the 4 shades of grey at the bottom of the screen (assuming you have the scan converter frame timing selector switch to "8 seconds + grey scale" position.

Now adjust the "white" compression control so that a white area in the SSTV picture just matches the intensity of the white pattern, and adjust the "black" compression control so that blacks in the picture area just match the black pattern. For the truest grey scale rendition, you should avoid the evident pure black or pure white in your picture. However, for greater "punch" in QRM or weak conditions, advance the "black" and "white" compression controls for considerable black and white clipping. Color pictures can come out very well by proper black and white compression. I can't stress the value of the spectrum analyzer too much.

Credits

I would like to thank the large number of SSTVers who have helped with the design, evolution and testing of this scan converter. I would like to particularly thank George Kinder, W8OZA, K7OLO, W6MXV, W9NTP, K7YZZ and WA7MOV.

...WØLMD

Emil E. Hrivnak W3HPX
19 Windmill Road
Enfield CT 06082

HOUSE CLEANING The Logical Way

Here are some basic techniques to help you with what seems at times to be absolutely mindboggling circuitry.

Every profession has its tricks of the trade which makes things easier, such as the fisherman knowing what bait to use and the right depth to fish at for a particular catch, or a farmer knowing the best planting time and the right fertilizer to use, or an rf design engineer knowing the best LC ratio for a pi-tuning network. Most amateurs are not well versed in all fields of electronics but by some magic combination we get our circuits to work. Knowing a little more about the tricks of the trade could have made things much easier though. I'd like to present some digital guidelines practiced by most digital designeers in hope of making your next digital piece of gear easier to design and quicker to check out and put on the air.

Since most articles appearing in ham magazines are using TTL logic, because of its wide availability and low price, I'll direct my comments accordingly. However, no matter what logic family you use the same basic techniques apply.

The most common abuse in TTL circuits is to leave unused inputs to gates, flip flops and counters floating. Unfortunately, many TTL devices will operate with a floating input, but they are very noise susceptible and you're asking for unreliable and intermittent operation with the high intensity rf fields present in the average shack. A 1K pull up resistor to VCC on those input lines and a .001 μF capacitor to ground on inputs coming from the outside world, such as a key input to a keyer, will cure most problems encountered in home brew digital equipment. No TTL manufacturer recommends leaving unused inputs to gates or flip flops floating. Depending on the logic state desired, they should be grounded or pulled up to VCC through a 1K resistor. A single resistor can handle from 15 to 30 unused inputs. It's not necessary to use a separate resistor for each. They could be tied directly to VCC if you can guarantee that VCC will never transient above 5.5V. Manufacturers claim that inputs above 5.5V may damage

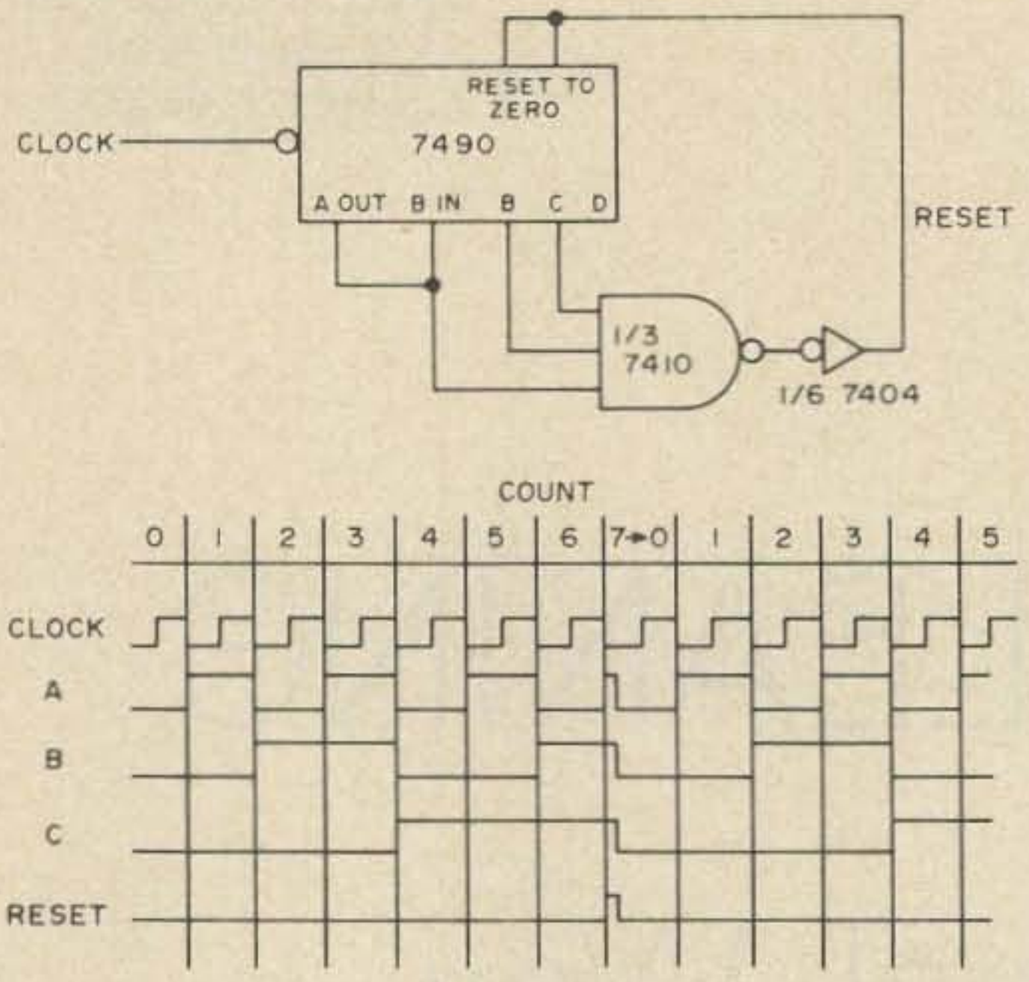


Fig. 1. A typical ÷ by 7 circuit.

the junction. Why risk it? It's safer to use a 10¢ resistor that provides current limiting than to trust your regulator not to over-voltage on a load transient.

Racey Resets

Another area where trouble can develop is in resetting counters. A 54/7490 is a decade counter. If we have a need for a divide by 7 counter we might use the circuit in Fig. 1. This circuit is usually satisfactory but now consider Fig. 2, a divide by 77 counter using two 7490's. The reset pulse is high at count 77 only until the first of the 6 inputs to the 7430 gate goes low. If the units and the tens counters are not matched as to the minimum required reset pulse width, the units counter, for example, could get reset causing the reset pulse to go away before it was up long enough to reset the tens counter. Don't always believe the typical times for reset widths, propagation delays, etc., in the spec sheets. TTL manufacturers

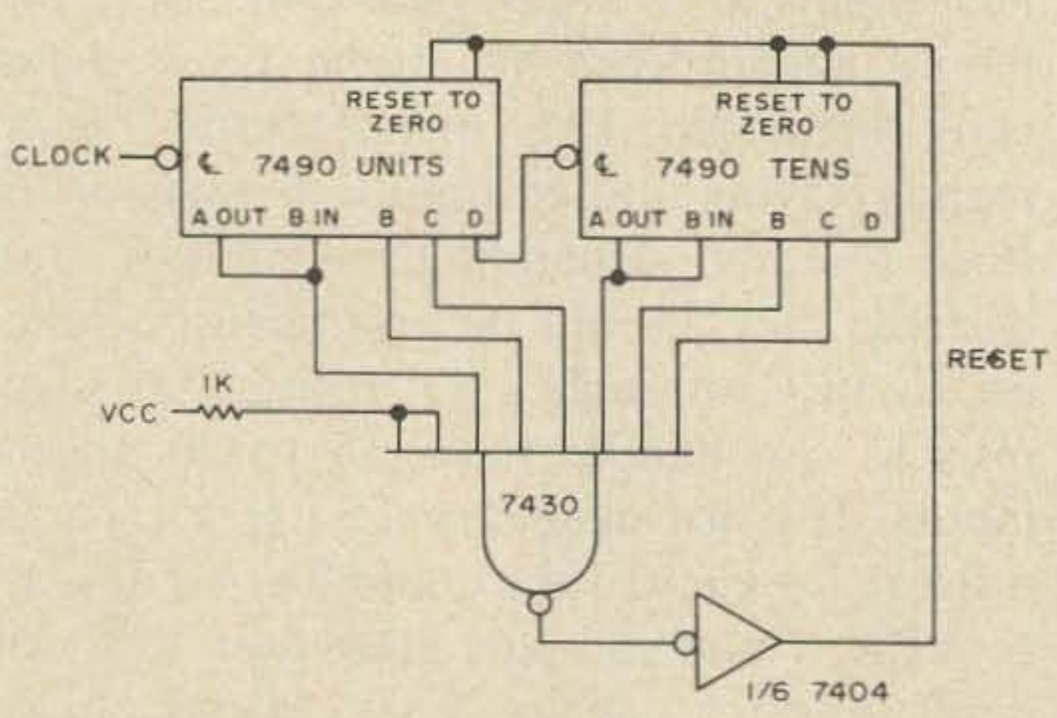


Fig. 2. A typical ÷ by 77 circuit.

sell most all devices they make and some are much faster than the typical values, and some just squeak by the slowest times listed on the sheets. And, by the way, look at the guaranteed numbers again on the spec sheets. They are valid only for 5.000V and 25° C. Over temperature and voltage limits lab measurements have shown that a 2.7 to 1 multiplication factor can be applied to the typical values. Because of these factors I have seen the reset circuit in Fig. 2, fail occasionally on strings of 2 counters and very frequently on strings of 3 or more counters. By adding a latch consisting of two nand gates to the reset circuit you can guarantee a good reset everytime. Fig. 3, shows the additions necessary. The reset pulse will always be ½ of a clock period wide, and at the highest clock rate you can use the counter, the reset will always be wide enough to do the job.

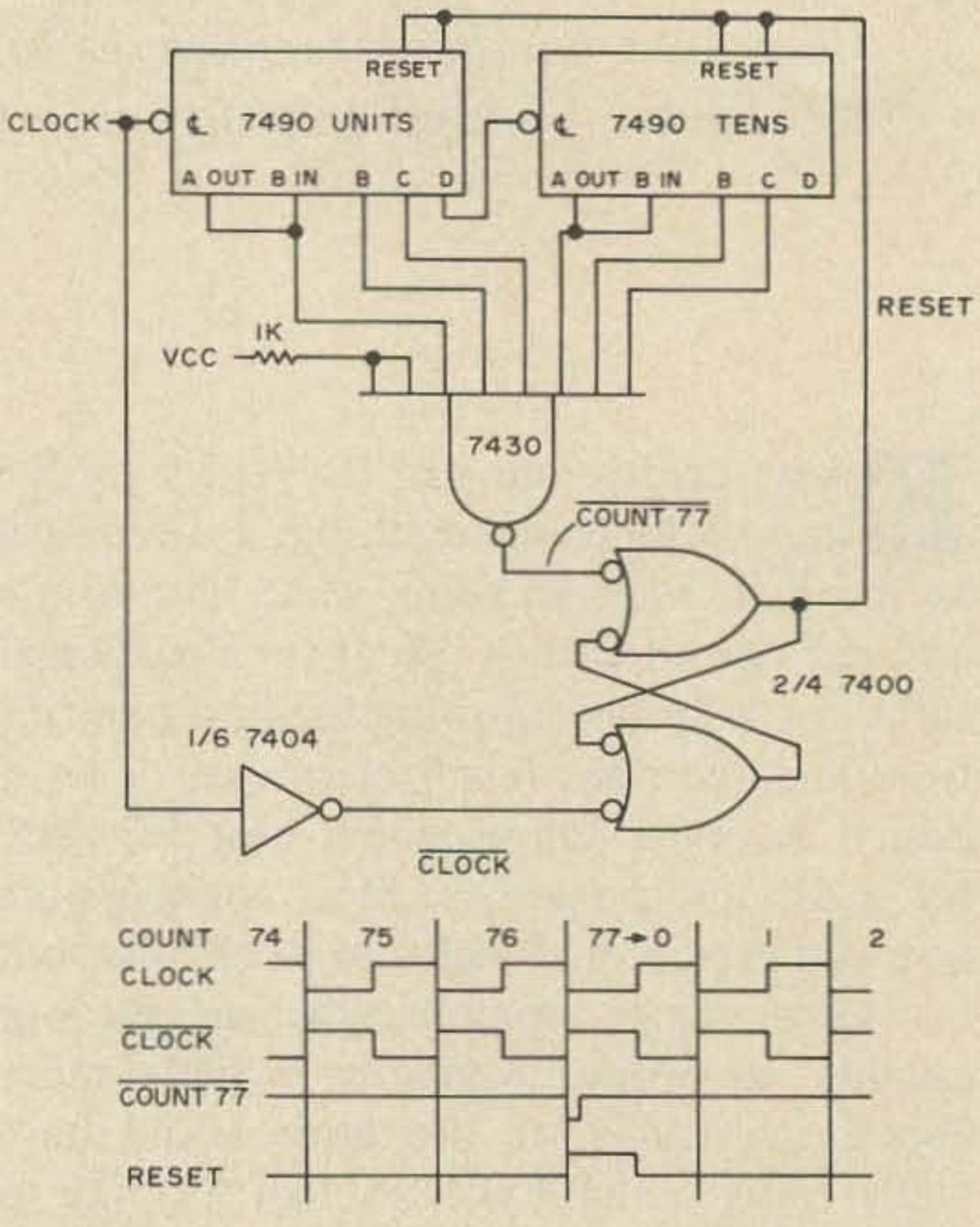


Fig. 3. A ÷ by 77 circuit with a clean reset.

I hate to even mention the following because it leaves a sour taste, but. . .some designeers(?) would have been tempted to use a RC filter on the reset line to lengthen the reset pulse, see Fig. 4. A TTL gate has a lower impedance when pulling to ground than when pulling to VCC. Gate A pulling to ground will discharge capacitor C relatively fast making reset go high. When the first of

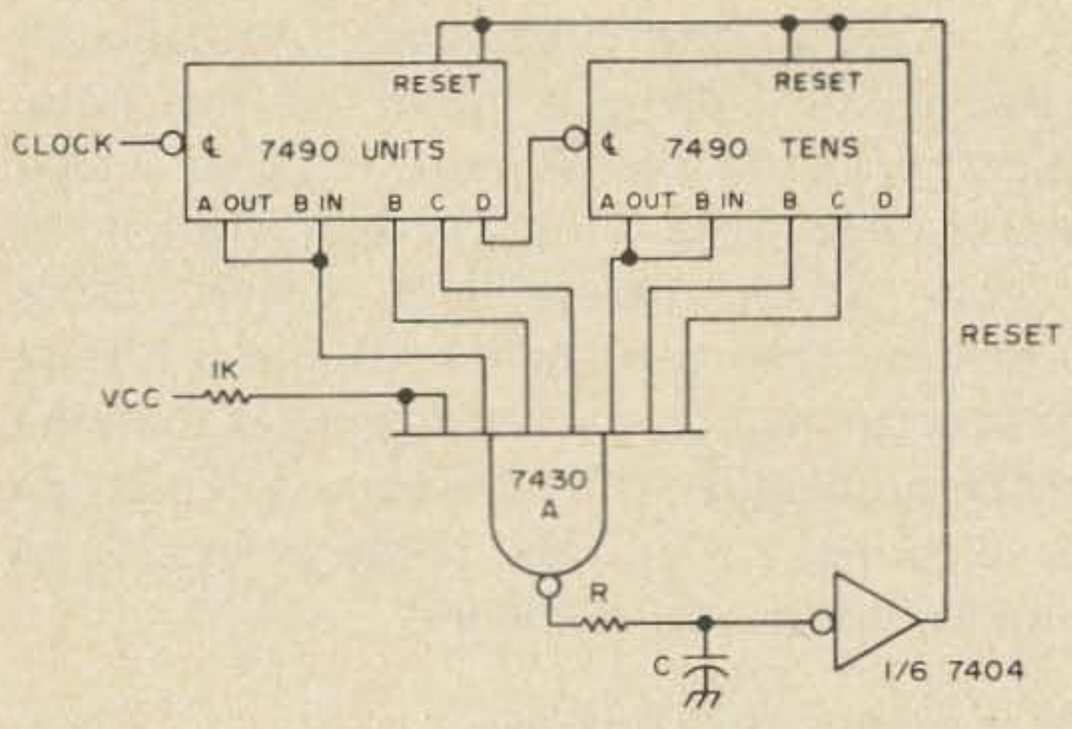


Fig. 4. The way not to lengthen the reset pulse for a ÷ by 77 circuit. RC networks are a no-no in digital circuits.

the counters responds to the reset and gate A goes HIGH, it does not charge up the capacitor as fast. The reset pulse is lengthened some. This is a bad design practice especially in critical circuits, because the time constant is not reliably predictable. Digital gates were not designed to be operated this way, and I have seen the outputs of gates blown because the C was too large and the R too small and the junction couldn't take the transient surge when trying to discharge the capacitor. You should never have to resort to a RC network; there is always a way to do it RIGHT! I don't know of a professional digital designeer that would even consider a RC network in a circuit. Resistors are used only for pull ups, and capacitors are for bypassing VCC to ground!!!

Power and Grounds

There are several ways of supplying power and ground to the chips which are satisfactory. I don't think anyone is capable of saying which is the 100% best way, but good practice is to establish a single point ground and a single point VCC location in the supply section of the equipment. Each card or group of ICs should have separate VCC and ground leads back to the supply terminals as shown in Fig. 5. This single point ground is probably the best place to establish chassis ground. If you have displays or lamps, don't ground them to the chassis, but use a ground wire back to the single point ground. The more bypass capacitors across VCC to ground the less noise there will be in the circuit. A .001 μF capacitor

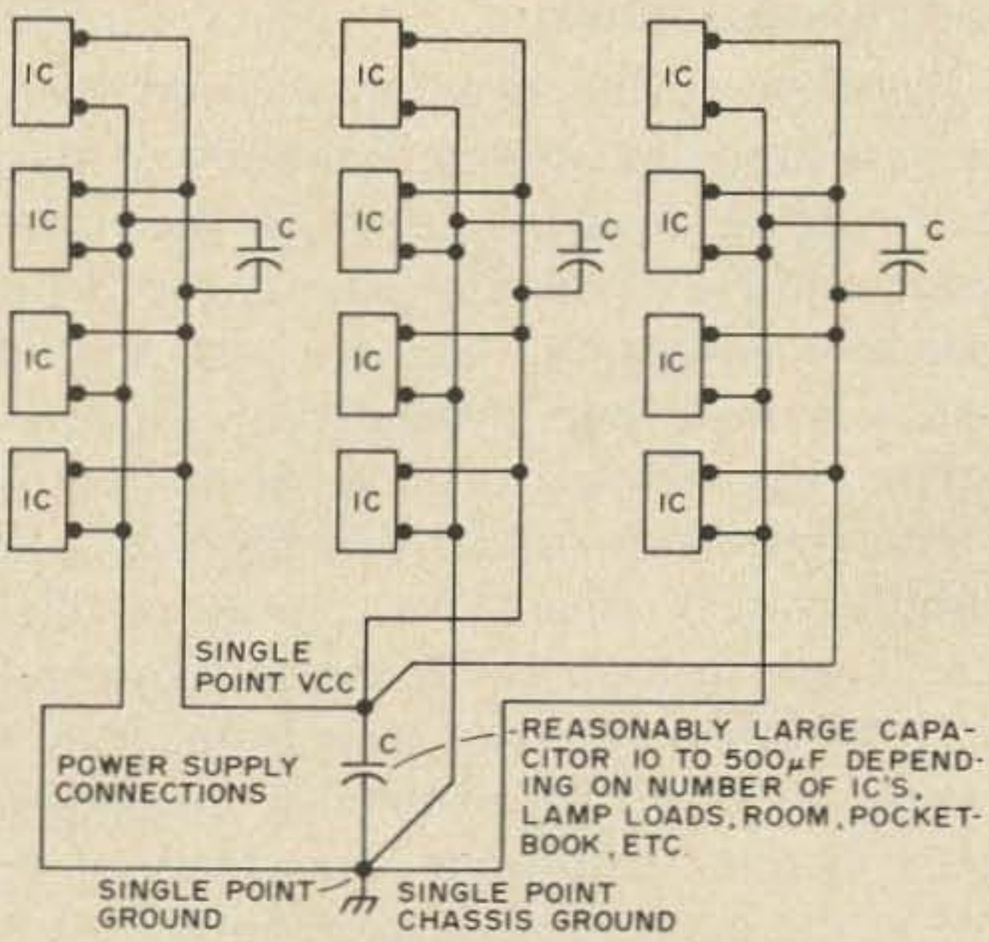


Fig. 5. A preferred method of powering ICs.

for each 3 chips or a .01 to .1 μF capacitor for each 5 to 6 chips will help reduce noise on the VCC line due to the large current spikes drawn when TTL outputs switch logic states. And keep those leads on the capacitors short, not 3.81cm (1½") as they come from the factory. That 3.81cm (1½") lead looks very inductive at the frequency of the noise you're trying to filter out, and the

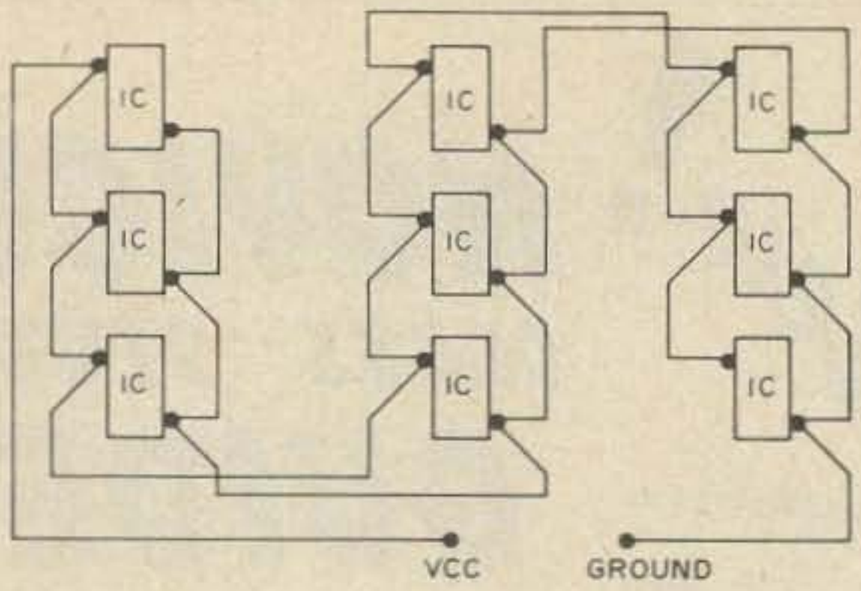


Fig. 6. How not to power ICs. A digital clock powered this way failed to operate properly.

effect of the capacitor is lost if the leads aren't short. A few electrolytics or tantalums, 2 to 50 μF, are always helpful, too.

Don't power your chips as shown in Fig. 6. I purposely wired a digital clock this way to see what would happen and it counted erratically everytime the furnace went on, the electric igniter in the gas clothes dryer went on, the dehumidifier went on, and worst of all anytime the transmitter was turned on. Cleaning up the power and grounds as indicated in Fig. 5, cured all the problems.

Synchronous Circuits

The best advice given to me and that I can pass along to anyone tinkering or starting in digital design is to avoid the use of presets and clears on flip flops except when absolutely necessary. These cases may be when a manual reset is needed to initialize a system after power turn on, or to force a system shutdown, or in synchronizers (an example later) where the preset or clear pulse is synchronous with the system clock. Use other than this can sometimes lead to difficult to find race problems. Bringing in inputs directly to presets and clears of flip flops is the most noise susceptible thing you can do. A noise pulse can easily trigger a part of the circuit. The best design is a synchronous design where all flip flops are clocked together from a common system clock. All next states for the flip flops are defined by the logic circuitry. A typical 7474D type flip flop has a setup time of 15ns. This means that next state information must be present and stable at the D input 15ns before the clock rises. If noise is strong enough to get into the logic circuit it can only affect operation if it occurs within the 15ns window prior to the clock edge. Actually all gate delays from the point of the noise injection up to the D input must be added up, but even in a typical system if the noise is gone 50-70ns before clock it won't cause problems. The probability of noise hitting this narrow window is much smaller than the 100% probability of a noise pulse presetting or clearing a flip flop if these inputs go directly to the outside world.

Race or Initial Conditions

If your digital circuit looks like it should work on paper, but doesn't when you build it, (and all wiring mistakes are out) it could be a race condition. You could have a timing or decoding spike which is triggering another part of the circuit at the wrong time. That's why it's best to clock all flip flops from a common system clock, rather than through levels of logic decoding where propagation delays of gates can generate spikes on an output. Fig. 7, shows a divide by 100 circuit using two SN74160 synchronous decade counters. The carry out of the units counter is high only when it has reached a full count of 9. It enables the tens counter to advance on the next clock pulse, and at the same time the units counter will go to the zero state. Count 19 is decoded and gate X goes

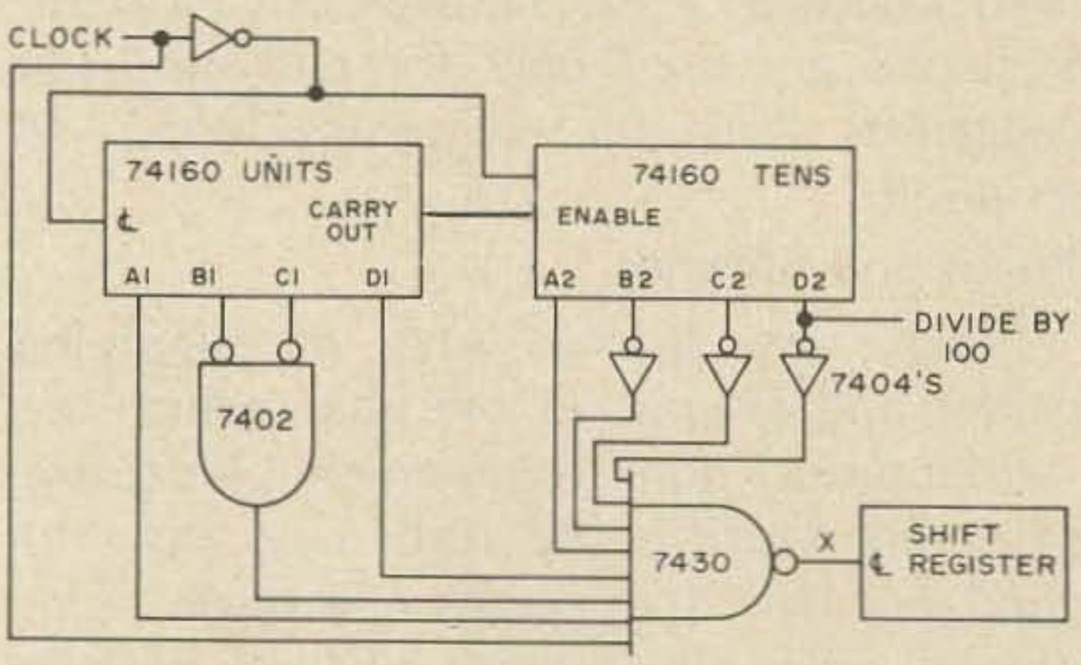


Fig. 7. Illustration of race in a digital circuit. Spike on gate X at counter transistion from state 9 to state 10 causes incorrect clocking of shift register.

LOW when the counters are at state 19. When they are clocked again to count 20, gate X will go HIGH clocking the shift register. The shift register is supposed to be clocked only once for each 100 input clock pulses to the divide by 100 counter, and for purposes of this example, it is to be clocked when the counters go from state 19 to state 20. If the two counters are not matched as to propagation delays, the outputs of the tens counter could change first, and at the transition from count 9 to count 10, A2 could go HIGH looking like a 19 decode before A1 and D1 go LOW really making a 10 decode. A short spike could occur on the output of gate X, long enough to clock the shift register, but short enough that you won't see it without a good high frequency scope. The possibility of this spike occuring increases if the tens counter is very fast, and the units counter just passed the slowest delay times allowed by the manufacturer for the device. Changing the circuit to that of Fig. 8, will cure the race problem. When system clock goes LOW gate X is disabled. The counter is clocked 1 gate delay later and then there is ½ of a bit time to allow the inputs to gate X to setup and decode state 19. Then clock goes HIGH making gate X go LOW. When clock goes LOW at the end of the bit time both the counter and the shift register are clocked together, and gate X is disabled again for ½ a bit time to allow the other 7 inputs to gate X to settle again. The shift register will be clocked once and only once on the transition of the counters from state 19 to state 20 and the race is over.

If your circuit usually works but every time you turn it on it malfunctions for a short period of time, you probably have failed to check that all initial conditions that you thought were there are satisfied. Take a good look at the circuit and try to see what would happen if some flip flop didn't start in the right condition you assumed it would.

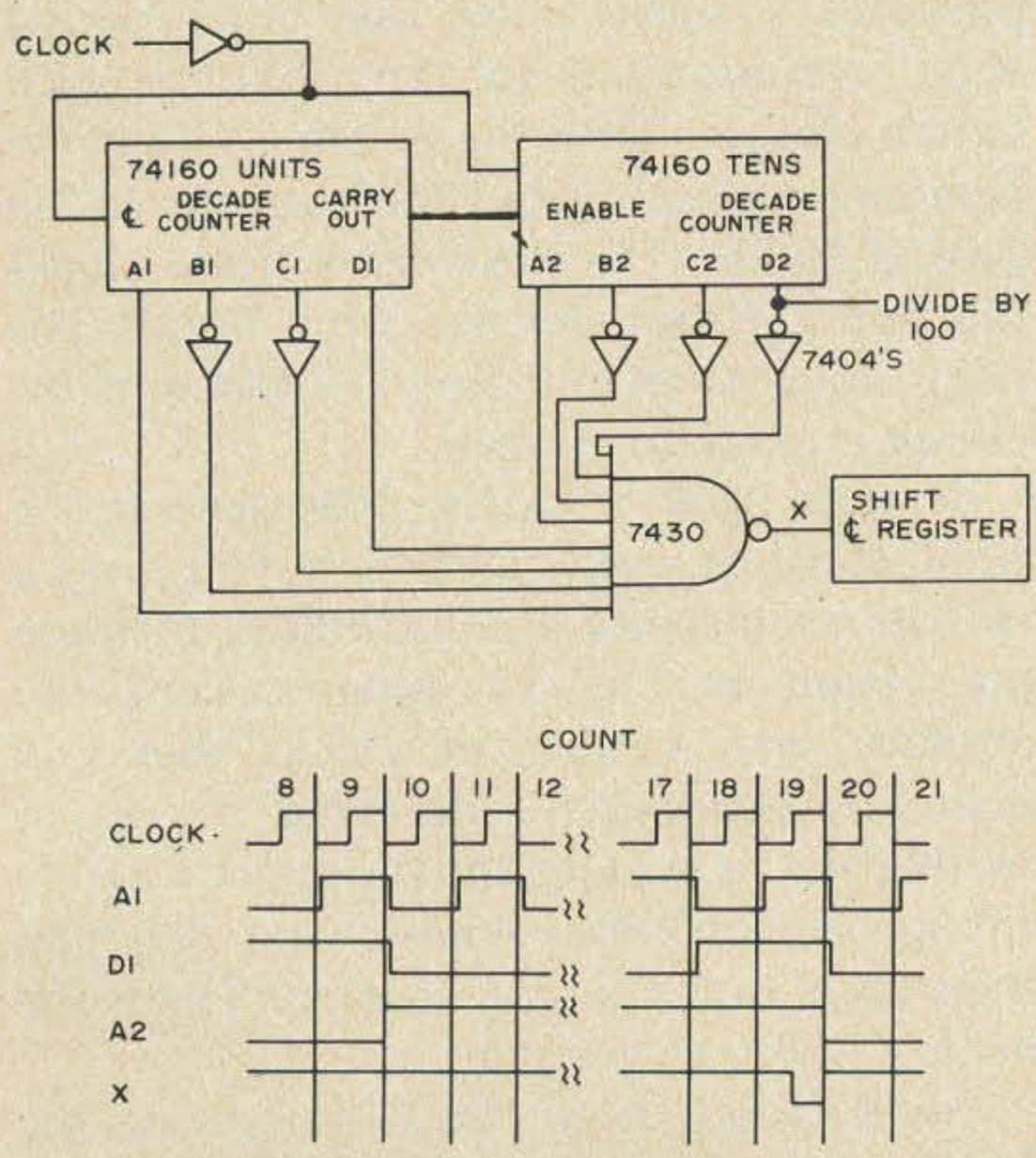


Fig. 8. How to clean up the race condition of Fig. 7.

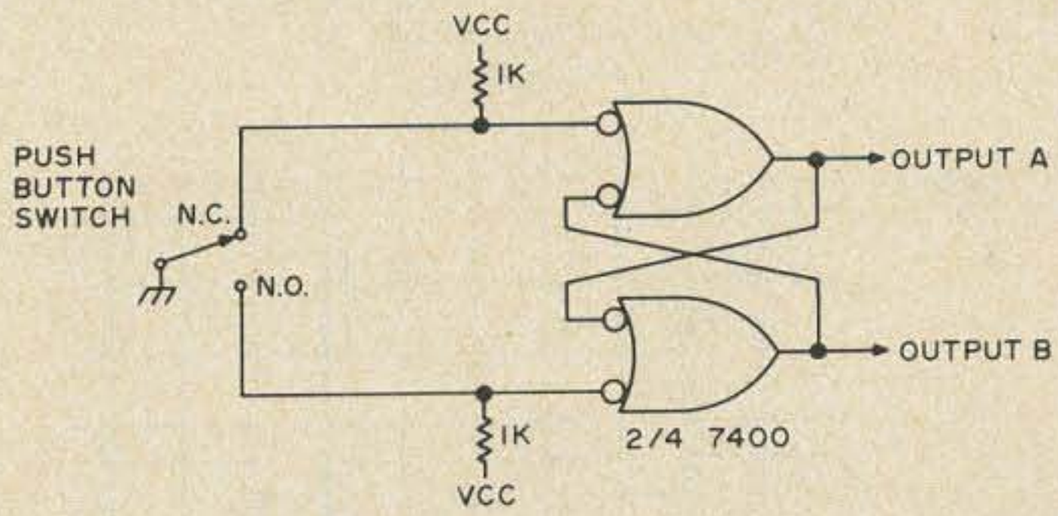


Fig. 9. Switch debouncer circuit. Output A goes LOW when switch is pushed. Output B goes HIGH when switch is pushed.

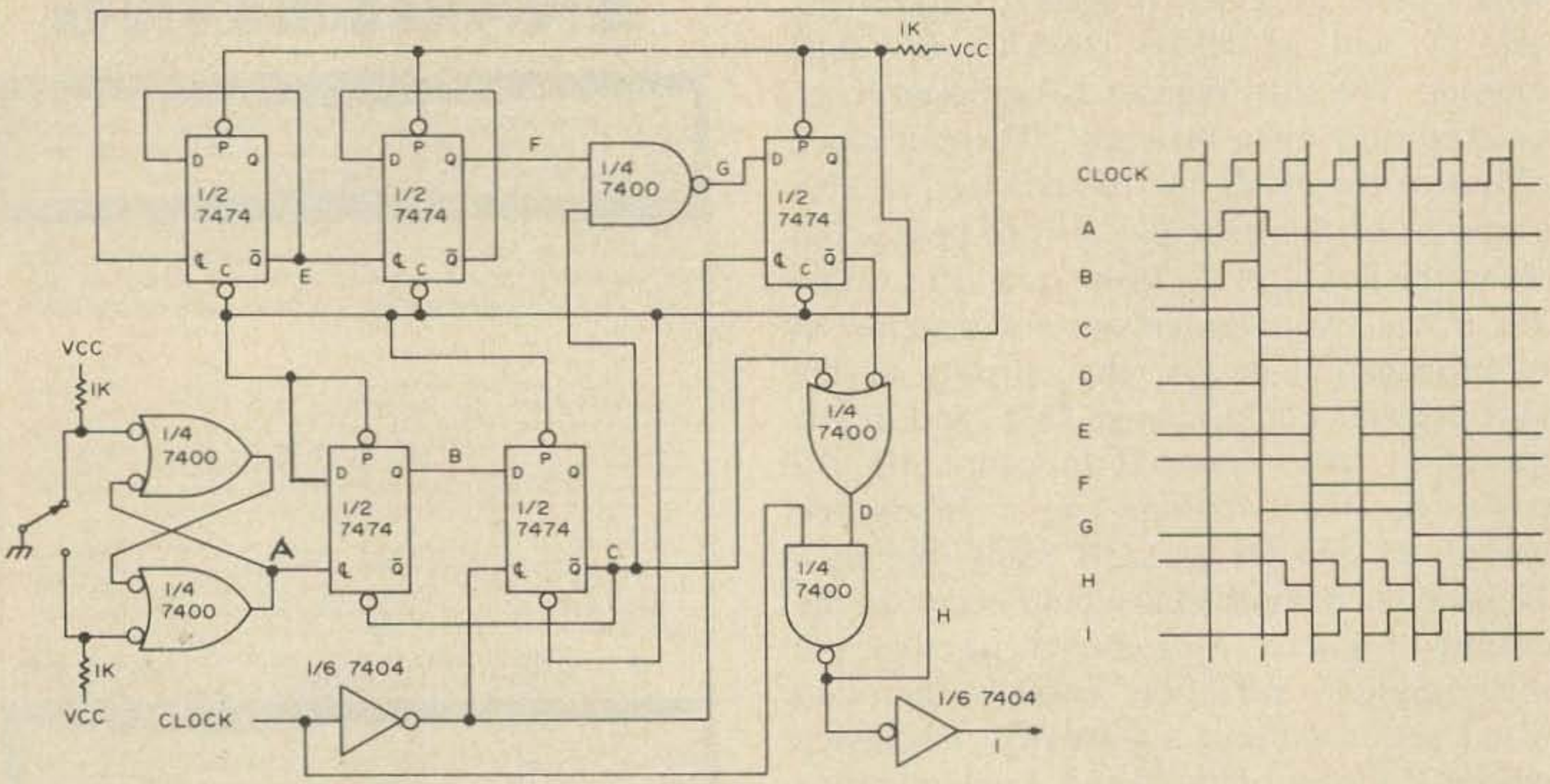


Fig. 11. A circuit that produces four clock pulses each time the push-button switch is pressed.

Draw a timing diagram if necessary and you should find out why your circuit starts off wrong.

Useful Circuits

Some helpful circuits that you might be able to use when testing your digital circuits are shown in Fig. 9, 10 and 11. As you know mechanical switches bounce for several milliseconds when closed. If you try to generate a single clock pulse from a switch closure you will really get many because of the contact bounce. Fig. 9, is a switch debouncer used frequently to generate a single pulse on a switch closure. The only requirement for it to work is that the wiper of the switch just bounces between a contact and an open. If it bounces against the opposite contact (which most don't) then the latch will alternate states and not produce the single output desired.

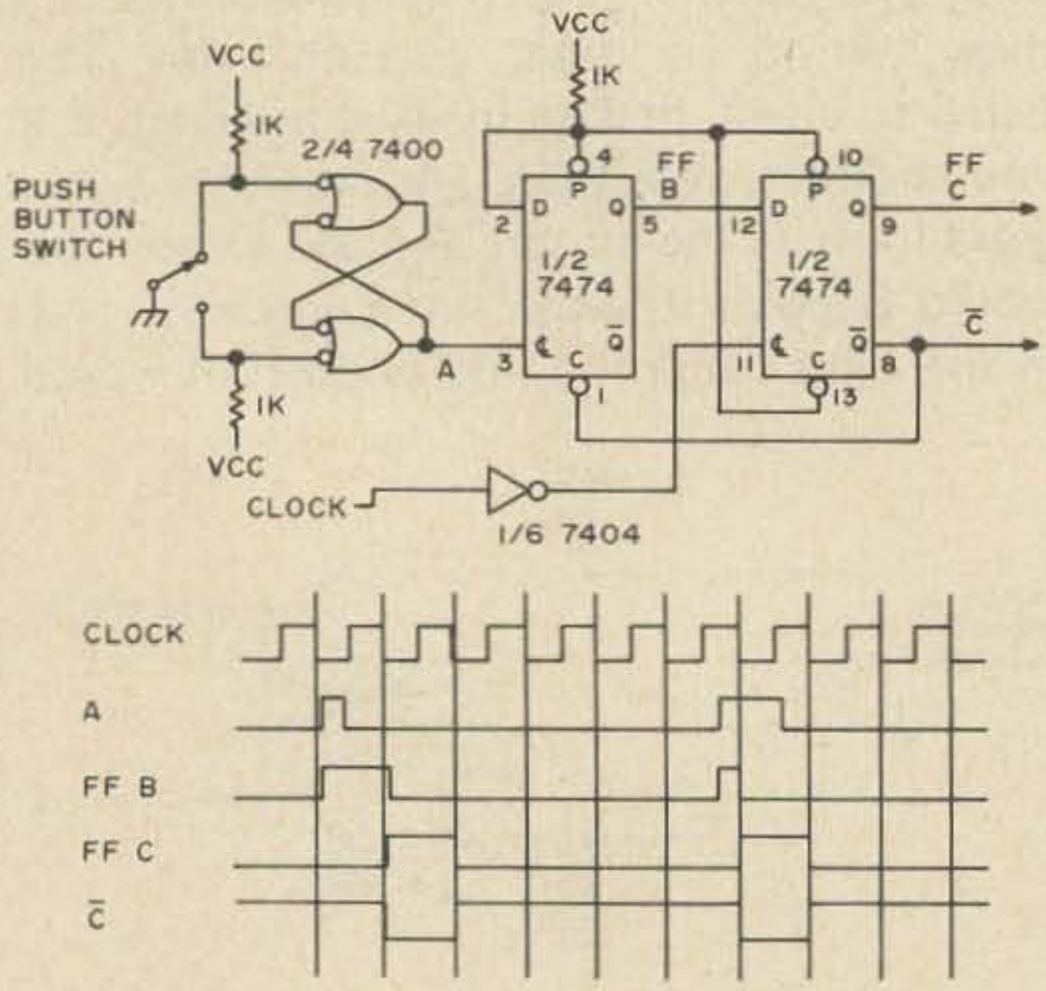


Fig. 10. A synchronizer that produces one output pulse one clock period wide, synchronized with the clock for each switch closure.

Fig. 10, is a circuit for a synchronizer. It produces a single pulse one clock period wide, synchronized to the clock on each switch closure. When the switch is closed the de-bouncing latch goes HIGH and clocks flip flob B HIGH. The next clcok pulse clocks flip flop C HIGH and resets flip flop B. The next clock takes flip flop C LOW and the circuit is ready to go again.

If you need a circuit that generates a burst of clock pulses each time you press a switch, for instance 4 clock pulses, then use the circuit in Fig. 11. Modifications can produce any number of clocks that you desire. If you haven't mastered the art of writing the next state equations for a digital circuit, or don't even know what they are, then draw out a timing diagram. That's the next best way to get going.

So let's get those pencils out, erase the race in those designs and go digital.

. . .W3HPX

73 DUZZ MORE FOR YOU!

REASONS TO SUBSCRIBE:

One Year Sub Saves

☐A one year subscription is only $7 — 58¢ per issue. That's a 42% savings. (Egad!)

Two Year Sub Really Rips Us Off

☐A two year subscription for $12 saves you 50% — each issue costs only 50¢. (We must be nuts!)

Don't Read This Paragraph

☐A three year subscription takes us for a bundle. It's only 42¢ an issue — a savings of 68%. (We certainly won't make much money off you. Come to think of it, what kind of person are you, reading this paragraph and thinking of subscribing for three years?)

OUR RATES ARE REASONABLE

☐We have managed to hold our subscription rates at a reasonable level despite a host of rising costs: postage rates (our nemesis, due to go up again), staff salaries (itinerant apple pickers are making more every year and the chimpanzees are asking for more and more bananas), rising printing costs and increased costs in just about everything else.

WHAT WE GIVE YOU:

☐More articles on every facet of amateur radio than any other publication.

☐We're usually a couple of steps ahead of our competitors in publishing articles you want to read about.

☐More ads than any other Ham magazine— that means you can keep up on what's new in your hobby.

☐NEWS PAGES: Read about how hams are aiding people during times of crisis. Read our special interest columns which will keep you up on what's new in your facet of ham radio — contests — SSTV — 50 MHz — Solid State — and more, more, more!

☐An open forum for you in our letters to the editor column. Here you can sound off on your likes and dislikes (about us or anyone else). We publish both sides.

☐Wayne's Editorials — never boring, sometimes controversial. They're a great conversation starter at ham clubs and on the air.

☐IRS Report: Does an average ham pay more in taxes than a multi-million dollar company? Find out how the IRS is out to screw you and what you can do about it.

NAME _____ CALL _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

☐ Sign me up for a money-saving 1-year subscription for $7.
☐ Here's my $12 to rip you off for a 2-year subscription.
☐ YEAH! I'm mean enough to sign up for a 3-year subscription for $15.
☐ BankAmericard ☐ MasterCharge Account No. _____ Expires _____
☐ New Subscription ☐ Renewal
☐ Bill Me Signature _____

73 MAGAZINE INC. *Peterborough, New Hampshire 03458*

73 Books & Stuff

the Books

NOVICE CLASS STUDY GUIDE

$4

The world's easiest to understand book on the theory required for the Novice amateur radio license exam. Frustrated by fundamentals? Read this book. One simple reading should carry you through the exam.

GENERAL CLASS STUDY GUIDE

$6

This book will help you to really understand the theory and enable you to easily pass the FCC exam. This is not a Q&A manual for memorization. Study this book and go into the exam with confidence.

ADVANCED CLASS STUDY GUIDE

$4

Thousands have used this book to help them breeze through the Advanced exam with no strain. This is the ONLY study guide published which covers ALL the material you will have to know.

EXTRA CLASS STUDY GUIDE

$7

Does the theory required for the Extra Class exam panic you? No need, for this book reduces it to easy comprehension. Many amateurs find that a quick reading through this book is enough to get them through the tough Extra Class exam. Face that exam with confidence.

1974 FM REPEATER ATLAS

$1.50

Listings by states (or countries) and cities of all repeaters, both open and closed, in the world. Periodically updated. Handy size for mobile use.

FM REPEATER CIRCUITS MANUAL

hardbound $7
softbound $5

Contains almost every conceivable circuit that might be needed for use with a repeater. All circuits explained in detail. All aspects covered, from the operator to the antenna. Also contains chapters on setting up a mobile station, plus much more.

HOW TO USE FM

$1.50

This book presents the basics of two meter FM operation and repeaters in short form with the end in mind of getting you on FM quickly and easily.

It is easy to make some blunders when you are getting started with anything new. It is also embarrasing. A fast reading of this book should help you avoid the pitfalls.

VHF PROJECTS FOR AMATEUR AND EXPERIMENTER

$5

A must for the VHF op. Opening chapters on operating practices and getting started in VHF, both AM and FM, followed by 58 chapters on building useful test equipment, modifying existing and surplus gear, building complete stations, both fixed and portable, linears, converters, control units, preamps, band scanners, antennas, noise suppression, plus many more.

FASCINATING WORLD OF RADIO COMMUNICATIONS

$4

All about broadcast band DXing, tuning the tropical DX bands, DXing radio amateurs, antennas for shortwave, radio licenses, pioneers in electricity and radio, commercial broadcast stations, WWV, etc.

TVI

$1.50

Discusses all types of interference problems in great detail with recommended steps to cure these problems. Good for both the amateur and citizens band operator. Try this cure and suffer no longer.

IC PROJECTS

$4

This book tells how to understand and use ICs, with numberous construction projects.

COAX HANDBOOK

$3

All about coaxial cables, connectors and applications. It's all here — pictures, part numbers and specifications for all types.

SOLID STATE PROJECTS

$4

More than 60 projects of interest to anyone in electronics. The devices range from a simple transistor tester to a ham TV receiver. This collection will help you become more intimately acquainted with zeners, ICs and varactors, etc.

TRANSISTOR PROJECTS

$3

Crammed full of home construction projects, from receivers to transmitters and all in between. Chapters include such articles as zener diodes, how they work, how to use, test and buy them; integrated circuits; how to design transistor amplifiers; and many more.

DX HANDBOOK with MAP

$3

How to work DX, how to get QSL'S, country lists, award lists, QSL bureaus, maps of the world, great circle maps centered on major U.S. cities, DX bearing charts for major U.S. cities, how to go on your own DXpedition, and much more. Wall size DX map of the world included.

more Books

INTRODUCTION TO RTTY

$2

In this book the world of radioteletype is explained in an easily understood manner for the beginner. There's also a chapter on RTTY Art which will teach you everything you need to know in order to be a RTTY Artist. The last part of this book contains a bibliography of everything published about RTTY since 1952.

RTTY HANDBOOK

$6

A comprehensive book covering all areas of radio teletype, from getting started with the basic principles, what equipment to procure and how to make it work. The only up-to-date book available on the subject. Well written, easy to read and understand.

73 USEFUL TRANSISTOR CIRCUITS

$1

Useful transistor circuits for audio, receivers, transmitters and test equipment. 47 chapters with circuit diagrams for each, complete with component values, etc. A must for the solid state home brewer. Easy to read and to understand.

SLOW SCAN TELEVISION HANDBOOK

hardbound $7
softbound $5

This excellent book tells all about it, from its history and basics to the present state-of-the-art techniques. Contains chapters on circuits, monitors, cameras, color SSTV, test equipment and much more.

DIODE CIRCUITS HANDBOOK

$1

115 diode circuits including power supply application, regulators, ac meter applications, receiver detectors for AM-FM-SSB, noise limiters, squelch, AGC, varicap tuning, audio clippers, compressors FM modulators, RTTY keying, varactor multipliers, noise generators,

VHF ANTENNA HANDBOOK

$3

Would you believe that the secret to success in VHF/UHF is in the antenna system? This is no earth shaking discovery, but it's true. A complete, detailed book with descriptions, dimensions, tuning data, diagrams and photos. Antennas from the instant coathanger to the giant collinear beam can be found here.

DIGITAL CONTROL OF REPEATERS

hardbound $7
softbound $5

Here's a book for the FMer who wants to design and build a digital repeater control system. Contains sections on repeaters, basic logic functions, logic circuit design, control systems, support circuits, mobile installations, touch-tone, plus a special section on a "mini" repeater control system.

CONVERTING COMMERCIAL FM GEAR

$2

General information on commercial FM gear with specific conversions for Motorola equipment.

DIODE CIRCUITS

$1

Full of simple handy goodies built with diodes.

the Stuff

73 CERTIFICATES

WAAS **$1**

Worked Almost All States — Proof of your having worked 49 of the 50 states. It is for those who are just unable to get that last state confirmed.

RRCC **$1**

This Real Rag Chewers certificate is awarded only for the feat of a non-stop QSO for a period exceeding six hours with no time out for anything. Order must be accompanied with date/time (GMT) of start/end of contact, station contacted, and your call sign.

DXDC **$1**

Available for those who present proof of contact (copy of log) with 10 different countries. Awarding this certificate makes you a member of the DX Decade Club.

RTTY-DXDC **$1**

Frame and hang this one above your machine. All operating award for those who have submitted proof of 2-way teletype communications with 10 countries. Endorsement provisions for different bands.

SSTV-DXCC **$1**

Dress up the shack with this award for 2-way Slow Scan Television communications with 10 countries. Endorsement provisions for separate bands.

ALL MODE DXDC **$1**

How many can qualify for this one? An award for 2-way communications with 10 countries using CW-SSB-RTTY-SSTV modes.

UNDERSTANDING XYL/OM **$1**

An unusual certificate — get one and keep your mate happy. An award to those who have the good fortune of having an understanding partner who appreciates all good things about amateur radio (staying up all night, spending money for rigs, etc.).

CHC **$1**

Presented to those who submit a sworn statement that they have never received a certificate for radio operating and if they ever receive one, they will hate it. This certificate should be your first before you accidentally do something and receive a certificate for it. This attests to your membership in the Certificate Haters Club.

Be certain to enclose sufficient postage for the return of your QSLs.

73 BACK ISSUES

VOL.1 **$4**

This is an assortment of twelve different back issues of 73 from the years 1960 through 1964. Normally these back issues would cost you $1 or more each, but since this assortment is our choice instead of yours you benefit with a big bargain. Here is a good way to build up your technical library with hundreds of interesting and valuable technical articles and construction projects.

VOL. 2 **$4**

Twelve different back issues of 73 from the years 1965 through 1967. These are the real vintage years of 73 for home builders of transistorized gear. Lots of VHF projects and gadgets galore. See for yourself what 73 was doing back when QST was

more Stuff

the Stuff
(continued)

still bringing you only tubes. At this price you get our choice of back issues. This is an excellent way to fill in missing back issues, if you like to gamble.

VOL. 3 $4

Twelve different back issues of 73 from the years 1968 to 1972. These bundles are already made up so you have to accept our choice at this price. Individual issues for most months are still available for $1 each for these years.

MAGNETIC CALL SIGNS

$4

Let the world know that you are proud of your ham call. These magnetic call signs will adhere to the side of your car, and they won't fall off at high speeds.

U.S. MAPS

$1

These wall sized maps show the states and call area. They are specially designed for coloring to show your progress toward the Worked All States award of ARRL or the Worked Almost All States award put out by 73 (for proof of contact with 49 states). Since you will probably be wanting to work for the award on several bands you will want several maps. They come in groups of four.

WORLD DX MAP

$2

This is the same wall-sized DX map that is included with the DX Handbook except it comes to you rolled up instead of folded. This is so you can put it on the wall or have it framed. The map is designed with all country prefixes indicated and space for you to color in the countries as you work them. Visitors can see immediately how much of the world you have contacted! The zones are on the map as well as prefixes. Maybe you need several maps.

CUSTOMIZED DX BEARING CHART

$4

An amateur who works for a big computer company has a program which permits him to plug in your location and have it print out the bearings of all the countries of the world from your shack. Once you have this list you will use it for every DX contact. The chart gives the bearing and distance to all major cities and countries. Be patient when you order for these have to be run through in groups so that we can offer them to you at such a low cost.

73 BINDERS

$5

These binders are a gorgeous red and come with the nicest set of year stickers you've ever seen. The perfect thing for storing your issues of 73 so that they won't get lost or spilt on, or into the hands of the Jr. Op. Dress up your shack with these binders.

LAPEL BADGES

$1

Name and call identifies you at club meetings, hamfests, busted pot parties. Hand engraved by skilled New Hampshire craftsman with loving care. Only one lousy dollar. Send first name and call.

CALL LETTER DESK PLATE

$2

How about dressing up your operating table with a desk plate showing your first name and call? These embossed desk plates are nice — and inexpensive. No zero available, sorry. There is room for twenty letters and spaces total.

the Sting

73 Magazine, Peterborough NH 03458

NAME ______

ADDRESS ______

CITY ______ STATE ______ ZIP ______

SEND ME: ______ PRICE: ______

______

______

______

SIGNATURE ______

CARD # ______

EXPIRATION DATE ______

☐ master charge ☐ BANKAMERICARD

TOTAL ENCLOSED ______

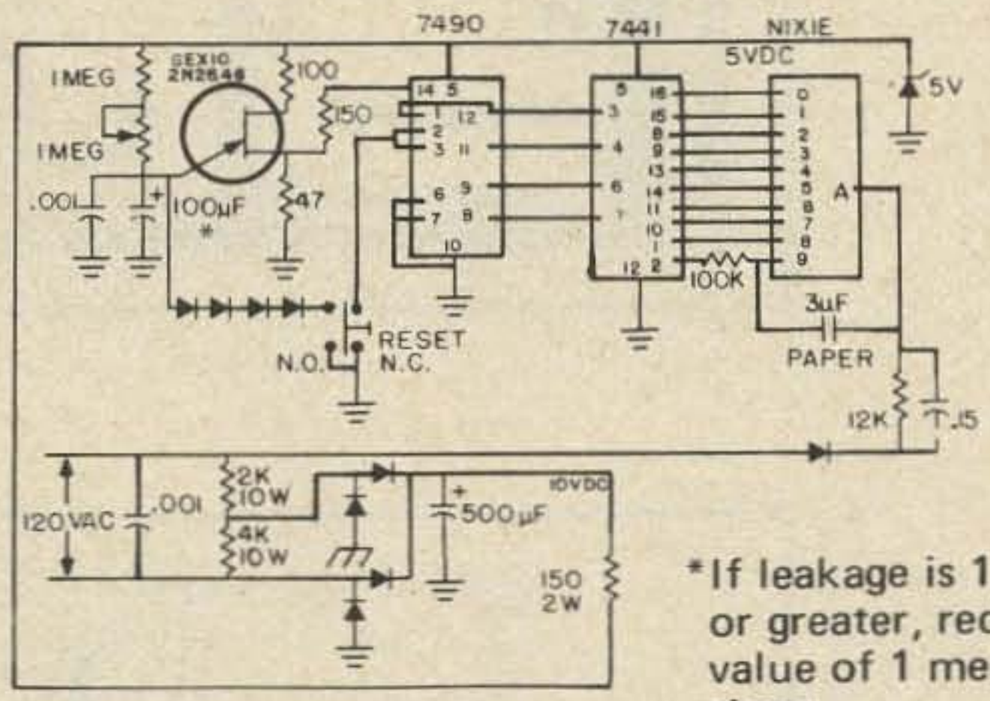
Walt Pinner WB4MYL
7304 Lorenzo Lane
Louisville, KY 40228

ID TIMER

Operating convenience – plus – impressive to visitors.

For about eight dollars this project can be many things to many people. This ten minute station timer utilizes a digital readout display indicating elapsed time in minutes. When nine minutes have passed, the 9 numeral blinks for 60 seconds, which is a real eye catcher, before resetting to zero, starting another count cycle. A manual zero reset is provided to start the timer at the beginning of your QSO.

If you have not, as yet, got your feet wet with relaxation oscillators, ICs or numeric display tubes, this is a simple starter project.



*If leakage is 10µA or greater, reduce value of 1 meg resistor.

Fig. 1. Schematic. Diodes are 1N4001 or similar.

Circuit

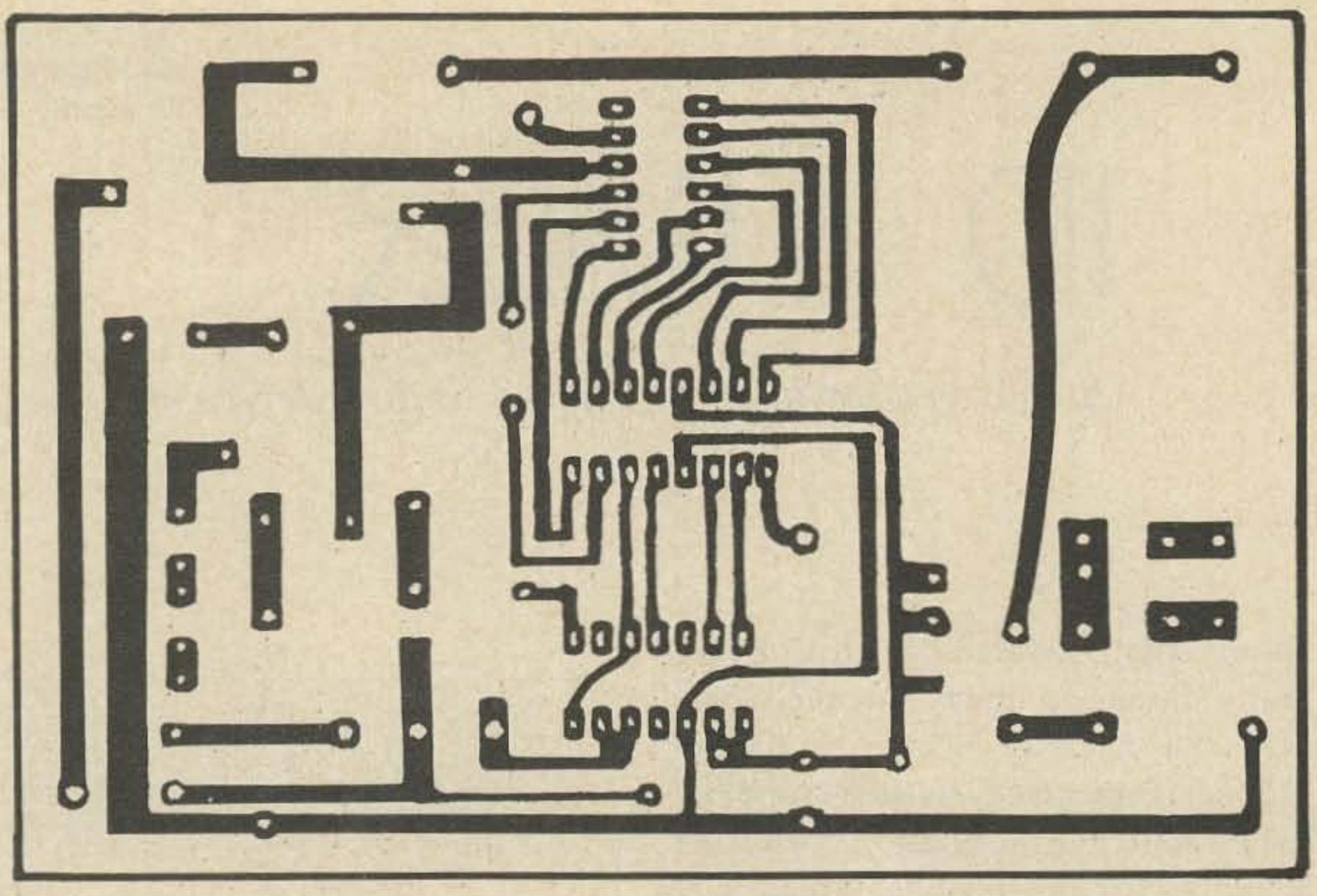
The timer is line operated, and all circuitry should be isolated from the exterior cabinet. Line voltage is divided to supply 10 volts to the bridge rectifier. This voltage is dropped and regulated to 5 volts for the unijunction pulse generator and ICs. Adjustment of the 1 meg pulse generator pot determines the time necessary to charge the 100 µF timing capacitor, which should be good quality. When this capacitor charges sufficiently to turn on the unijunction, the transistor fires, discharging the capacitor and generating a voltage pulse across its 47Ω resistor. These pulses are counted by the 7490 decade IC. The output of the counter is fed to the 7441 decoder driver which turns on the proper numeral in the readout tube.

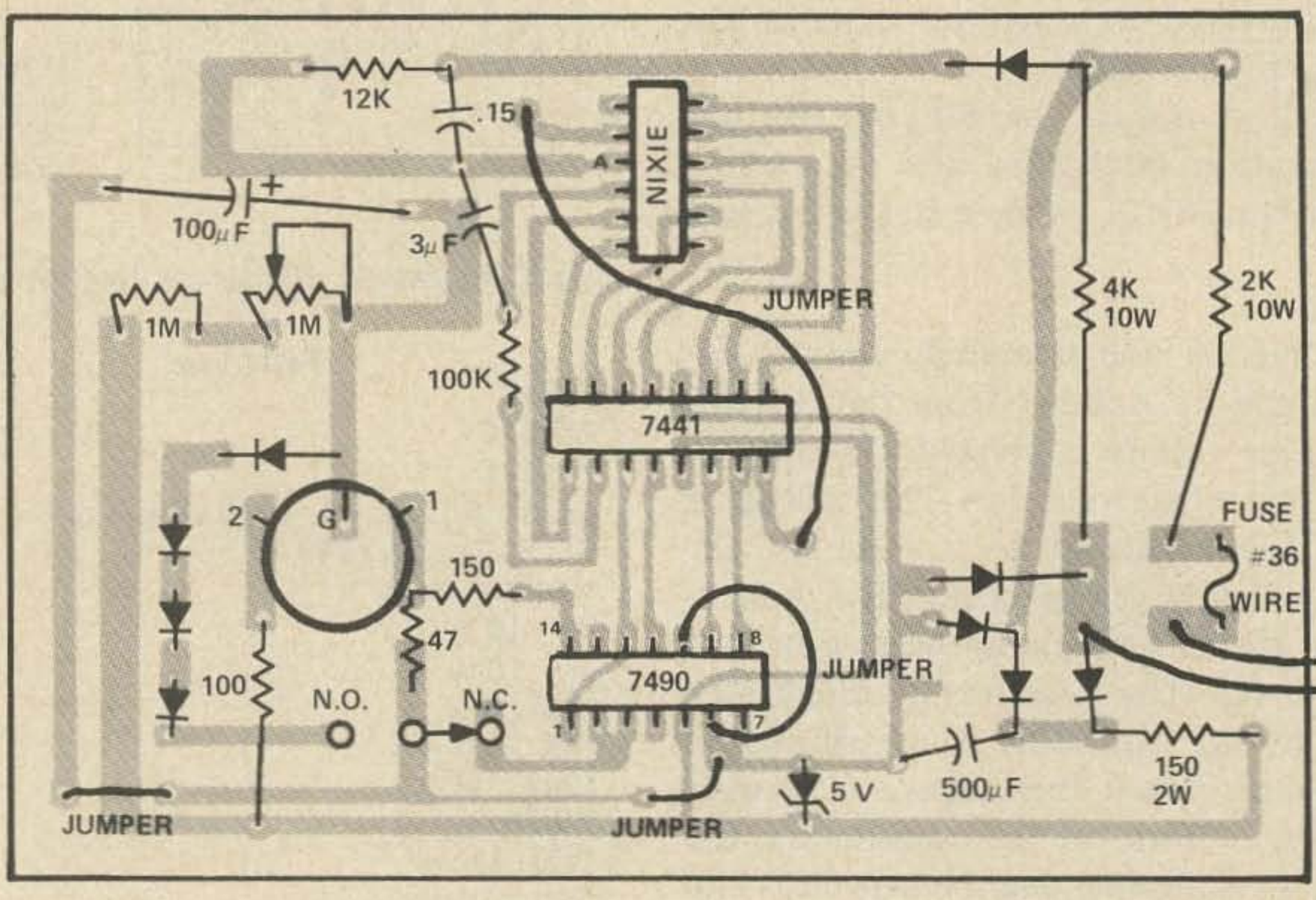
The 9 numeral is connected as a relaxation oscillator and flashes. The flash rate may be varied by changing the value of the 100K resistor. The 3 µF capacitor must be paper, not electrolytic. Approximately 140 vdc for the readout is obtained from the line via a single diode and filter.

Parts List

ITEM	QUAN.
7490 IC	1
7441 IC	1
NIXIE B5750, NL 1220 or similar	
GE X10 or 2N2646	1
1N4001 diode	9
2K 10 w	1
4K 10 w	1
150Ω 2 w	1
12K 1/2 w	1
100K 1/2 w	1
150Ω 1/2 w	1
47Ω 1/2 w	1
100Ω 1/2 w	1
1 meg 1/2 w	1
1 meg pot	1
.001 µF	2
500 µF 10V	1
100 µF 10V	1
3 µF 200V	1 paper
.15 µF 200V	1
SPDT push button SW	
5V ZENER 1/2 w	1

If you choose not to use the printed circuit board, assembly may be on .2" vector board. Straighten every other IC pin and hand wire the connections using the circuit board as a guide.





Re-set

Depressing the manual reset button, lifts the 7490 terminal 2 and 3 from ground, re-setting the count to 0. At the same time, the 100 μF capacitor is shunted to ground through four diodes, which discharges it to about the same level as does the transistor. This eliminates an extra long first count after a manual reset.

If you have not done so before, the action of all functions of this circuit may be observed with a scope or VTVM.

This circuit, of course, may be used for other timing functions by changing the value of the unijunction timing components.

Accuracy on several units built was within 15 seconds over any ten minute period.

. . .WB4MYL

John T. Hunt
251 W. Bruceton Road
Pittsburgh PA 15236

FAIL SAFE SWITCHING IMPROVED

The article, Fail Safe Switching, *73* October, 1971 was useful and quite correct. There are some simplifications and improvements possible, however. The circuit of Fig. 2 in that article does exactly what it is purported to do and the logic switching scheme for it could be drawn as in Fig. 1.

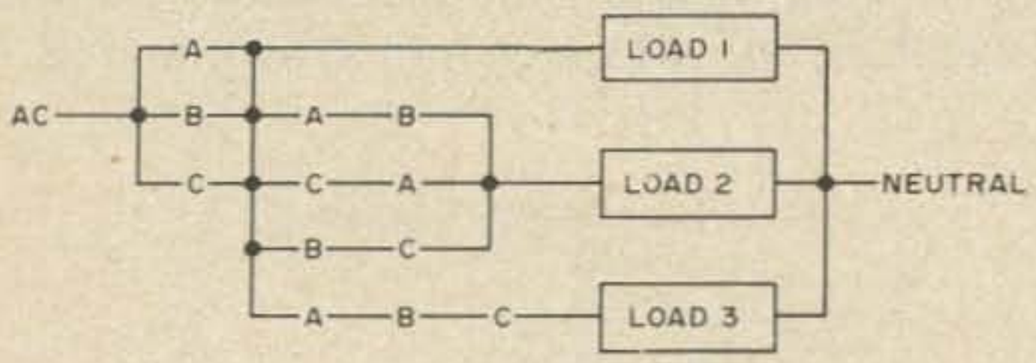


Fig. 1. Logic switching scheme.

In Fig. 1 each letter represents one pole of a given switch. Such a representation makes it easier to see what the circuit does than a conventional wiring diagram. In this case all three loads have to be carried by the first A, B and C contacts. The contact load can be reduced if the logic circuit (Fig. 2) is used.

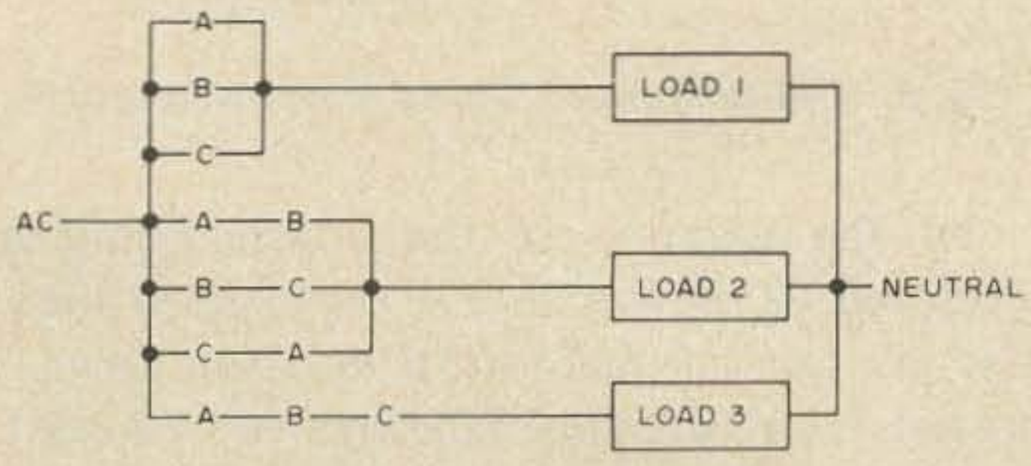


Fig. 2. Logic circuit.

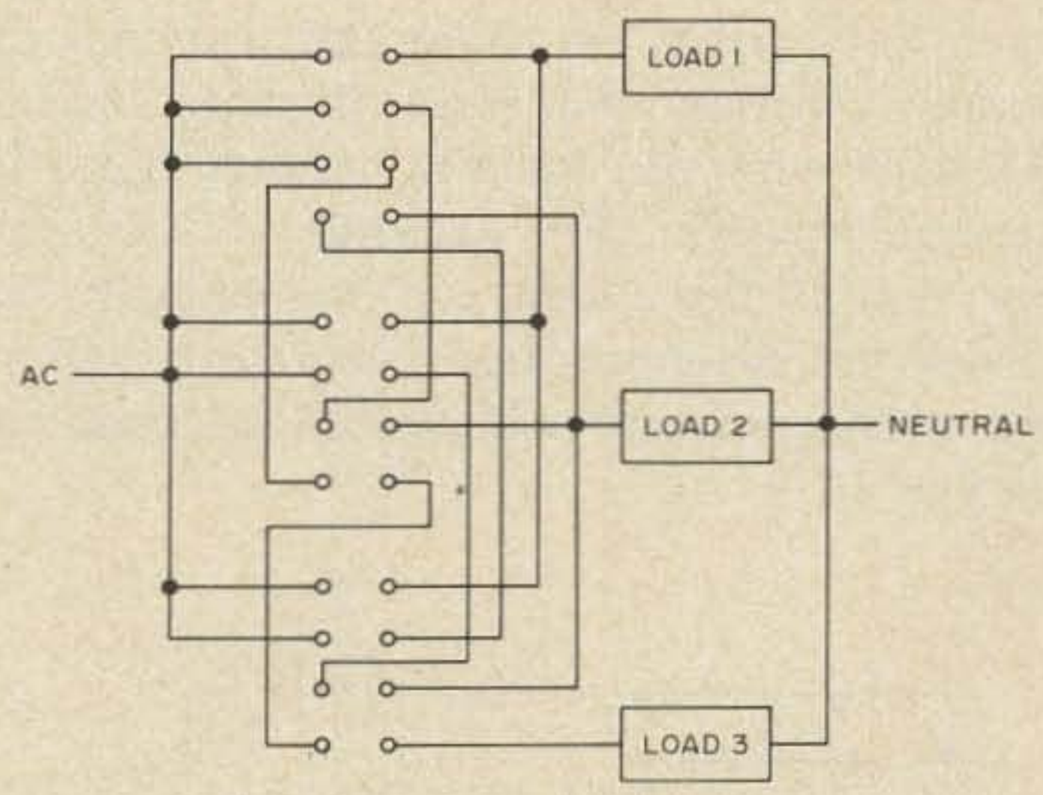


Fig. 3. Conventional wiring diagram.

The conventional wiring diagram could then look like Fig. 3. In reference to Fig. 3, if the momentary open can be tolerated, a simpler setup can be provided by using double throw switches. The open time is the

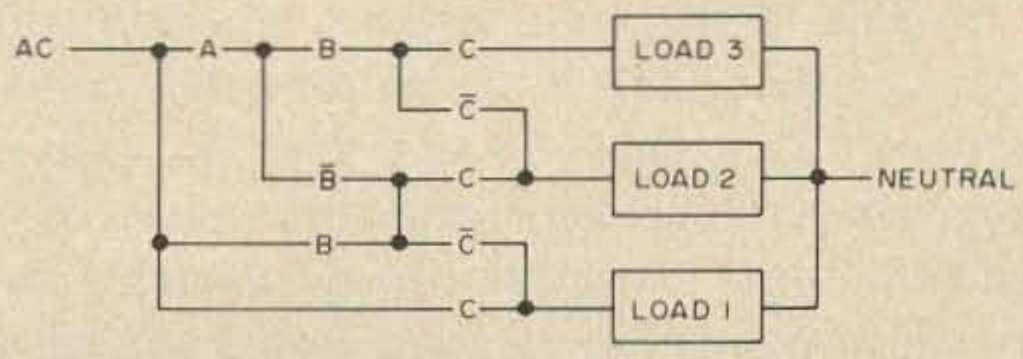


Fig. 4. Logic switching arrangement when C is first operated.

time it takes the switch between the normally open and normally closed positions. If make-before-break contacts are used no open time exists, but many applications can readily tolerate the short duration open. (Caution with the transfer contact types is needed, however. For example, if C is first operated all three loads are momentarily on during the switch motion.) The logic switching arrangement to achieve this is suggested by Fig. 4.

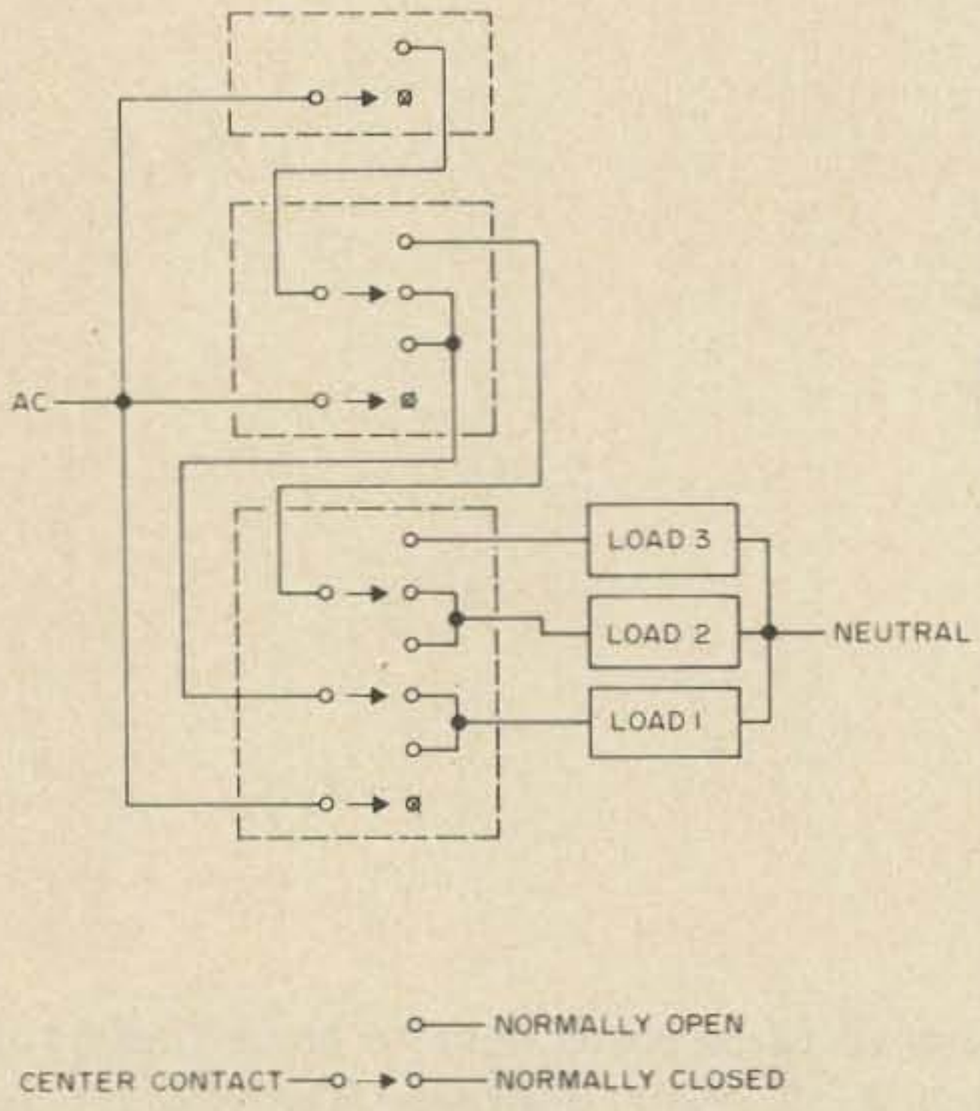


Fig. 5. Conventional wiring diagram with a double throw switch.

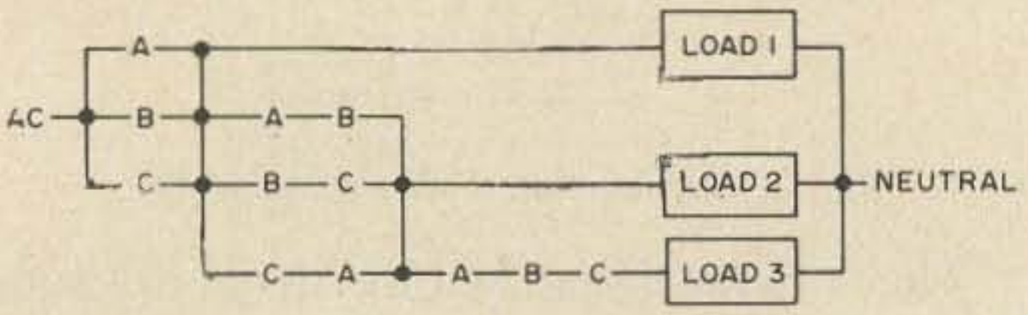


Fig. 6 Logic scheme for most foolproof scheme wiring diagram.

In Fig. 4, the plain letter C is a normally open contact and $\overline{C}$ is a normally closed contact, etc. One C and one $\overline{C}$ with a common connection form one pole of a multiple pole – double throw switch. The conventional wiring diagram would appear as Fig. 5. Notice that the switch requirements are only 1 SPST, 1 DPDT, and 1 3PDT, and that the contact loading is divided. All contact ratings should be equal to the heaviest load.

Hope these simplifications prove useful.

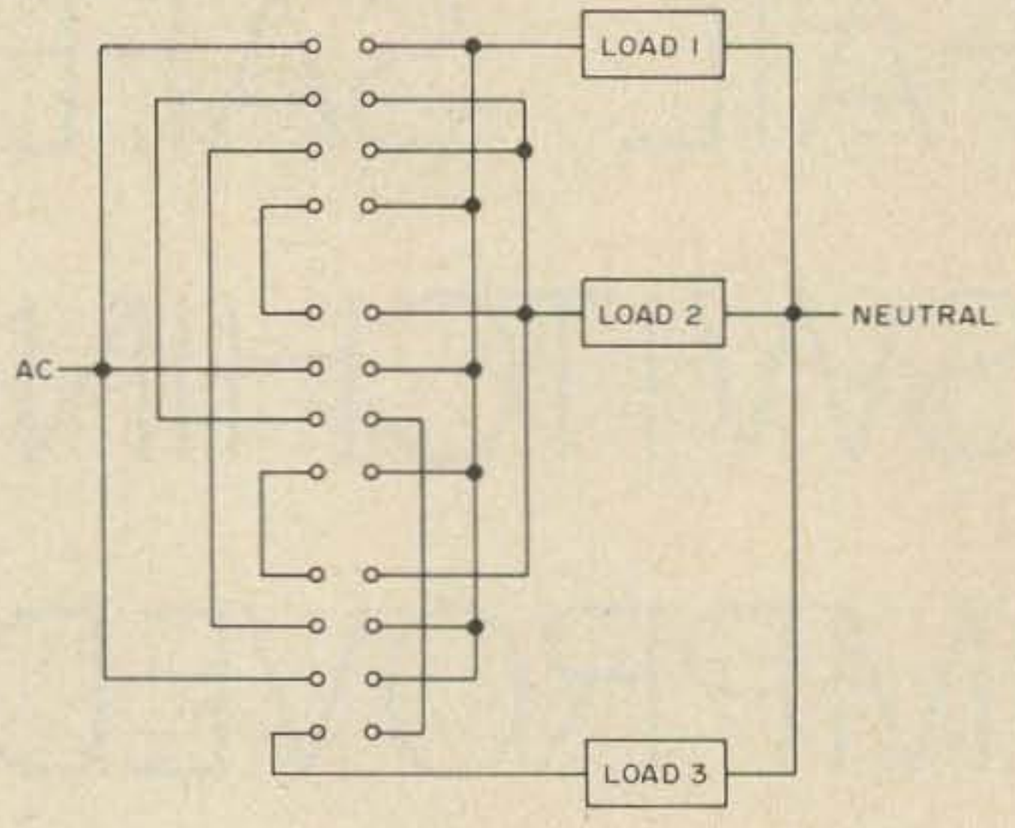


Fig. 7. Series arrangement of contacts and guards against contact failure.

If one wants the most foolproof scheme use the logic system of Fig. 6. Notice that load 2 cannot receive power unless load 1 is supplied power, and load 3 cannot receive power unless load 2 is supplied power. This is achieved by the series arrangement of contacts and guards against contact failure. The wiring diagram for this could be (since several are possible) as it is shown in Fig. 7

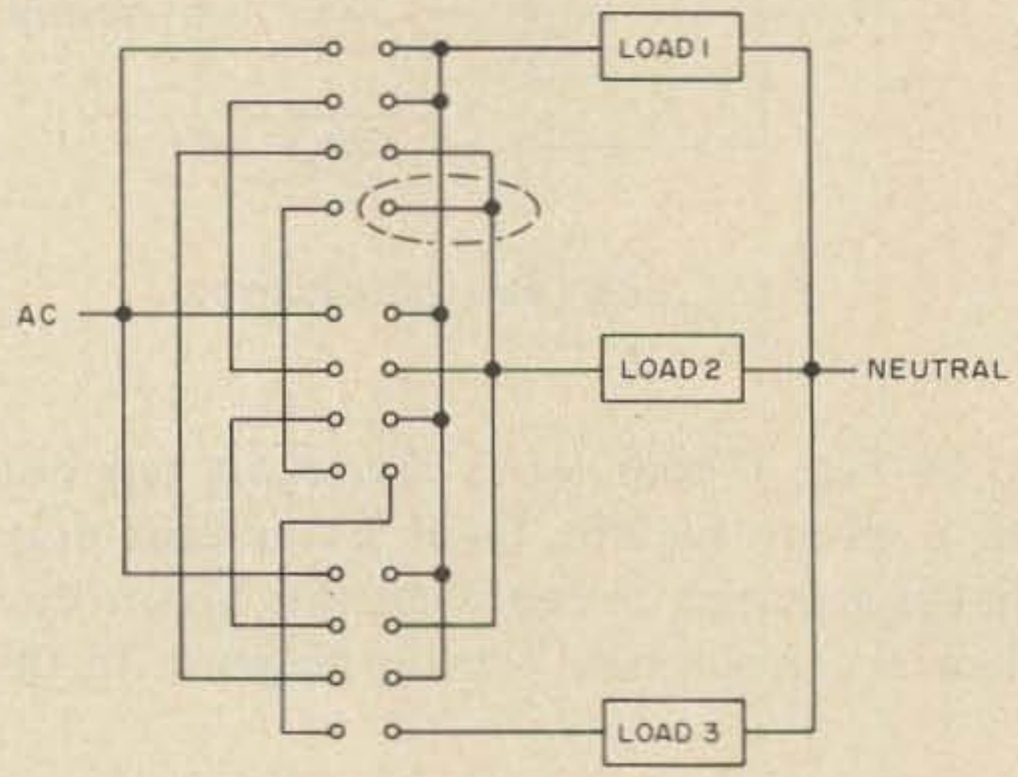


Fig. 8. Modification of wiring diagram in article.

Or the diagram in the article could be modified as shown in Fig. 8 (dotted area). The output of the fourth contact down is moved from the line feeding No. 1 load to the line feeding the No. 2 load.

. . .Hunt

CIRCUITS, CIRCUITS, CIRCUITS...

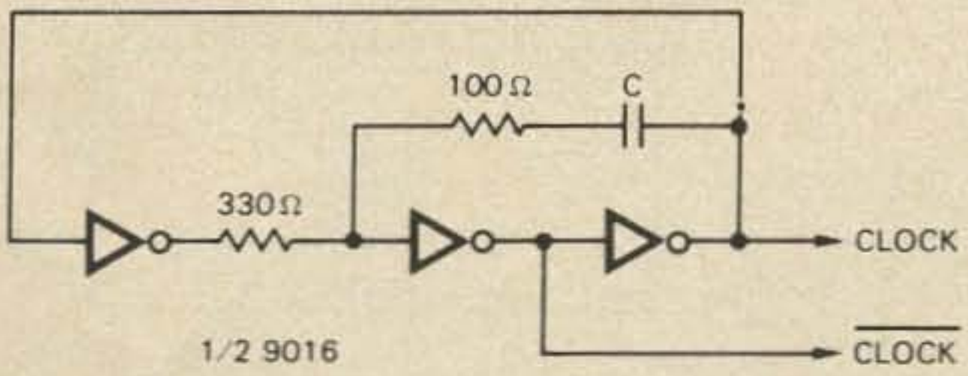
The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.

All of the circuits used this month were sent in by Douglas R. Schmieskors, Jr. The 4A Voltage Regulator circuit is taken from the Fairchild Semiconductor *Voltage Regulator Applications Handbook*. All of the other circuits used this month are taken from the Fairchild Semiconductor *TTL Applications Handbook*.

If you have any circuits that you think might be of interest to others send them to 73.

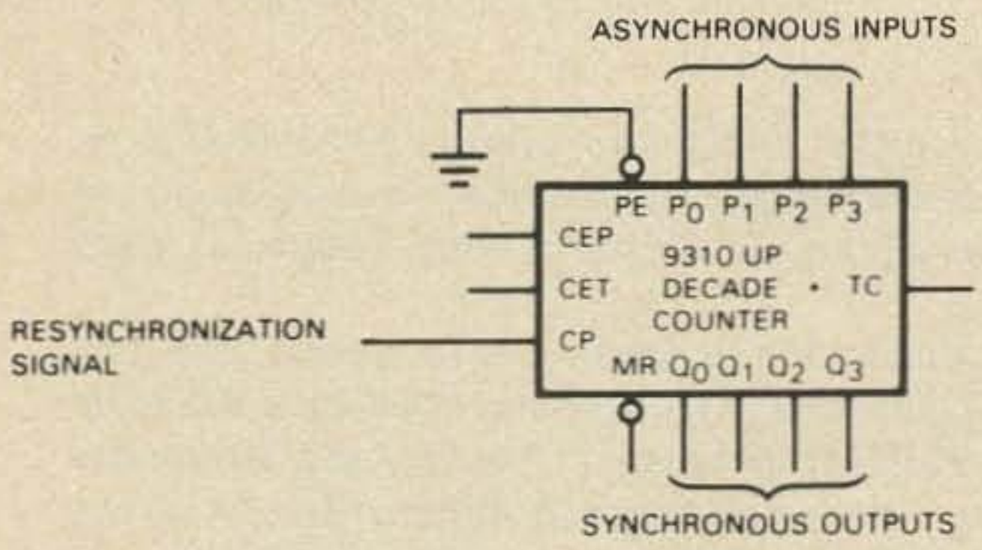
SIMPLE RC CLOCK GENERATOR



C	f
200 pF	5 MHz
1600 pF	1 MHz
0.018 µF	100 KHz
0.18 µF	10 KHz

The simple TTL clock generator circuit shown provides a clock satisfactory for most simple TTL systems and it always starts oscillating without coaxing. This circuit requires only ½ of a hex inverter package and three passive components — two resistors and a capacitor.

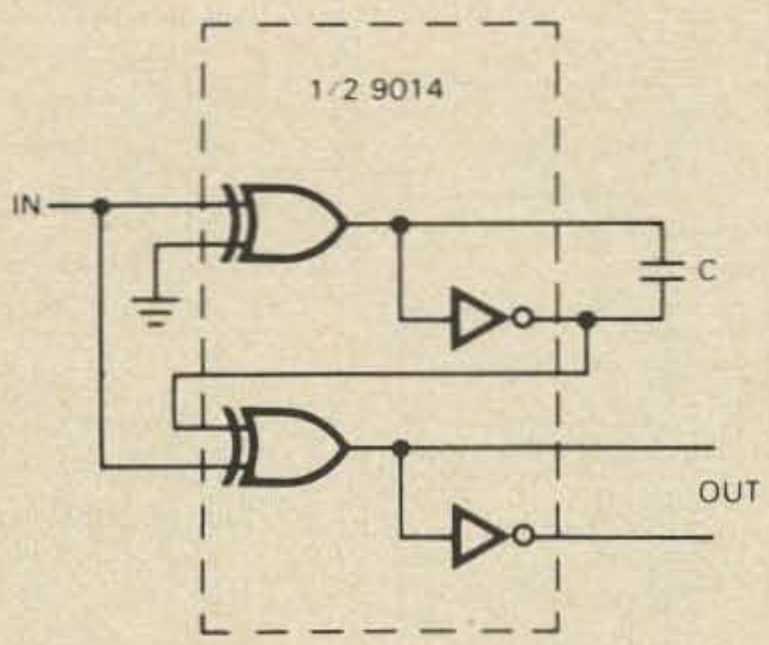
RESYNCHRONIZER

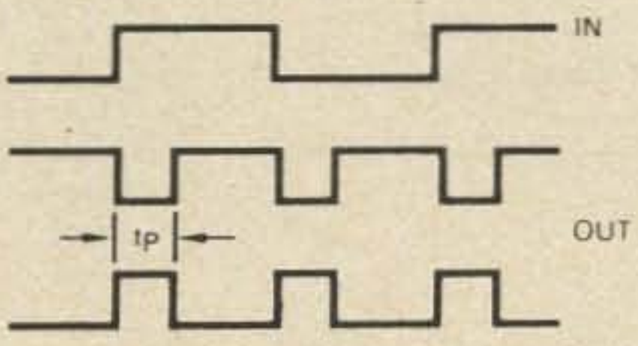


*OR 9316

A resynchronizer using a 9310 (or 9316) as four D-input flip flops is shown. In this circuit the PE input is grounded, and the resynchronizing input is applied to the CP input. In most cases, the 9300 universal shift register is preferable for this function.

DUAL EDGE DETECTOR

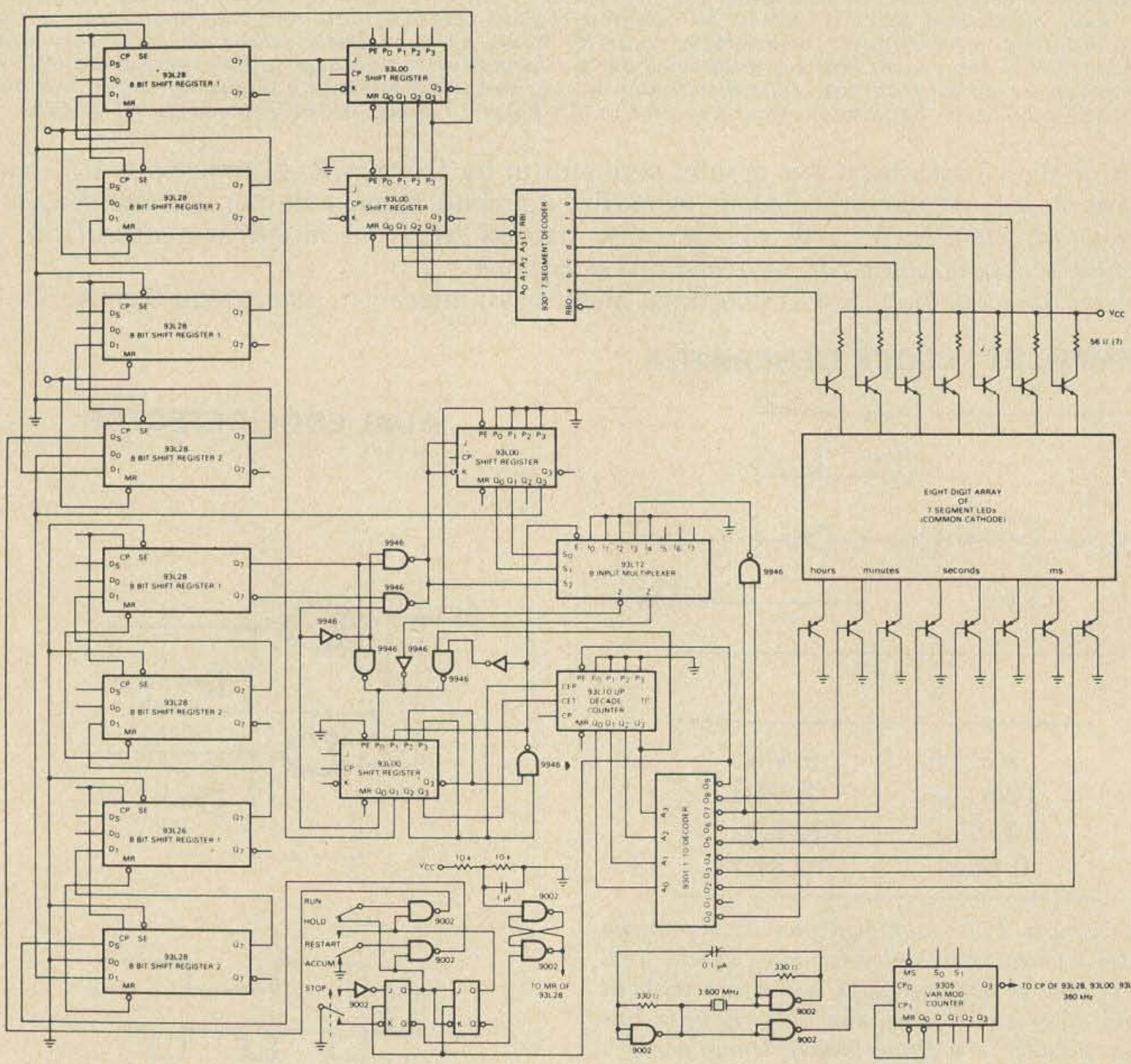




C	t_P
0	10 ns
200 pF	30 ns
1000 pF	70 ns

Half of a 9014 quad Exclusive-OR gate with one capacitor provides a circuit generating an output pulse for both a LOW-to-HIGH and a HIGH-to-LOW transition of the input signal. This function is useful for regenrating the clock in a self-clocking PDM transmission system. When fed with a square wave input, this circuit acts as a frequency doubler.

BATTERY OPERATED,CRYSTAL CONTROLLED STOPWATCH WITH MULTIPLEXED DISPLAY

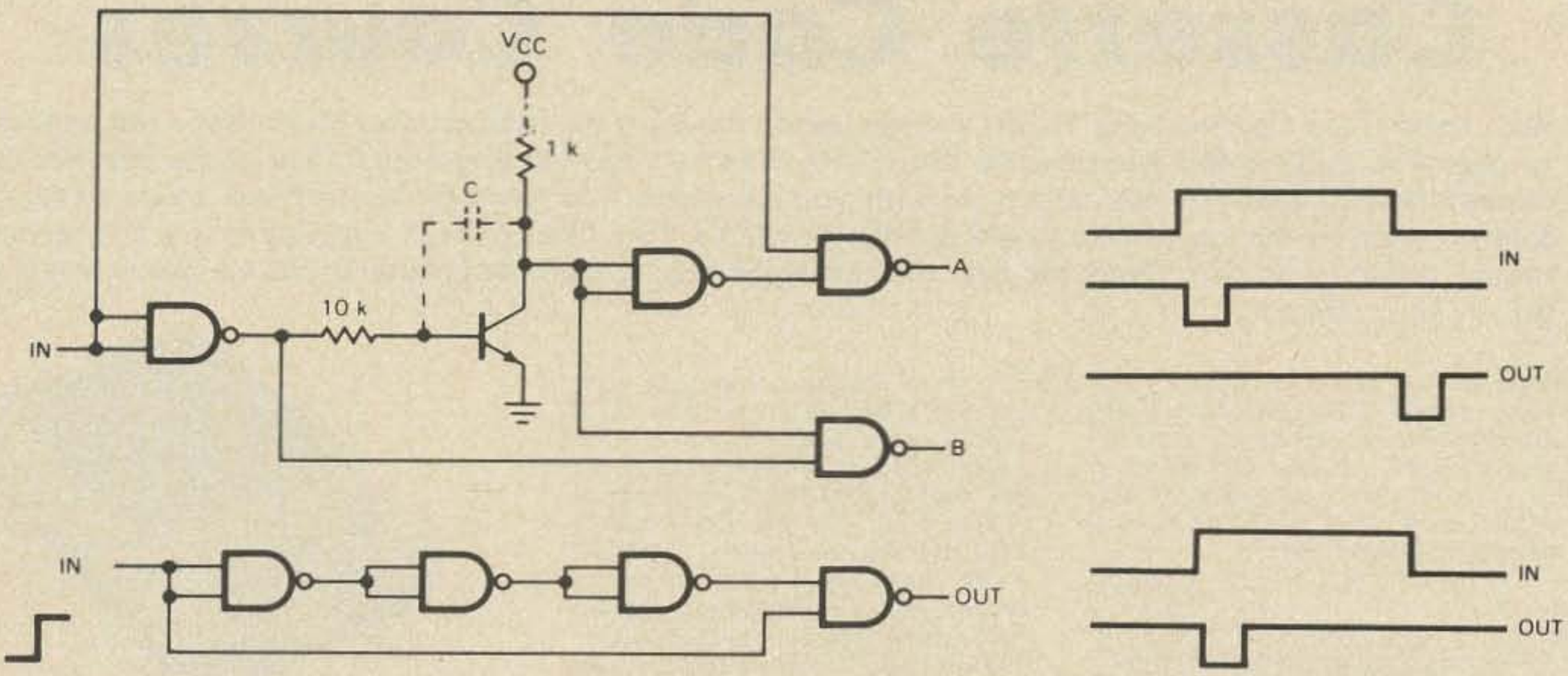


*All 9300, 9310, 9312 and 9328 devices in this circuit are Low Power version.

This circuit stores 9-digits bit-serially in a 36-bit shift register comprised of two 9328 dual 8-bit shift registers and a 9300 4-bit universal shift register incrementing or decrementing with an exclusive OR. This counter offers very economical display multiplexing and is shown driving 7-segment LED displays.

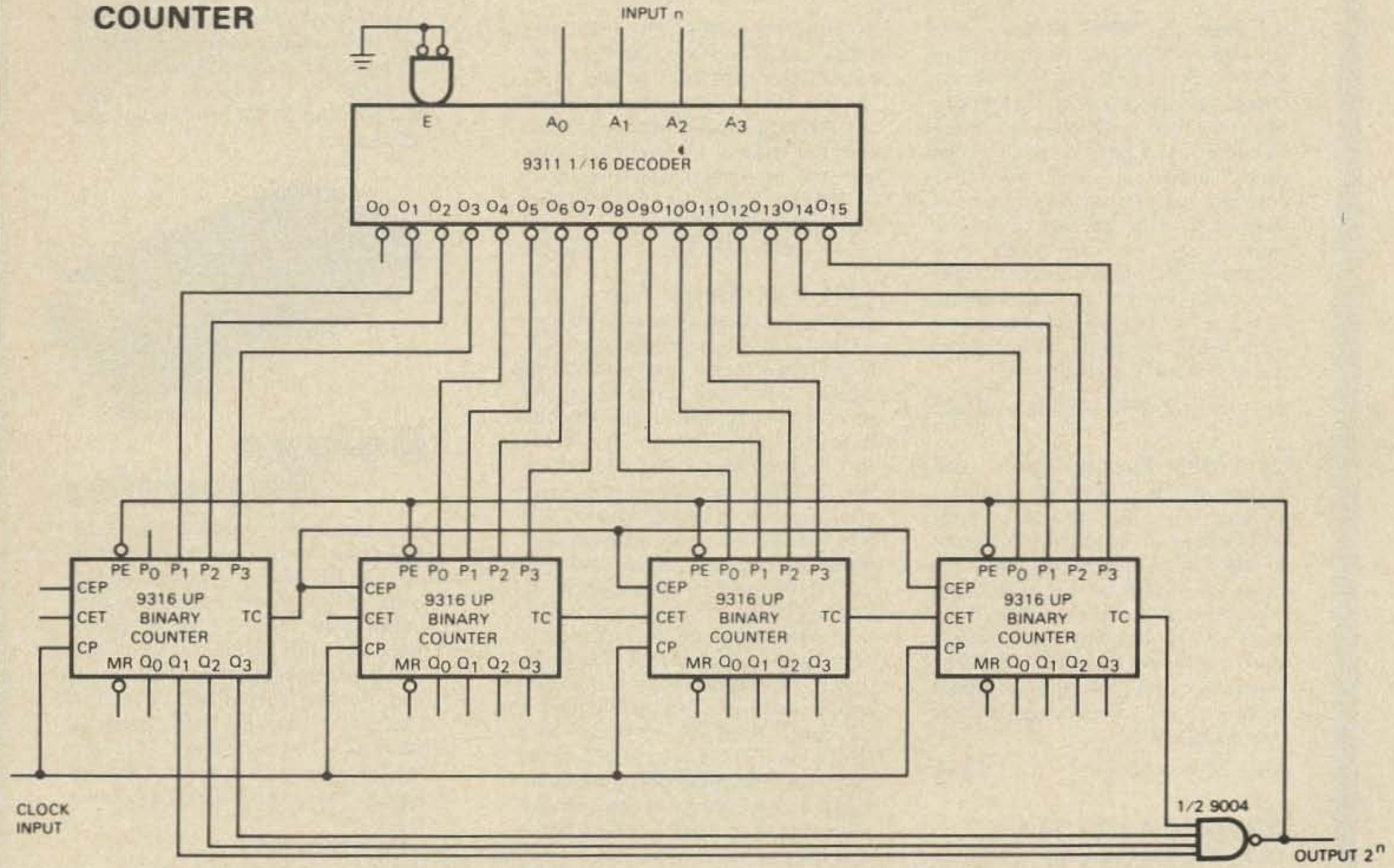
This circuit operates as a crystal-controlled stopwatch, displaying milliseconds to hours. The time counter is a 36-bit (9-digit) bit/serial incrementer (two 93L28s, one 93L00) controlled by a 3.6 MHz crystal oscillator and time base (9305, 93L00, 93L10 and 9301) so that the 10-second and 10-minute digits are counted modulo 6. A second set of shift registers stores display data independently of the state of the counter whenever the Stop contact is activated. The contents of the storage register are strobed every four clock pulses into a 93L00 feeding a 9307 7-segment decoder. This decoder, through current-limited buffers, drives the anodes of the 8-digit LED display matrix. The cathodes are sequenced by the 93L)1 and eight PNP transistors. Since this counter requires 36 clock pulses to increment the least significant digit (1/10ms, not displayed), the shift frequency is 360 kHz, derived from a 3.6 MHz oscillator through a 9305 decade counter. In this case, the low count rate inherent to serial incrementers is advantageous, resulting in a shorter divide chain for the time base. The use of low power MS1 keeps total power consumption under 2.5W and also simplifies clock distribution.

EDGE DETECTOR



This edge detector circuit generates a negative-going pulse on output A for each LOW-to-HIGH transition of the input, and generates a negative-going pulse on output B for each HIGH-to-LOW transition of the input. The pulse width is adjustable by varying the Miller capacitance. A non-adjustable short pulse (≈20ns) on the LOW-to-HIGH transition of the input can be generated by replacing the transistor inverter stage with the unused fourth NAND gate.

COUNTER



A programmable counter can be designed using a 9311 decoder that counts in modulo 2^n, where n is the programmable input. Shown above is a 9311 decoder and four 9316 binary counters capable of counting up to 2^{15}. The input n drives the selected output LOW so that when a parllel load occurs, all HIGHS are written into the register except at the stage represented by the address n. The counter counts pulses and reaches the condition 0000111111111, at which point, the terminal count of the last stage goes HIGH. Ater 14 additional pulses bring the total 2^n-1, the three remaining inputs to the 9004 gate are HIGH, and the next clock pulse reloads the counter to its original condition. The circuit therefore performs as a 2^n programmable divider.

Cassette Code Courses

With these Code Courses from 73, the average person can learn the International Morse Code fast enough to pass FCC code exams from Novice thru Extra Class in a few painless hours! One of the beauties of cassette tapes is that you can take them with you anywhere – at work for lunch break (code on rye is great) – even in the car while you are driving (or what's more likely, moldering away in line at a service station *trying* to get gas). With the help of these tapes passing the code portion of the various exams is a gas . . . *er* . . . snap!

My class was so enthused over your code cassette tapes that after hearing the 13 word per minute cassette every student in the class decided to get one for home practice. Enclosed is an order for 23 of the 13 word per minute tapes.

K6MLC

After about a week of playing your 13 word per minute cassette (which I timed out at 14 words per minute, incidentally!), I went down and passed the General exam with no strain. The plain language of the FCC exam seemed so slow that I lost all fear after the first few letters and made perfect copy from then on. It's fear that gets you, and your tape gave me confidence. Thanks!

WN9JGQ

I've been teaching code for over twenty years now and I've tried every record and tape and other gadget that has come out. Let me say that the 73 MAGAZINE code course is by far the finest that I have ever heard. I never thought I would learn new tricks, but you've taught me a lot about teaching code. Suffice it to say, I am recommending that every student of mine get your tapes.

K1IF

My wife, who has been almost totally resistant to the code, breezed through your 5 word per minute beginners cassette and was ready for the Novice exam in one day.

WB8JON

---

1 Basic 5 WPM Code – this cassette code course will teach the IMC at five words per minute, all letters, numbers and punctuation. The tape not only gives all these characters, but gives them in a very simple order so you can start copying code within one minute of hearing it. This has got to be the easiest way to learn code ever invented. The cassette actually has the code being sent at 6 WPM, allowing a margin for operator panic when the chips are down and the real exam is at hand.

Basic Code 5 WPM – 60 min. **$3.95**

2 6 WPM Practice Tape – (also known as The Back Breaker) this is a toughie – five character code groups sent in no particular order, so there is no way to memorize the tape. It is sent at six words per minute to give you that margin for error you'll need when faced with a stern examiner at THE EXAM. Practice in your head or on paper wherever you are, whenever you have a minute or two.

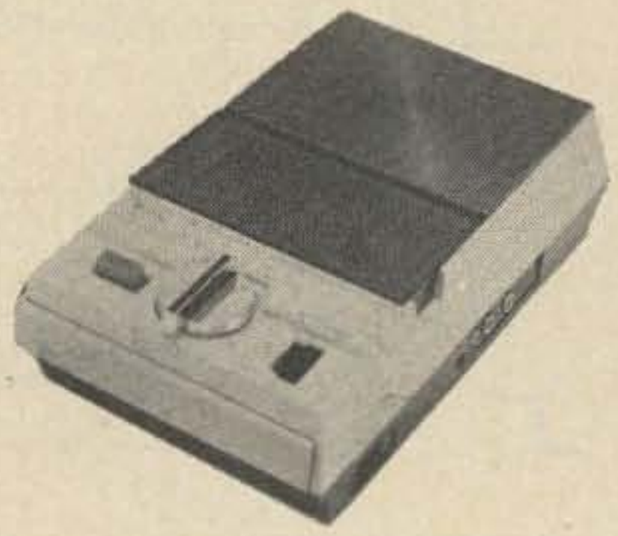
BB-6 WPM – 60 min. **$3.95**

3 13 WPM Practice Tape – This tape will take anyone over the hump which exists when you have to stop translating the dits and dahs, and go to an automatic recognition system where you "know" what the character is without thinking, thus enabling you to pass the general or advanced code test. This very nasty tape is really at 14 wpm, to give you that added edge when taking the exam.

BB-13 WPM – 60 min. **$3.95**

4 20 WPM Practice Tape – This cassette has been fiendishly designed to get you through the FCC Extra Class code test with flying colours. The code on this actually runs about 21 words per minute, though it starts out at a lazy 18 per for the first few minutes. The intermix of letters, numbers and punctuation instead of plain language will give you such an edge when you sit down to take the exam that you should be able to breeze through. Though much of your practice with this cassette can be just copying in your head – after all, the important object of practice is to train your brain to convert code into letters – be sure that you exercise your pencil too. The cassette will make your code practice portable, available to you whenever you have a few minutes to spare – even while driving.

BB-20 WPM – 60 min. **$3.95**



Cassette Recorder

Here is a cassette recorder that is ideal for use with the code courses since it can be operated anywhere.

Comes complete with four "D" batteries, AC power cord, earphone and mike and is useful for dozens of ham applications. Cassette tape recorder is available for only **$23.95** (plus $1.00 for shipping and handling).

Deluxe Recorder

Key operated – and the keys lock for easier rewind and fast forward operations, which you will appreciate if you have a recorder that doesn't do this – as most don't. Records with mike or from line input (telephone, receiver, etc.). Has monitor output. AC or built-in batteries - comes with batteries supplied. Has automatic gain for recording so you don't have to watch the recording level all the time.

Deluxe Recorder

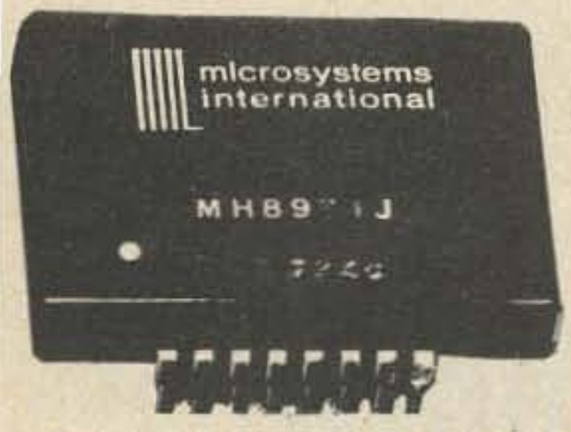
$32.95 postpaid in U.S.A.

Order Today from 73 Magazine

master charge

PETERBOROUGH, NH 03458

BANKAMERICARD



The Hybrid Analog TONE GENERATOR

MH8913J $18.00

DATA and APPLICATION SHEETS FURNISHED WITH ORDER

general specifications

Frequency Drift(1): < 1.5%

Group Amplitude Stability: ±25%

Total Distortion (Harmonic + Intermodulation): < 5% (relative to level of fundamental frequencies)

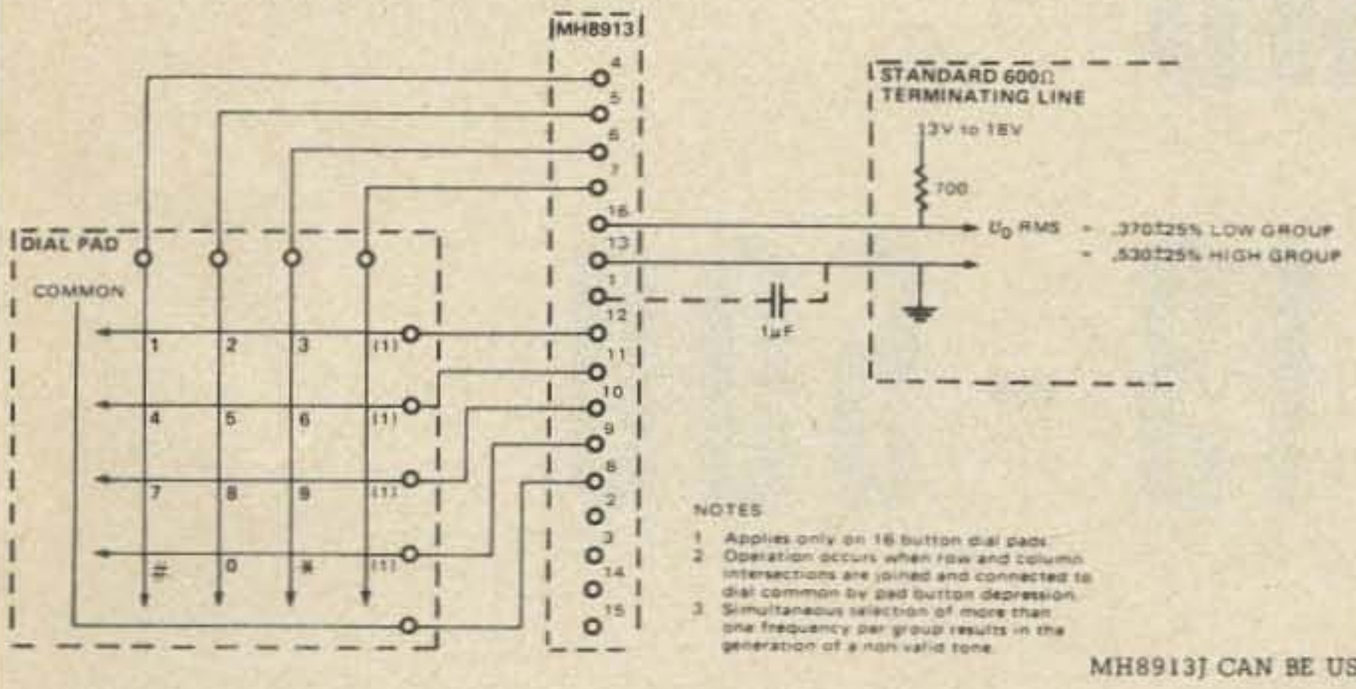
Typical Rise Time to Specified Output and Frequency:

1) Frequency selected, power supply switched ≤ 5ms
2) Power applied, frequency selector switched ≤ 2ms
3) Power applied, frequency within same group changed ≤ 2μs

features

- Dual Frequency Capability
- Standard Telephone Tone-Dial Frequencies: Low Group – 697, 770, 852, 941 Hz; High Group – 1209, 1336, 1477, 1633 Hz
- Specification Ratings Exceed CCITT Recommendations

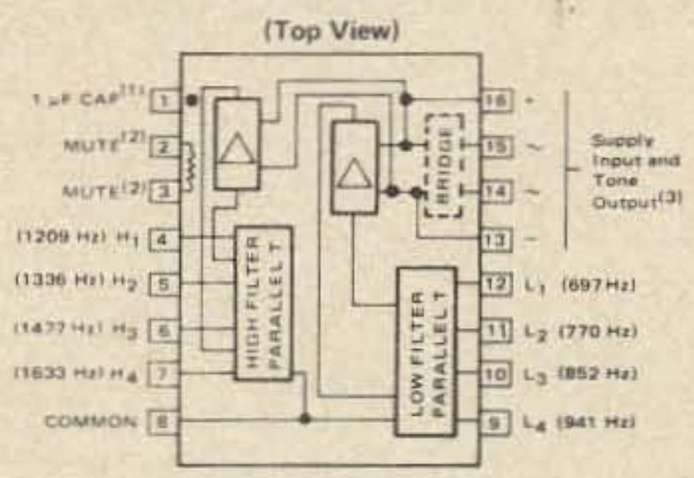
typical circuit connection diagram



NOTES
1. Applies only on 16 button dial pads.
2. Operation occurs when row and column intersections are joined and connected to dial common by pad button depression.
3. Simultaneous selection of more than one frequency per group results in the generation of a non valid tone.

block diagram and pin configuration

(Top View)



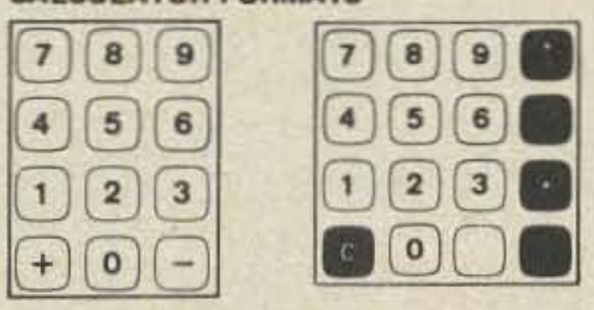
MH8913J CAN BE USED WITH CHOMERICS #ER21624 TOUCH TONE KEYBOARD

CHOMERICS

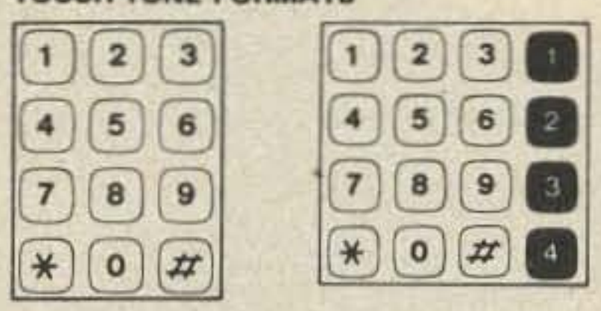
QUICKEY® TACTILE KEYBOARDS

FORMATS
Standard legends are black and white set in Standard Medium type.

CALCULATOR FORMATS

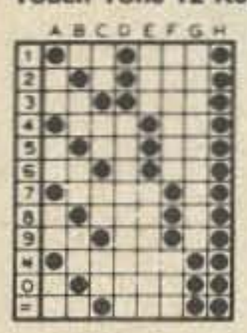


TOUCH TONE FORMATS

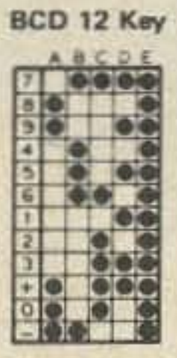


CODING

Touch Tone 12 Key

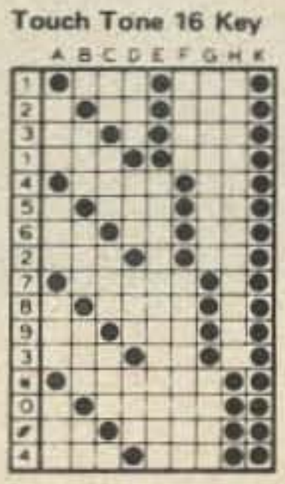


BCD 12 Key

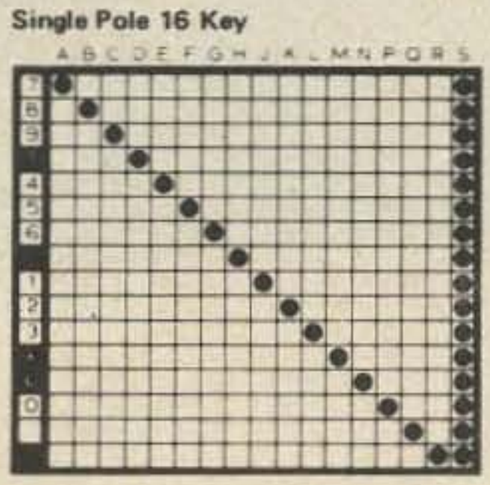


Single Pole 12 Key

Touch Tone 16 Key



Single Pole 16 Key



1/2" centers Model #	Price	3/4" centers Model #	Price	Format	Coding	# of Keys
ER 21622	7.15	ER 21605	7.70	Touch tone	Single pole	12
ER 21623	8.70	ER 21606	9.25	Touch tone	Touch tone	12
ER 21624	9.25	-	-	Touch tone	Direct to MH8913	12
-	-	ER 21607	7.70	Calculator	Single pole	12
-	-	ER 21608	11.00	Calculator	BCD	12
ER 21625	8.70	ER 21609	9.25	Calculator	Single pole	16
-	-	ER 21610	9.25	Touch tone	Single pole	16
-	-	ER 21611	11.15	Touch tone	Touch tone	16

KA CATALOG 25¢ OR FREE WITH ORDER

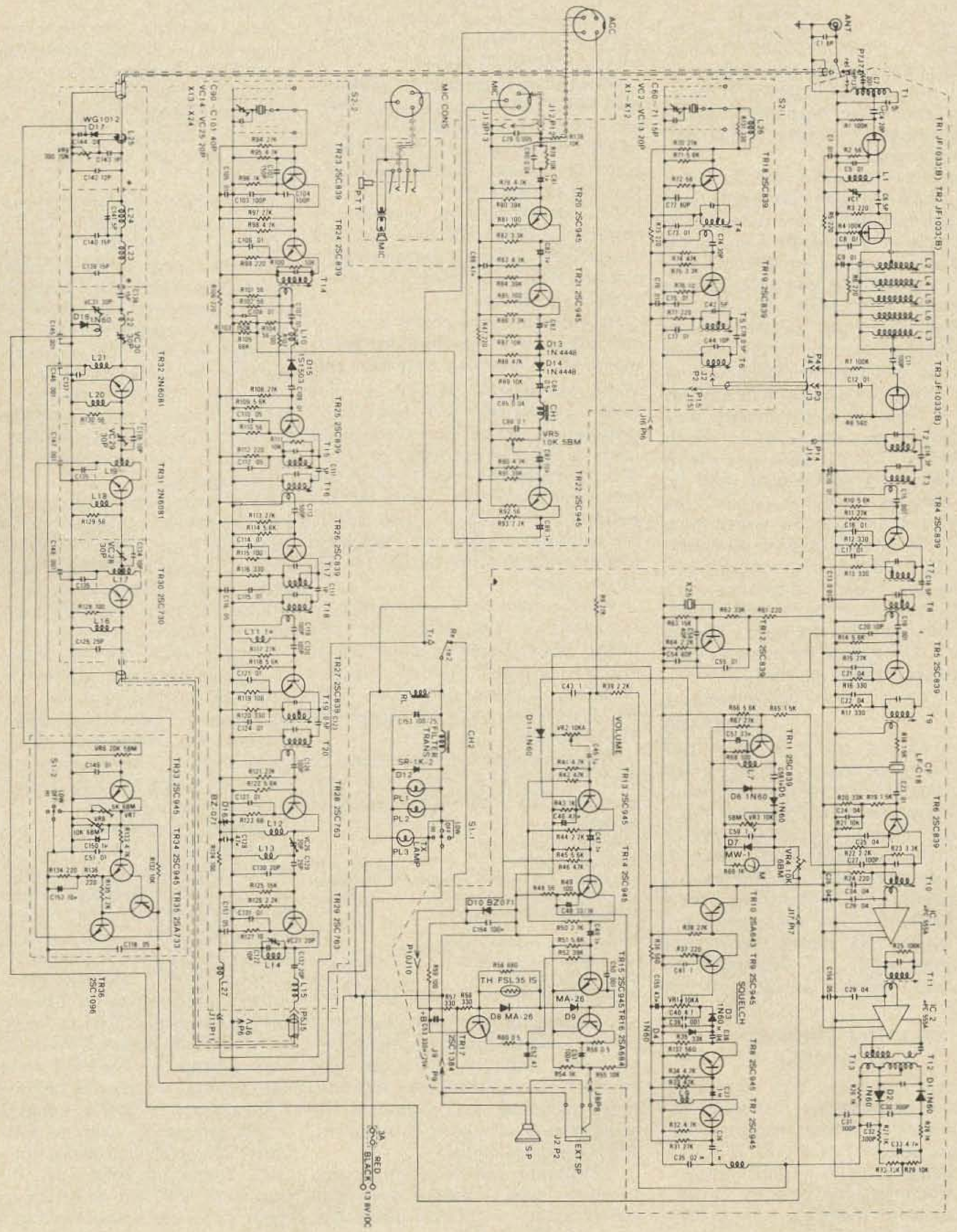
ELECTRONICS FOR THE HAM and EXPERIMENTER

KA ELECTRONIC SALES
1220 MAJESTY DR DALLAS, TEXAS 75247
(214) 634-7870
TWX 910-861-9028

Schematic Of The Month

MIDLAND 13-500

Midland has come out with an excellent low priced transceiver with their Model 13-500. It has a 12-channel frequency range of 144-148 MHz. It comes with 3-channels supplied. It has a HI/LOW rf output of 15W/1W. For a more comprehensive review of this rig see the article on page 61 of this issue.



CIRCUIT DIAGRAM

Letters. Cont'd from page 16.

doms left and from our place in the concentration camp we will wish we had listened to Wayne and cut the monster down to size before it (the IRS I mean) cuts us.

It really is a monster. It is the only governmental organization that openly calls the taxpayers (who support it), "THE ENEMY." It works on the principle that the taxpayer is guilty until proven innocent. It has so many conflicting regulations that it doesn't know itself what is right and what is wrong.

I could go on and on with a catalog of horrors, but you have pretty well covered them. What I am trying to say is that the very principle is wrong. We must put a handle on this monster, and I am glad that you have the guts to stand up to them. The Internal Revenue Act was shoved through originally by the international money boys, so that they would be sure to have enough money to finance World War I. Soon as it was passed, they cooked up the war so as to enrigh themselves. Then it took on a life of its own and is now gorging itself on the taxpayer who has reached the breaking point. But the worst thing about the whole rotten set up is that the IRS is used as a *punishment* arm of the government. When they can't "get" someone through legal means, they sic the IRS on them. That is what I take it they are doing to you, and therein lies the injustice.

Name Withheld
Hong Kong

Some readers say they think IRS articles do not belong in a ham magazine, that if they want to read about that they can do it elsewhere. Since virtually all publishers are so scared of IRS they can't even think about it, one wonders what magazine readers will read to get this information. 73 is not afraid, so if you want more inside info on the IRS, realize that there is no other source. . .ed. Reprints of the IRS editorials are available for an SASE.

TELETYPE EQUIPMENT AVAILABLE

I have just had a large number of Teletype machines released to me by Western Union. These are mostly page printers: Model 19's, Model 15 KSR's and Model 15 KSR's in floor consoles. The machines have been in storage, and some of them are still in their original factory crates never having been put into service. Most of the remainder were given standard overhauls just prior to being placed in storage.

The Model 19's are complete with printer and keyboard, transmitter-distributor, perforator and character counter, and a heavy-duty steel desk. The heavy-duty power supplies are built into the desk.

The Model 15's are all KSR's (keyboard), and are in two styles. The first style is the standard cabinet, which is normally placed on a desk or table for operation. The second type is in a sound-proofed floor console, whose shape is somewhat similar in appearance to a Model 28 KSR.

All of these machines are equipped with WRU (who are you), and answer back (here is) mechanisms which can be coded with up to 18 characters for automatic station identification at the touch of a single key.

All machines have synchronous motors, low paper indicators, etc., and the cabinets, consoles, and desks are a pleasant light green color. All are in excellent condition.

In addition to the above, there are perforators and reperforators (both typing and non-typing; both with and without keyboards), plus strip printers (with keyboards) and transmitter-distributors, but no statement can be made as to the condition of these. (For example, the end-of-line indicators need repair on most of the perforators.) These all have synchronous motors, incidentally, which are interchangeable with Model 14, 15, 19, etc., gear.

Finally, there is a wide variety of miscellaneous test equipment, test tables, power supplies, polar relays, end-of-message readers, duplex repeaters, Siemens dial Telex gear, etc., plus a few parts for Models 14, 15, 19 and 32.

The equipment is to be released to any interested amateurs at cost, according to the following price schedule:

Quantity Available	Item	
33	Model 15 KSR	$39.00 each
18	Model 15 KSR in floor console	46.00 each
17	Model 19 (ASR, complete)	79.00 each
18	Model 2-B strip printer with keyboard	5.00 each
16	Misc. perforators & reperforators, with and without keyboard	5.00 each
9	Transmitter-Distributors	4.00 each
	Misc. test equipment, etc.	$1.00 to $4.00 each

Of course, as with most equipment distributions of this type, there is no guarantee, and you can't get your money back. But, with the exceptions noted previously, the condition of the equipment is very good to excellent, and is a genuine bargain.

Distribution will be on a first-come, first-serve basis. I cannot ship (with the exception of the few pieces that are already crated), so purchasers must make their own arrangements for pick-up.

For additional information, I can be contacted at the following address: Bill Johnston WB5CBC, 1808 Pomona Drive, Las Cruces NM 88001. All inquiries *must* be accompanied by a SASE.

COUNSEL FOR THE TAXPAYER

Last year, Internal Revenue Service officials assured Congress that they were making conscientious efforts to comply with the 1967 Freedom of Information Act. Have they kept these promises?

No – according to testimony received in April by the Senate Appropriations subcommittee on the Treasury, chaired by Joseph M. Montoya (D-NM), Philip and Susan Long, of Bellevue WA said IRS officials have left "a string of broken promises."

IRS disclosure staffers still flout the Freedom of Information Act. Their arrogance is almost unbelievable. When the Longs asked Freedom of Information Chief Mark Farbenblum why IRS personnel don't even follow their own regulations, he merely shrugged and said: "Oh, we don't pay any attention to that directive."

Members of Ralph Nader's Tax Reform Research Group have been similarly frustrated in their attempts to examine data compiled by IRS at public expense.

From an unrevealed source, Nader's group obtained a copy of IRS Document 5667 for fiscal 1972. It's a bunch of statistical tables, charts and graphs called "The Audit Story." IRS officials had tried desperately to keep this information under wraps.

The fat was in the fire. Nader got the telltale document published in the record of hearings held last year by the Montoya committee. When he introduced it, Nader said, "This is a collection of information which should be available to anybody who can buy a newspaper."

Despite the importance of this information to citizens who pick up the tab for compiling it, the Longs and the Tax Reform Research Group got the run-around when they tried to get a squint at 5667 for years other than 1972. Here are a few highlights:

April 19, 1973: IRS gave the Longs written authorization to inspect such pre-1972 issues of 5667 as "may" be on hand in the Seattle District Office. You guessed it, Pre-1972 issues in Seattle were as scarce as hen's teeth.

August 31, 1973: The Longs wrote to IRS requesting access to 5667 for fiscal '73, which had ended June 30, 1973. Would you believe it? IRS said Document 5667 for 1973 and subsequent fiscal years would not be published!

November 21, 1973: Robert M. Brandon, Tax Reform Research Group director, wrote to IRS requesting 5667 for fiscal 1973, or in lieu thereof, the source documents. IRS Assistant Commissioner John Hanlon, replying, merely said IRS did not plan to publish 5667 for 1973. He ignored

Brandon's request for the source documents, which IRS still is compiling.

December 21, 1973: Brandon wrote to Farbenblum, making crystal clear the specific source documents he wanted. To this day, he has received no reply.

February 28, 1974: The Longs visited the IRS "Freedom of Information" reading room in Washington. Surprise! No statistics there. The shelves were as bare as a college streaker.

Mrs. Lotus Savoy, the attendant, said she "recently" had been ordered to take all the statistics out. Where were they? She would say only "you'll have to talk to the disclosure staff about that." The Longs did. They got loads of double talk, but not one peek at Document 5667.

April 1974: These and other disturbing facts were made known to the Montoya committee, which hasn't yet approved IRS's appropriations for fiscal 1975, to begin July 1.

May 8, 1974: Commissioner of Internal Revenue Donald C. Alexander wrote to the Longs: "The Audit Story (5667) is available to the public, and issues for the years 1962 through 1972 are in the Freedom of Information Reading Room." By that time, the Longs were back home in Bellevue, some 3000 miles away from the reading room.

May 1974: Still no word on when, if ever, this vital information is to be made available to anyone for 1973 and subsequent fiscal years. But as they say, hope springs eternal in the human heart. Who knows? Some sunny day Brandon may get an answer to his letter of December 21, 1973.

Internal Revenue Service officials say taxpayers are satisfied with our federal tax system. Are they?

They certainly are not, according to a stream of worried citizens who testified in April before the Senate Appropriations subcommittee on the Treasury. These courageous Americans came to Washington from great distances, at their own expense, to tell chairman Joseph M.Montoya (D-NM) and his colleagues what's wrong with the tax collecting system.

One of the most impressive witnesses was H. M. "Hank" Greenspun, outspoken publisher of the crusading Las Vegas Sun, Nevada's largest morning newspaper. He warned, "Some future administration may be successful in focusing the awesome power of the IRS against its political enemies. And that will spell the end of democracy in this country."

Greenspun said that if he wanted to become dictator of the United States, he'd seek first to gain control of IRS. "Within months" after taking over this agency, he could become the absolute ruler of the U.S.A., he declared.

Fantastic? Not at all. Here are some of the techniques a would-be dictator could use, if he controlled IRS, to destroy his enemies and reward his friends:

* He could stymie his enemies by having revenue agents conduct time-consuming, infuriating audits of their records, searching out every error, no matter how picayune it might be.

* In addition, he could sic special agents on his enemies. These are gumshoeing detectives of the IRS Intelligence Division who try to get the goods on taxpayers suspected of criminal tax fraud. They're often called "the American gestapo."

* He could use the IRS jeopardy assessment power to tie up virtually all the assets of his enemies without a single court order, before they had been given a chance to test the validity of the assessments in court. This maneuver has reduced thousands of defiant taxpayers to putty, leaving them without a dime to spend for such essentials as living expenses, legal fees and business operating costs.

* If his "jeopardized" enemies couldn't post bond to secure the payment of enormous IRS-determined deficiencies, he could sell them out at sacrifice prices. Years later, the Tax Court might find that nothing was owed to Uncle Sam in the first place. But what the heck! The victims would be mortally wounded by that time anyway. They'd get back, not their property or its value, but only the money IRS had taken in from the forced sales, after deducting storage and other selling expenses. Not a nickel for lost time, lost profits or litigation expenses.

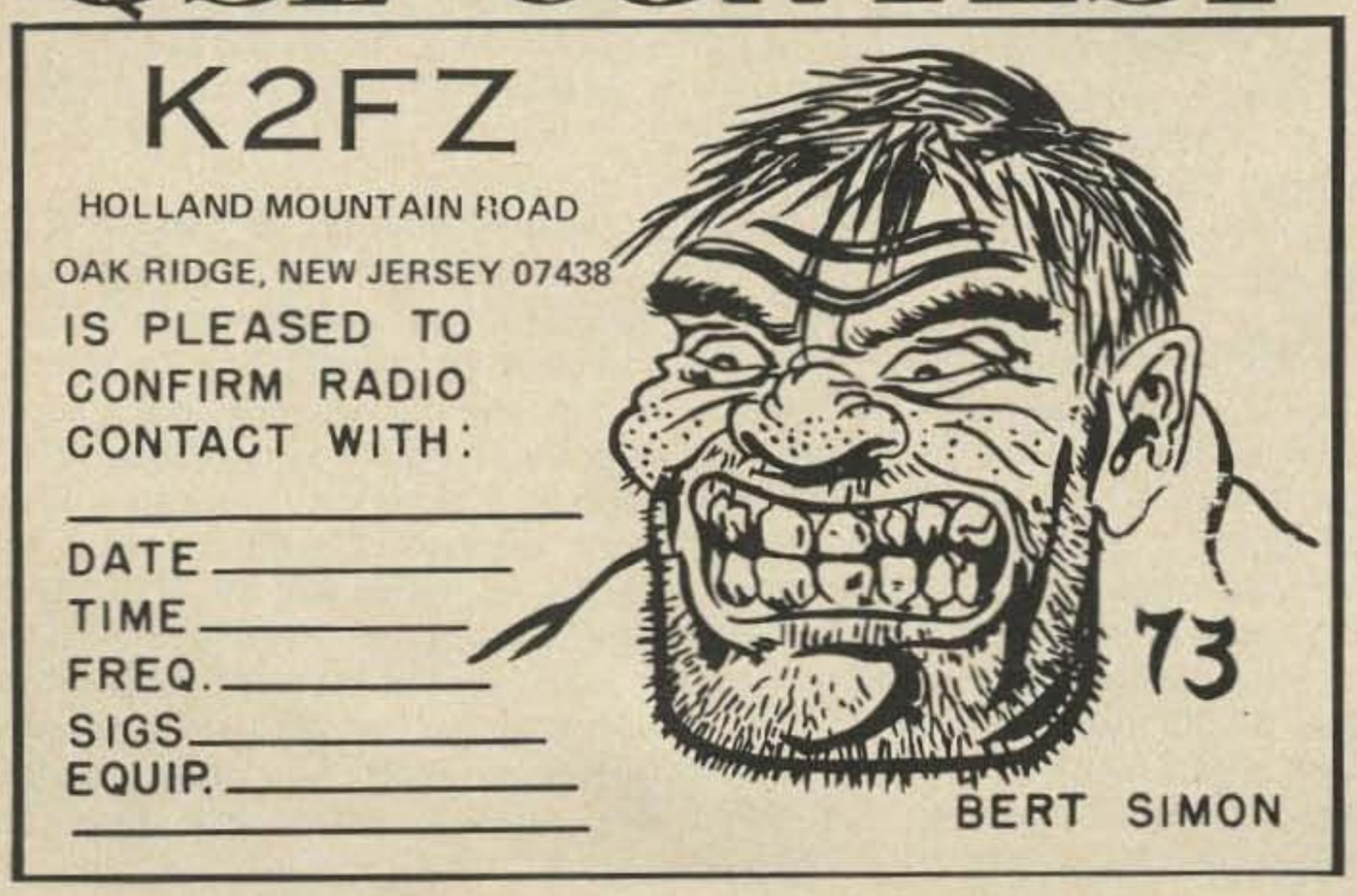
* In his bid for dictatorship, a person in control of IRS wouldn't be limited to destroying his enemies. With equal facility, he could turn about and win the support of influential people by rewarding them in various ways. For example, he could insure them against audits and investigations, so they could wheel and deal as they pleased. And he could assure them of favorable advance rulings from IRS, so they could carry out their plans without fear of adverse tax consequences in future years.

Smooth Treasury lobbyists have talked congress into building this juggernaut. Over the years, our elected legislators have bestowed more and more power on IRS to strengthen its whip hand and keep tax money pouring into Washington.

Taxpayers have just about had it. The winds of tax revolt blow stronger day by day.

E. Edward Stephens
815 King Street
Alexandria VA 22314

QSL CONTEST



Our hulking QSL contest winner this month is Bert Simon K2FZ, of Oak Ridge NJ. The picture of Bert on the card was done after he had successfully worked DXCC in one weekend only to find that in his enthusiasm he hadn't written anything down.

You too can make it really big in life and win a 1-year subscription to 73. (There are some that say it's the next best thing to receiving the Congressional Medal of Honor). Send all winning entries to 73 Magazine, Peterborough NH 03458. SEnd all loosing entries to QST, Newington CT 06111.

UPPER PENINSULA HAMFEST

August 3 & 4, 1974, Negaunee Township Hall, Negaunee MI. Hiawatha Amateur Radio Association host. Registration $2. Swap n' Shop, Program for XYL's, Door prizes. Mobiles talk in on 3.920 and 146.94. Reservations and info: Frank K4CGQ/8, 322 Fortress, Sawyer AFB MI 49843. 906-346-5501.

ARK ARC

The Arkansas amateurs proudly announce the annual Queen Wilhelmina Hamfest at Queen Wilhelmina State Park on Rich Mountain, Mena AR, Saturday and Sunday, September 7-8, 1974.

WARREN 17TH

The 17th Annual Warren Amateur Radio Association Hamfest will be held at the Yankee Lake Amusement Park in Yankee Lake OH, on Sunday, August 18, from 9:00AM-6:00PM EDST. For more information contact: R. Drew Kelley W8GFG, 822 Moore Street, Hubbard OH 44425. Phone: 216-534-3376. Bus. Ph. 216-448-6801, Ext. 393.

HAMILTON – HAMILTON

Q.T.H. – Holiday Inn, Hamilton, Ontario, Canada. Dates – October 25, 26, 27, 1974. There will be eight forums, extensive ladies program, fleamarket, banquet. Everything under one roof. For registration forms write: P.O. Box 836, Burlington, Ontario, Canada.

STRICTLY CINCY

This year the 37th Annual Cincinnati Hamfest will again be sponsored by the Greater Cincinnati Amateur Radio Association and will be held on Sunday, September 15, 1974, at the new Stricker's Grove located on State Route 128, two miles west of Ross (Venice), Ohio, north of Cincinnati. For more information contact: Greater Cincinnati Radio Association, 3965 Harmar Ct., Cincinnati OH.

MONTREAL '74

The 1974 Montreal Hamfest will be held August 4, at the MacDonald College Farm, Ste Anne de Bellevue. Prizes, Giant fleamarket, technical sessions, family fun, $2.50/adult. For more information contact: VE2RM, Box 201, Pointe Claire-Dorval, Quebec H9R 4N9.

OH! ADRIAN

The Adrian Amateur Radio Club will hold a Hamfest on October 13, 8:00AM – 3:00PM at the Lenawee County Fairgrounds in Adrian MI. Tickets $1 in advance, $1.50 at gate. Flea market, trunk sales, large display area – table $3 – half $1.50. Ample parking. prize drawing every hour. Grand prize drawing 3:00PM. Talk-in 146.46-.52-.94MHz For more information contact: Adrian Amateur Radio Club, Box 26, Adrian MI 49221.

ANGOLA FEST

The original FM hamfest Sunday August 4, 1974, near Angola, Indiana. Free flea market, entertainment for ladies and kids. Picnic grounds, campsites, boating, food, soft drinks, available, rain or shine. For information contact: Fort Wayne Repeater Assoc., Box 6022, Fort Wayne IN 46806.

20TH VHF

The 20th Annual VHF Conference will be held at Western Michigan University, Kalamazoo MI, on October 19, 1974. There will be Swap 'n Shop, Technical Forums, Evening Dinner, etc. For details please write: VHF Conference, S.M.A.R.S., P.O. Box 934, Battle Creek MI 49016.

GRAND EVENT

The Grand Rapids Swap and Shop will be held Saturday, September 21, 1974 at the Hudsonville Fairgrounds, M-21 at 40th Street, three blocks west of the Hudsonville traffic light. Admission is $1.75 at the gate, no charge for tables or trunk sales. Talk-in on .16/76 and 146.94. For more information contact: Grand Rapids Amateur Radio Association, Inc., P.O. Box 1333, Grand Rapids MI 49501.

LOUISVILLE BASH!

The 4th Annual Greater Louisville Hamfest will be held at the Oldham County Fairgrounds, LaGrange KY, on Sunday, August 25, 1974, from 8:00 AM until 6:00 PM. For more information contact: Denny Schnurr K4GOU, 1022 Sylvia St., Louisville KY 40217 or telephone 502-634-0619 (home); or 502-774-7549 (work) leave message.

THE L'ANSE CREUSE ARC

The L'anse Creuse Arc will open the fall season for swap 'n shops in the Detroit area on September 22, 1974, EDT 9:00 – 3:00 at L'Anse Creuse Central Jr. High School, main drawing 3:00, 3800 Reimold Rd., Mt. Clemens MI. Free parking, good food, prizes, tables $1.00. Admission $1.00. Talk-in on .94; For more information contact: L'anse Creuse Arc, 38024 N. Bonkay Dr., Mt. Clemens MI 48043.

BAY AREA FUN

The 11th annual greater Bay Area Hamfest will be held at the Royal Coach Inn in San Mateo CA on October 26 and 27, 1974. This year's event will be a joint effort with the ARRL Pacific Division Convention and is expected to break all northern California attendance records. Additionally, this hamfest is expected to provide an outstanding selection of technical seminars and amateur radio attractions. Attendance during the activities is expected to be in the thousands, with a good probability of 1000 people at the Sunday banquet, when a nationally known member of the amateur fraternity will be the principal speaker. For more information contact: Dick Altman WA6AXV, 1053 Shrader Street, San Francisco CA 94117.

FT. WAYNE ORIGINAL

The original FM Hamfest sponsored by the Ft. Wayne Repeater Association WA9EAU, will be held Sunday, August 4, 1974 at the Steuben County 4H Fairgrounds off the Lake James Crooked Lake interchange of I-69 3 miles of Ind. Tool Rd. 80-90. Gate and flea market, open 0600-1600, free coffee & donuts 0600-0800. Admission $2.00 includes main prize drawing. Children under 12 – free. Talk in – 16/76–94/94.

NINTH SWAPFEST

The ninth annual Northwest Texas Emergency Net Picnic & Swapfest will be held at the City Park in Levelland, Texas on Sunday, August 11, 1974. Bring your own picnic basket. Free registration begins at 0900. Lunch at 1300. Swapping all day. This event is for the entire family. Mobile talk in frequency is the net frequency 3950kHz and 28/88, 34/94 on 2m.

MELBOURNE HERE I COME

The 9th annual Melbourne Hamfest is September 7-8. All air conditioned, $1.50 at door. Tables $2/day. PCARS, P.O. Box 1004, Melbourne FL 32901.

OKLAHOMA HAM HOLIDAY

The Oklahoma Ham Holiday will be held Saturday and Sunday, August 3 and 4 in Oklahoma City. In addition to the largest fleamarket in the Southwest the program will include special speakers, technical seminars, equipment displays, MARS meetings and unique activities for the XYL. Overnight parking for recreational vehicles is available. For more information and advance registration write Central Oklahoma Radio Amateurs, Inc., P.O. Box 15013, Oklahoma City OK 73115.

CENTRAL OHIO AUC

The Central Ohio Radio Club, Inc., will hold their Annual Hamfest Sunday, August 11, from 8AM-6PM, at the Franklin County Fairgrounds, Hillard OH (just west of Columbus). Exit from 270 west at the Hillard Exit (N.W. of Columbus), follow the signs to the Fairgrounds. Come rain or shine – indoor display area. PRIZES – PRIZES – PRIZES. Flea market $3 – you furnish your table, only $2 – outdoor and you furnish your table, $1. Free auction too. Tickets $1 per person. Refreshments available. For more information contact CORCInc, P.O. Box 23, Delaware OH 43015.

RADIO EXPO

Radio Expo 74 will be held September 14 and 15, at the Lake County IL Fairgrounds, Rt. 120 and 45. Expo will feature manufacturers and club exhibits, seminars, door prizes and a giant indoor flea market. The gates open at 6AM, and the exhibit hall at 9AM. Free camping available. Reserved rooms are available at the Mundelein IL Holiday Inn, but should be reserved two weeks before Expo. Refreshments and meals are available at Expo Fairgrounds, and an Expo Cocktail Party will be held Saturday evening at the Holiday Inn. Talk in 16/76, 34/94, 52.525 and 443.75. Tickets $2, $1.50 advance sales. Sponsored by the Chicago FM club, WA9ORC/WR9ABY, PO Box 1014, Arlington Heights IL 60006.

FINDLAY EVENT

The Findlay Ohio Amateur Radio Club's annual hamfest will be held September 8, at Findlay Riverside Park. Talkin .94 and .52. Clubs wishing tickets write Clark Foltz W8UN, 122 W. Hobart, Findlay OH 45840. Please include number of tickets desired.

PEORIA – YAY!

The Peoria Area Amateur Radio Club's 17th Annual Hamfest will be held Sunday, September 15, at the Exposition Gardens, same place as last year. The site is located on Northmoor Road just west of University Ave., at the Northwest edge of Peoria. Lunch will be available and there are activities for the entire family. Free swap session, parking, contests, cartoons for the children and many prizes. Advance registration $1.50, $2 at the door. Banquet on Saturday, September 14 at V. Junction, $6 per person. For banquet reservations write Larry Pearsall W9FDY, 2224 W. Herold Ave., Peoria IL 61604. For hamfest information and advance tickets write Earl R. Kimzey WA9SCA, RFD 1, Hanna City IL 61536.

SO. JERSEY

The 26th Annual South Jersey Radio Association Hamfest will take place on Sunday, September 8, starting at 10AM, rain or shine, at Molia Farms Picnic Grounds, Malaga NJ (intersection of Routes 42 and 47). The day's activities will include swap shops (tail gate and tabletop), electronic equipment displays, prizes, ladies' games, and grab bags for the children. Family picnic tables are available for lunch baskets and barbeques. In addition, hamburgers, hot dogs, corn and soft drinks may be purchased at the picnic site. Free parking. Talkin on 145.20 and 3.930 MHz. Advance registration $2, $3 at the gate. For information and advance registration write to Bill Brandberg W2BBN, 322 Lakeview Ave., Haddonfield NJ 08033.

HAMARAMA

The Mount Airy VHF Radio Club's annual Pack Rat HAMARAMA is Sunday, October 6, at the Bucks County Drive-In Theatre located on Rt. 611 in Warrington PA. This is near exit 27 of the Pennsylvania Turnpike and north of Willow Grove PA. Huge flea market, auction, homebrew van, ATV demonstration, free playground for children, parking for 400 cars. Festivities begin at 9:30AM and auction starts at 2PM – RAIN or SHINE. Food concession on the premises with nearby motels and restaurants. Registration $1, tail gate selling only $2. Talkin .52, 52.525 and the club repeater (WR3ACD) 222.98/224.58. For further information and flier with map send SASE to Lee A. Cohen K3MXM, 8242 Brookside Road, Elkins Park PA 19117.

OH SHENANDOAH. . .

The Shenandoah Amateur Radio Club will present its 24th Annual Hamfest in Winchester VA on Saturday and Sunday, August 3-4, in the Winchester Armory. It attracts one of the largest crowds of any hamfest in the eastern seaboard area. For further information write to the Shenandoah Valley Amateur Radio Club, Inc., P.O. Box 139, Winchester VA 22601.

LOUISVILLE KRC

The Fourth Annual Greater Louisville Hamfest will be held on Sunday, August 25, 1974, at the Oldham County Fairgrounds in LaGrange KY (4 miles north on I-71 on state route 146, signs posted). Admission is $1.50. Large flea market and ladies program, food available, children's prizes. Talkin 34/94 and 28/88. For more information contact Dennis W. Schnurr K4GOU, 1022 Sylvia St., Louisville KY 40217.

HAMBURG INTERNATIONAL

The Hamburg International Hamfest will be held in Hamburg NY (only 45-minutes from Niagra Falls), September 21, 1974, at the Erie County Fairgrounds. Fleamarket – Forums -- Code Contest – Displays – Prizes (over $3000 in awards presented at the 1973 Hamfest) – plenty to eat and drink. Admission $2 in advance, $2.50 at the gate, $1 for fleamarket parking. Recreational vehicle parking, $2.50 for the entire weekend. Children under 12 admitted free. Talkin 31/91 (WR2ABU), .94, 7.255 (ECARS) and 3.925. Other area repeaters: 6.40/7.00 (WR2ACA) and 13/73 (WR2ADR). For further information contact Lin Brownell, 210 Bufalo St., Hamburg NY 14075. Phone: 716-649-3106.

VT FUN

The Burlington Amateur Radio Club, Inc., Burlington VT, will sponsor the 1974 International Field Day at the Old Lantern, Charlotte VT, Sunday, August 11. New events this year will include flea markets for both XYL's and OM's. Contests, demonstrations, and other activities for all members of the family. Portable color television raffle, and many prizes including main door prize of Heath 30MHz frequency counter. Refreshments available and camping on the grounds for trailers, campers, tents, etc. Come a few days early, no reservations necessary – talk in on 2m (34/94, 22/82, 16/76, 28/88). Special happy hour Saturday evening to celebrate 10th year of W1KOO repeater, and you're invited. Registration is $3.50 at the gate, $3.00 for early birds. Write to Slim Borkman K1RMI, 48-21, Richmond VT 05477.

FOXY LEAGUE

The Fox River Radio League will hold its Annual Hamfest September 22, at the beautiful Phillips Park in Aurora IL. Picnicking Zoo and Gardens for the entire family. Talkin on .94 and .52. Mail $1 advance donation with SASE to WB9HYH, President, 1888D Carnation Ct., Aurora IL 60506. Drawing #1, HR-2B, #2, ACT-R10H/L/U, and many others. Will ship U.P.S.

CENTRAL MINNESOTA

The Central Minnesota Hamfest will be held on the third Sunday of August (August 18), in Sauk Rapids Municipal Park (near St. Cloud MN). There will be refreshments, games, prizes, transmitter hunt and a swap market. This is the largest hamfest in Minnesota. The entry fee is $1 and the park is free for campers. For further information contact Lolly Loomis WNØGSD, Rt. 2, Rice MN 56367. Phone: 612-253-6408.

TACOMA FAIR

The Radio Club of Tacoma, Inc., presents their "Hamfair – '74" (much more than just a HAMFEST), Saturday and Sunday, August 17-18, at the Pierce County Fairgrounds (11 miles south of Puyallup, on Meridian Ave., Highway 161), Graham WA. Many door prizes – Grand Prize IC-230. FORUMS – CONTESTS – HIDDEN TRANSMITTER HUNTS – DISPLAYS – FLEA MARKET – FREE CAMPING – MORE. Registration for Saturday evening dinner and all activities $7. Children under 10 -- dinner only $2. Registration without dinner $4. For more information contact Bill Morgan W7GPR, 3421 E. 138th St., Tacoma WA 98446. Phone 531-3821.

S.W. MO

The Southwest Missouri Amateur Radio Club will hold its Annual Hamfest, swap meet and family picnic on August 25, 1974, at Lake Springfield Park MO. For further information contact Gary L. Polodna WBØIJZ, Secretary, Southwest MO Amateur Radio Club, 3121 South Parkview Drive, Springfield MO 65804.

HI SIERRA

The Sierra Nevada Hamfest will be held at Idlewilde Park, Rena NV, Saturday, August 10, 1974. Preregistration $10, after August 1, $11. Western style barbeque dinner, and a lot of prizes to be given away. Free beer and soft drinks. For information, contact Nevada Amateur Radio Association, P.O. Box 2534, Reno NV 89502.

ZERO-BEATERS A.R.C. HAMFEST

August 4, 1974, Washington MO City Park. It starts at 10AM CDST, Auction at 11AM. Attendance prizes and other goodies. Auction, free bingo for XYL, cake walk, candy scramble – gigantic traders row. For Hamfest information and tickets write or contact Zero-Beaters ARC, Box 24, Dutzow MO 63342.

GRANT COUNTY ARC

Indiana's fastest growing fall hamfest. Grant County ARC's annual hamfest will be held September 29, 1974, at the 4-H Fairgrounds. Admission still $1 for advance tickets, $1.50 at the gate. Large flea market, technical sessions, bingo for XYLs. Large inside pavillion, plenty of parking. Talkin on 19/79 and .94. For more information on advance tickets write to W9EBN, P.O. Box 815, Marion IN 46952.

75m PICNIC

The Iowa 75m Net will hold its annual picnic on Sunday, August 25, at Riverview Park in Marshalltown IA. All radio amateurs and net members are cordially invited to attend. You may check in at any time. A pot luck dinner will be served at noon. Everyone is asked to bring a covered dish. Drink and pop will be furnished free. Prizes will be awarded. For further information contact Jerry Smith WØDUN, P.O. Box 14, Akron IA 51001.

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA 91402

If you live in California or any other mountain area, then you probably know about remotes, what they are and what they can do. If there is one facet of amateur FM that started and matured out here it is the remotely controlled amateur radio station, better known as the remote base. In order to answer a steadily growing number of letters from readers unfamiliar with remotes and the reason people build them, "LW" spent a day with the members of the Grand Funk Radio Network, owners of the WA6ZYY remote here in Los Angeles. While this is their story, I suspect it is indicative of many other systems. Here is Part 1 of "The Remote Base, Another Alternative."

Skip Hansen WB6YMH, Marc Abrams WA6DPB, and Gary Belda WA6ENS, were busy in Marc's workroom putting the finishing touches on the new ZYY machine prior to its installation in Hollywood Hills. They are three of ten hams that comprise the Grand Funk Radio Network. They are amateurs like the rest of us; looking for a better, more efficient way to communicate. The pride they took in what they had created was evident especially in Marc's voice as he demonstrated what the machine could do. "It can even turn on an electric heater at the site if we have to service it during bad weather," was Marc's comment as he hit a couple of numbers on his HT220's touchtone pad. The desk lamp lit up to simulate the aformentioned heater.

"Fine," I said. "One HT on 450 and you have access to 6, 2 and the phone line to boot. But why a remote instead of a repeater?"

"If you own a repeater," said Skip, "you are not really free to experiment with it in a way you might like. This is due to your obligation to your users to see that the repeater is there when they want or need it. But a remote is your own private toy. If you do something wrong and the system becomes inoperative, you have only yourself to blame or better yet, hold responsible. If you feel that you have spent enough time up on the hill, and you don't mind if the system is down for a few weeks, it's your decision. You aren't obligated to perahps hundreds of users. After all, what is our remote? It's like having our base station, mobile or HT always sitting at an excellent location."

According to the information I have been able to gather, there are well over 200 private systems in California – all operating between 439 and 450MHz. This figure includes small private repeaters, autopatch systems and probably 50 or so systems similar to ZYY. In the Los Angeles area we account for approximately 75 of the total state number. As Marc says, "You need only carry a small handheld unit equiped with a touchtone pad. With it you can operate our system as a straight 450 repeater, tune in any preselected 2m or 6m channel or access the phone line. It is the type of versatility that is impossible to offer on a repeater in an area with as dense an amateur population as you find here in L.A."

"Remotes, they're an outgrowth of the terrain we live with in this part of the country," Marc continues. "Go east to the midwest or south where the land is basically flat and in most cases you will find a tall building acting as a repeater site. The coverage of most machines in that type of installation averages 75 or so miles. Let's put this machine on 22/82 in our example. Well, if there is another machine on the same channel pair a hundred miles away, there will be little if any interference between the two systems. Now we put the same system on a 5000' mountain like Johnstone Peak. Even with the reduced power output required by the regulations, this system will cover over 200 miles. That makes this channel pair useful to only a few hams at a time. Fine, if you are willing to wait up to two hours to use a crowded repeater to get a few words in that may be of no real importance. But there are those of us that don't want to wait. A system like ZYY at the same type of location is there, ready and waiting to do its job at our command. I want to call someone on 2, I dial up 2m on the remote, select a channel and call him. Same for 6m, 450 or the autopatch. Most of the time it just listens on our 450 input,

but it also offers the versatility you can't get on a repeater. The potential is endless. Put up a beam and you can direct it from your HT. Name it and it can be done."

Well then, why are all remotes closed systems with confidential input and control channels? Skip answers, "I equate our remote with anyone else's personal amateur station. If you had spend $5000 on setting up the best lowband DX station you might not take too kindly to a total stranger walking into your shack, plopping down in your chair and firing up your station. All this without ever asking permission. We look at ZYY the same way. We put out the money, time and labor to build it. Over a $1000 and we have lost count of the manhours. We have the ability to converse with amateurs on 2m or 6m thru its ability to operate those bands, but it is our amateur station built for our personal use."

Skip continued, "The reason for not publicizing control channels is obvious and the way 450 is set up out here there is little likelihood of ever finding simplex operation on an input or output. If this should happen, that person would still need the proper tone to access the system. This information is also unpublished. Remember, while we have a set of 450 channels assigned to us, in reality the band is open for any licensed amateur to use. All bands are. The main difference is that we can hold a QSO for as long a time as we desire without a dozen breakers asking for signal reports or all of a sudden finding another QSO taking our place before we have reliquished use of the machine. On a private system these things just don't happen. The same holds true when we function up another band. Our location gives us the ears to hear a great distance and the voice to hold a simplex QSO that might otherwise be impossible. The remote lets us run simplex to areas that we might otherwise have to tie up a repeater to access. That seems like an efficient way to use the amateur spectrum."

Have not remotes been the cause of friction between amateurs on certain occasions? The answer is a qualified yes with a rather valid reason for this happening. I will go into this and other aspects of remotes next month.

WA2HVK/6

W2NSD cont'd from page 3.

how many people use the 73 oven, it is remarkable that it has been so trouble-free.

Frozen loaves of bread thaw in about two minutes (30 seconds a side). Ice cream can be made servable in a few seconds. Just about all leftovers come alive in the oven, except maybe salads. Leftover salad?

WILSON LOWERS HT PRICE

Can one of the better selling HT's become the best selling? Time will tell. Jim Wilson announced that his company is pulling out all stops to be first in HT's with their six channel two watt hand unit. The new price is $199, down from their $239, and still available through authorized dealers. This is about the only HT on the market with all crystals changable (most have one or two pairs soldered in) – the only one with the mike separated from the speaker for better fidelity (and so you can talk without having to move the HT from ear to mouth) – uses inexpensive AA batteries – has remote speaker/mike for belt operation.

ZAPPED FROM SPACE

A note from W5LVA enclosed a clipping about NASA getting ready to test a satellite solar power station (SSPS) in 1978. This will collect energy from the sun and beam it down via microwaves – about 5 kW worth.

The idea is that collecting solar energy here on earth is too lossy – much of it is dissipated in the atmosphere before it reaches the ground – and clouds turn off the power entirely, as does nightfall. This means a tremendous storage facility of some kind is needed. A satellite would get solar energy 24 hours a day and energies on the order of 10,000 megawatts are being considered.

That sounds like a great idea, but there are some glitches. Consider for a moment the household microwave oven which produces only a couple hundred watts of rf – and remember the frantic ado over the leakage from these units. The Environmental Protection Agency has worried about the leakage of a few milliwatts. So what happens if the multimegawatt beam from the satellite touches any of us? We'd get fried, wouldn't we? If we do build one – would we want the Russians to have one too? Or the Chinese? Or the Syrians? Ten gigawatts on a tight microwave beam should be able to do quite a job – how'd you like to try dodging that? It sounds like the death ray of Buck Rodgers.

MAKING HAMFESTS SUCCESSFUL

The key to the success of any hamfest lies primarily with the chairman. If you have a good chairman -- one with some know-how – with guts – and the ability to manage – you'll have a good hamfest.

Some clubs look around for a chairman for their hamfest and select someone with no business experience – someone who has been working for a large company and thus has never run into the problems that a fellow who has started his own business has encountered. Success eludes them.

The good hamfest chairman is an entrepreneur. He has his own business which he probably started himself. He has a few employees. He has had enough experience so he can delegate responsibility and then follow up on it to make sure it is exercised. He selects the exhibits chairman, tells him how to go about his job, and follows up on him every few days. He picks a program chairman, a ticket chairman, a promotion chairman, a program book chairman, a prize chairman, etc.

The entrepreneur is used to thinking in terms on the order of a hamfest

Cont'd on page 114.

A recent Sunday afternoon dinner at 73 Magazine with (left to right) Lin Green – Sage Green – Yvette Grimes WA8ULU/1 – Chuck Martin WA1HPS – Tony WA1MWN – and Sandy W1PVF. Chuck has done much of the 450 repeater work in the Boston area, including the WR1AAB machine near Peterborough on 449.1. He and Sandy spend most weekends, summer and winter, climbing the mountains of New Hampshire, often with 2m gear packed along. Tony is one of the driving forces down at A&W Electronics, one of the biggest ham dealers in New England.

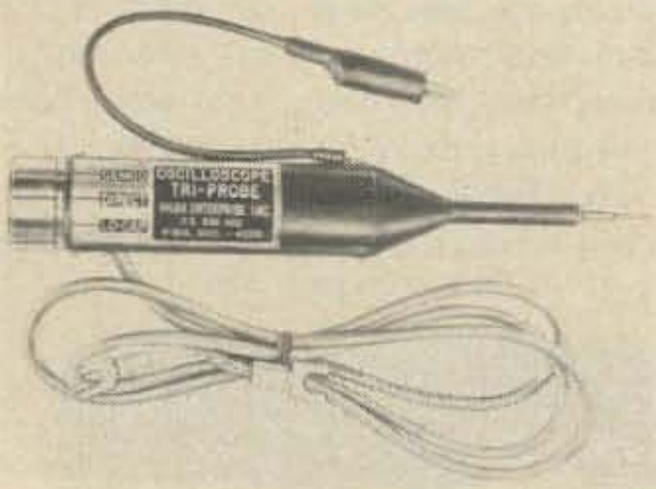
NEW PRODUCTS

100-150W POWER AMPLIFIER

This amplifier, designated Model 6100, employs six silicon transistors and six silicon diodes for years of trouble free service. Each amplifier comes complete with dc and rf cables, instruction manual and the final test data sheet. It is broadband so that no alignment is necessary, has balanced emitter transistors for reliability and is entirely solid state, including the antenna relay. It is rated for continuous operation and has reverse polarity protection as well as automatic switching. It has provisions for remote on/off control and a built in power sensor. It operates from a 15-35W input in the 40-54MHz range. There is an adapter kit available that can be installed in existing units for modification to linear operation. The amplifier also comes with a complete 1-year warranty. One of these amplifiers has been in use at 73 Magazine with excellent results.

For further information contact *JM Communications, 101½ Washington St., Venice CA 90291.*

NEW OSCILLOSCOPE TRI-PROBE



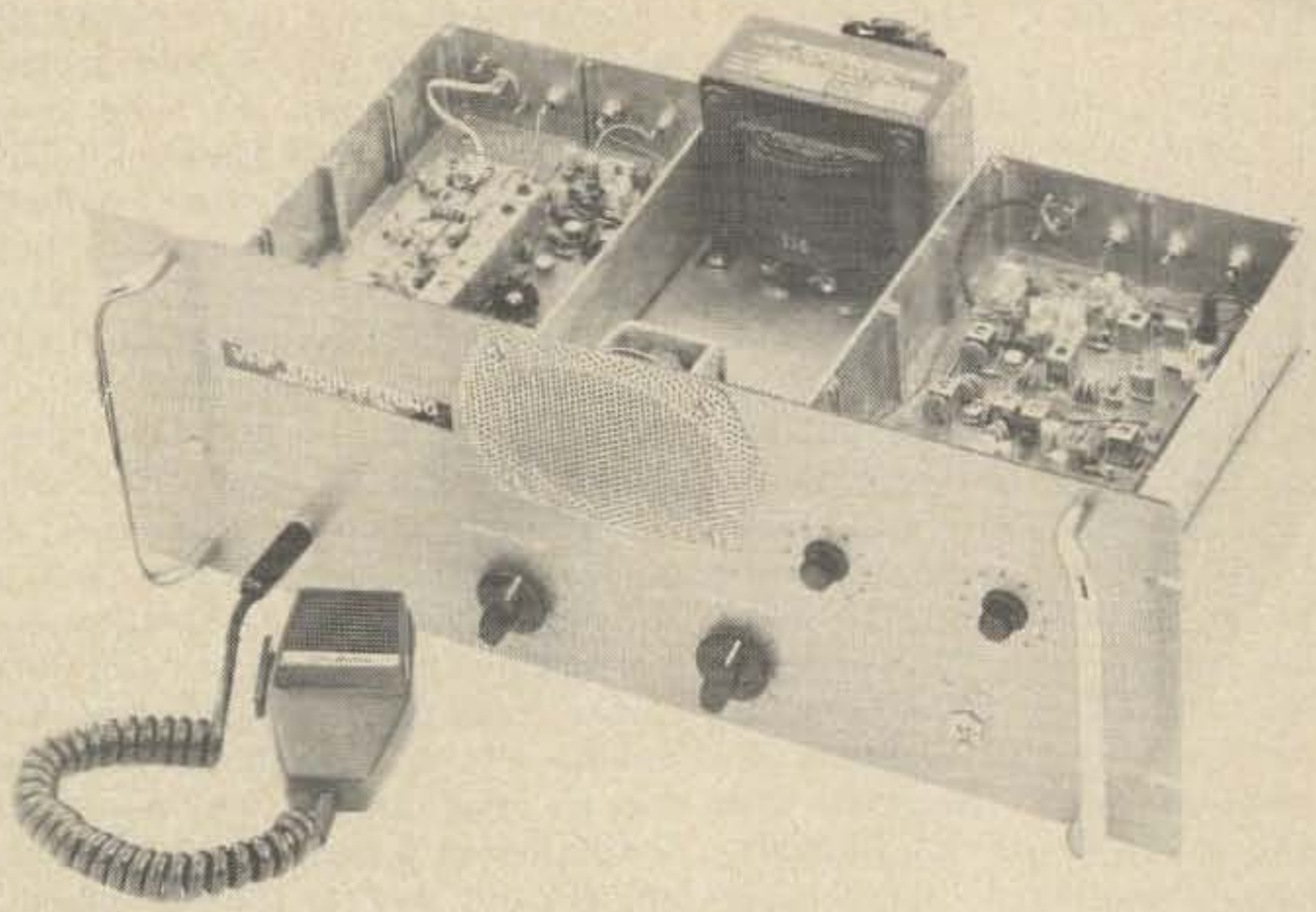
This NEW lightweight probe lets you perform three functions with one, rugged, easy to use oscilloscope probe.

The probe is designed to give you fingertip selection of DEMODULATION, DIRECT or LOW CAPACITY mode of operation for simplified use of your oscilloscope.

Insulation piercing prod for quick, positive contact through wire insulation, solder flux of MIL conformal coatings. Works with any oscilloscope, shielded signal cable is available with PL-259, BNC, banana plugs, or forked lugs to fit any oscilloscope.

For complete information, specifications and price, write *Valor Enterprise Inc., Dept. 203, P.O. Box 1162, Piqua OH 45356.*

VHF ENGINEERING REPEATER



With the cost of repeaters coming down, no wonder the number is growing at the rate of several a day! One of the newest entries is the VHF Engineering package, where a complete repeater can be put together for about $250 – and that even includes the identifier. Several of these repeaters are being used, with one of the newest being WR2ABS in Binghampton NY.

5200 ELECTRONIC INSTRUMENTS

The free 208 page 1974-75 Leasametric Instrument Databook gives spec-by-spec comparisons of over 5200 electronic test instruments. More comparative technical information has been assembled than in any previous publication.

Over 64-pages have been devoted to Rental and Lease information wherein one, two and three month rental rates are presented. Used prices are also given which constitute the "blue book" of the used equipment market.

Additionally, the book provides information on new low cost instruments for sale thru the nationwide "METRIC MART."

For additional information contact *Delight Howell, Leasametric, 822 Airport Boulevard, Burlingame CA 94010. Telephone: 415-347-3067.*

FULL WAVE BRIDGE RECTIFIERS

The MDA100 series of full wave bridge rectifiers are encapsulated in miniature plastic cases of unique design, affording high dielectric strength, vibration and shock resistance, and low cost.

These rectifiers utilize the same dice as the popular and time tested IN4000 rectifier series. Rated realistically at 55° C ambient for full output of 1.5 Amperes, they are available off the shelf, in voltages up to 1kV.

For further information contact the *Technical Information Center, Motorola Semiconductor Products, Inc., Box 20924, Phoenix AZ 85036.*

SIMPLE CRYSTAL SET

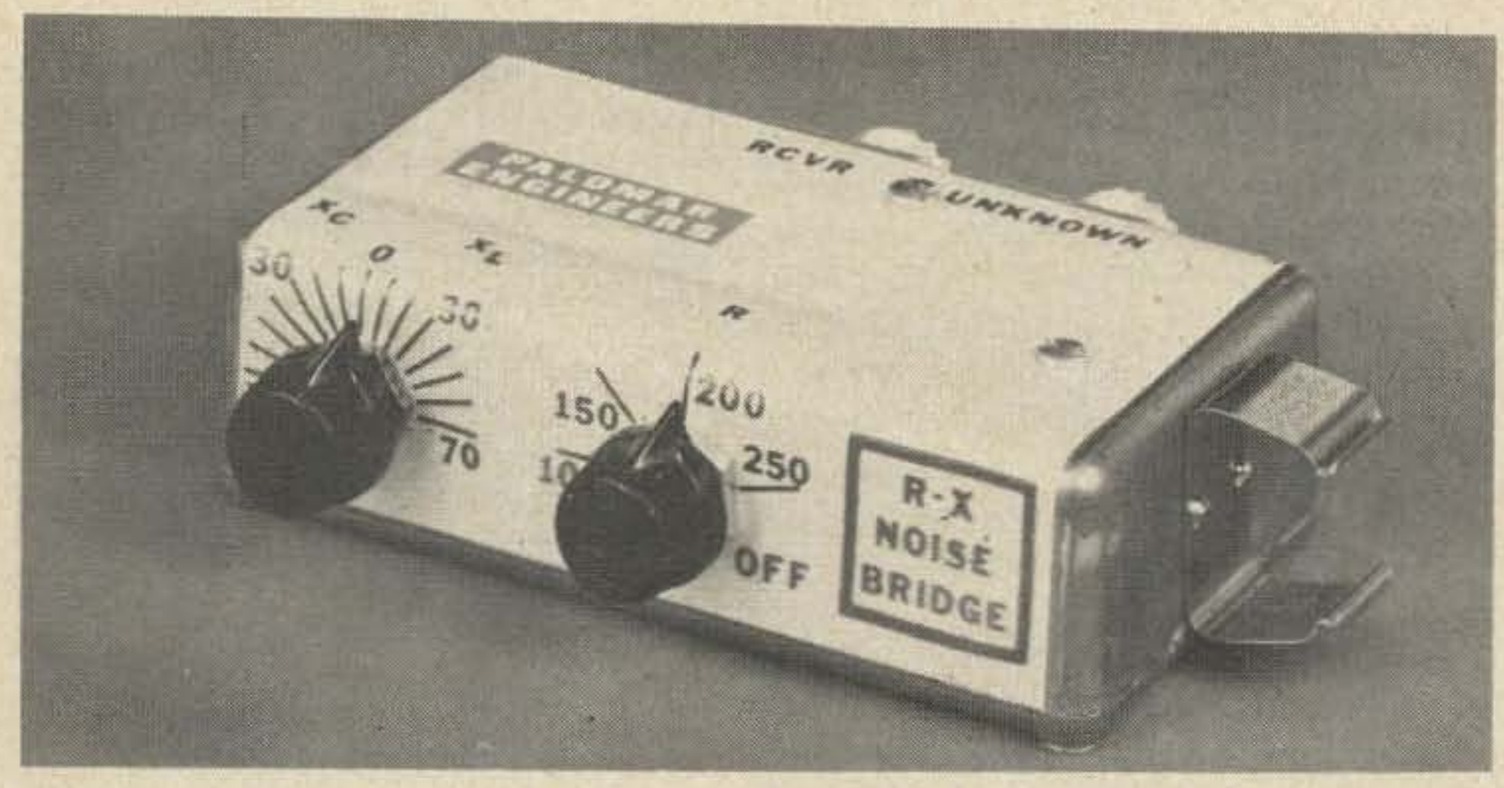
Radio signals from all over the world can be picked up on a simple crystal set designed for shortwave reception. It costs only $10 including postage from Britain. Using neither main nore battery electrical supply, the DX Crystal Set is powered solely by the incoming signal without amplification.

The manufacturer reports that Peking, Moscow, BBC World Service, Prague, Monte Carlo, Cairo and South Africa are among the broadcasting stations that can be received with varying degrees of fading according to aerial location and propagation conditions.

The set consists basically of a germanium diode and a variable capacitor, with two connections and an earth lead to an indoor antenna which also forms the tuned circuit. The antenna, a 15' long double loop of heavy gauge aluminum wire, covers the 49m wave band and part of the 41m band. A progressively narrowing semi-circular scale allows simple tuning over other shortwave bands to be carried out. To improve reception a self-supporting semi-directional antenna can be easily constructed from the same type of aluminum wire. The DX set is housed within a polystyrene case with a matching glossy black and silver front and weighs less than 12 oz.

For further information contact: *Partridge Electronics Ltd. (Mr. G. A. Partridge Managing Director), Broadstairs, Kent CT10 1LD, England. Telephone: Thanet 62535.*

ANTENNA NOISE BRIDGE



The new R-X Noise Bridge by Palomar Engineers measures both resistance and reactive components of antenna impedance. The resonant frequency of an antenna as well as its feed point resistance is easily found.

The ability of the bridge to measure reactance is a useful feature not found in previously available noise bridges. The off-resonance impedance can be measured and it is easy to tell whether the resonant frequency is lower or higher than expected. This greatly simplifies tuning and matching.

The R-X Noise Bridge operates in the 1-100MHz range and measures resistance from 0-250Ω. Price is $39.95 postpaid from *Palomar Engineers, P.O. Box 455, Escondido CA 92025.*

TONE GENERATOR

Looking for a SUBAUDIBLE TONE GENERATOR for your small hand held or portable FM radio? "THE CUBE" is only 1.27cm x 1.52cm x 1.78cm (.5" x .6" x .7") in physical size, but it has a whopping sine wave signal out. Designed to be used with any of the subaudible guarded systems, it works on 9-16V and has no moving parts. It can be set on any frequency between 98 and 240Hz with a trim resistor. THE CUBE is available from RGS Electronics at the low price of $19.95. For an extra $5.00, it can be set on frequency by the factory. Contact *RGS Electronics, 3650 Charles Street, Suite K, Santa Clara CA 95050.*

TURNER CATALOG

An 8-page communication line catalog describing Turner's entire line of communication microphones is now available. It includes several recently developed models.

New products include a special version of the standard Turner M+3 mobile microphone supplied with a 6-conductor cable and wired for Johnson and other transceivers requiring 6-wire cable. Other microphones include the 450 series featuring completely new styling. Several medium impedance microphones have also been added.

Copies of the catalog, No. 2721-C, may be obtained by writing *Turner Division of Conrac Corporation, 909 17th Street, N.E., Cedar Rapids IA 52402.*

UHF TRANSISTOR

A new 12V, 25W ruggedized UHF transistor is now available from TRW Semiconductors, Lawndale CA.

The device, designated TRW PT8825, is a direct replacement for 2N6136 or C25-12 but also features infinite VSWR capability at rated input power and 15.5V. The emitter-ballasted silicon NPN transistor employs a grid structure design to achieve a high figure of merit.

The transistor is intended for land mobile UHF applications up to 512MHz and is especially suitable for radio applications where ruggedized construction is important to protect from antenna mismatches and other current transients.

Units feature low current density for long term reliability and are offered in standard 380 SOE packages. The new transistor can be specified as either TRW PT8825 or 2N6136. Price is $22.50.

For further information, contact *Sales Manager, TRW Semiconductors, 14520 Aviation Blvd., Lawndale CA 90260; phone 213-679-4561.*

THUMBNAIL SIZE SENSOR

This miniature optical sensor by General Electric Company is announced for a host of uses in government, home, business and industry. The tiny solid-state sensor makes possible tubeless TV cameras no larger than a pack of cigarettes and is being produced by *GE's Optoelectronic Systems Operation, Syracuse, N.Y.*

1.5W, 7.5V POWER MODULE

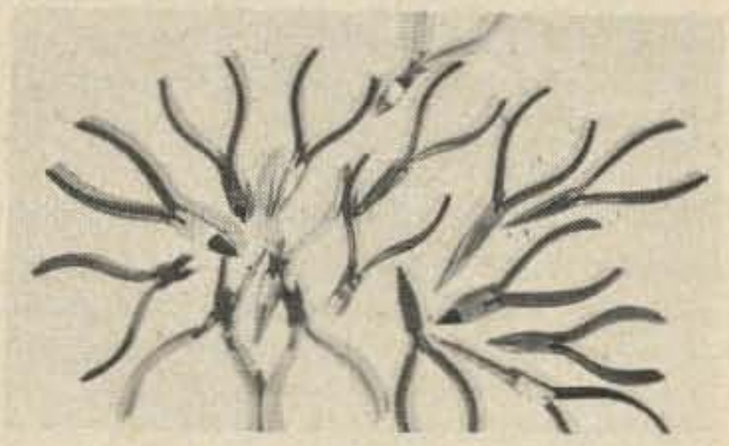
A new line of rf power modules designed specifically for UHF hand-held transceivers has been announced by TRW Semiconductors.

The modules, designated MX1.5, are designed to operate from a 7.5V battery supply. They provide 1.5W output, 20dB gain, 50% efficiency and feature full protection against over-drive and load VSWR. Harmonic outputs are more than 30dB down and the MX1.5 is stable under all operating conditions. The modules are designed for operation in the 400-512MHz range and have 50Ω input and output impedances.

The MX1.5 units occupy less than 4 cubic centimeters of space.

For further information contact *Sales Manager, Mobile Products Plant, TRW Semiconductors, 14520 Aviation Blvd., Lawndale CA 90260. Phone: 213-879-4561.*

CHEAP TOOLS



Perhaps inexpensive would be a better title since there is nothing cheap about the tools. Compared to many (if not most) of the imports, these are exceptional. Greene's Electronics down in St. George SC 29477 (Box 626) has somehow managed to get their hands on some seconds from one of the top makers of small tools and they are passing along their good fortune – an assortment of 10 needle nose, cutters and stuff like that for only $16. The assortment has been checked out at 73 and found to be first rate.

MINIATURE BC TRANSMITTER

Telonix Industries has a little 1500 kHz transmitter on the market ($9.95) which is designed particularly to plug into cassette recorders and play them through your broadcast radio. This is not a bad idea for playing Morse code cassettes for a large group, as many radios have a lot bigger speaker and more power than cassette players.

The "Soundcaster" module is about 1.5" high, by 2.5" square, and has a place for a 9v battery in the bottom. It has a plug to fit most cassette players, and a little antenna wire. Dealers might get in touch at 3272 S.W. Temple, Salt Lake City UT 84115.

C/MOS LOGIC ICs

Amperex Electronic Corporation has announced the availability of a series of C/MOS logic ICs in microminiature LID packages. The new series, available from stock in production quantities, consists of 14 logic circuits that have the electrical characteristics of the equivalent 4000 series C/MOS ICs, already widely available in in-line packages, and are functionally interchangeable with those devices.

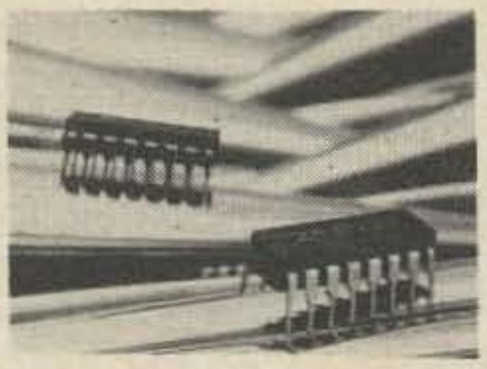
The new Amperex devices have all the recognized packaging advantages of LIDS (Leadless Inverted Devices). The primary advantages, to manufacturers of hybrid circuits are the great reduction in size compared to in-line packaging for the same electrical functions, ease and economy of assembly on the substrate, and extremely high circuit yields.

LID packaging, first introduced by Amperex in 1966, eliminates the need for expensive wire-bonding machinery in the assembly of the hybrid circuit.

The 14 C/MOS ICs initially available in Amperex LID packages include NOR and NAND gates, an exclusive-OR gate, shift registers, counters, flip flops, switches and buffers.

Detailed specifications on all of the available 4000 series C/MOS LIDS and on the numerous other ICs and discrete transistors and diodes available in the Amperex microminiature LID package may be obtained by writing: Amperex Electronic Corporation, Solid State and Active Devices Division, Slatersville RI 02876. Telephone: 401-762-9000.

FUNCTION GENERATOR



Most of the circuitry needed to build precision function generators or signal generators in communications and instrumentation systems is provided by the XR-2206 monolithic function generator. The XR-2206 contains a voltage-controlled oscillator, an analog multiplier and sine shaper, a unity-gain buffer amplifier and a pair of current switches.

The XR-2206 generates high-quality sine, square, triangle ramp and pulse waveforms with the aid of a simple passive network that biases the circuit and sets operating frequencies. The output waveforms may be amplitude and frequency modulated by varying an external control voltage. Also, logic levels applied to the current switches through an FSK input cause the circuit to operate at two discrete frequencies, such as the mark and space frequencies of an FSK system determined by two timing resistors and a capcitor.

As a precision function generator or sweep generator, the performance of the XR-2206 is comparable to that of a bench instrument. Total harmonic distortion is typically 1% without adjustment and approximately 0.5% with potentiomenter adjustments.

Because of the optional operating modes, the XR-2206 is also ideal as a signal generator in sinusoidal-tone, AM, FM, FSK and PSK (phase-shift keying) systems, as a voltage-to-frequency converter, and as the major component of phase locked loop systems. The XR-2206 is available in 16-pin, dual-in-line packages.

For further information contact *R-OHM Corporation, EXAR Integrated Systems, 16931 Milliken Ave., Irvine CA 92705.*

ISOLATED-PAD DRILL-MILL

The first isolated-pad drill-mills with builtin center drills have been introduced by A. F. Stahler Co.

Another exclusive feature of the Stahler isolated-pad drill-mills is heat treatment of the chrome alloy body of the drill-mills after the teeth are cut. This makes the mills exceptionally long wearing, even when milling isolated pads in glass-epoxy circuit boards.

The tools are used to fabricate circuit boards from full-size templates without etching, to add components to an existing board and breadboard circuits in a form that approximates final design. They are primarily intended for small quantity and experimental circuit board construction by researchers and hobbyists. The isolated-pad technique allows the builder to duplicate circuit templates with identical parts location and wiring layout. The component mounting is as rugged as with etched pc board construction.

After machining the teeth in the mill, Stahler heat treats the tools to a hardness of Rockwell C 44-47, minimizing wear on the mill teeth. The drill is held in place in the bore of the tube with two set screws, preventing accidental breakage of the drill which could be caused by excessive torque if only one set screw were used.

Stahler isolated-pad drill-mills are priced at $7.95 each. Additional information on the tools is available by writing to *A. F. Stahler Co., P. O. Box 354, Cupertino CA 95014.*

W2NSD cont'd from page 111.

and a few thousand dollars worth of prizes doesn't faze him. He knows that the parking chairman is going to have to be ready for hundreds of cars and plans for getting them parked. The flea market chairman is going to have to rope off his area, have help in assigning spaces, take care of complaints, watch out for deadbeats, etc.

All too many hamfests are doomed to mediocrity right from the beginning by being turned over to incompetent management.

STANDARD REPEATERS SELLING WELL

Standard reports that they are up to here in repeater orders, both ham and commercial. Apparently a fair percentage of the new repeater groups are using the Standard repeater. A report from Jordan tells us that the repeater in Amman, JY-73, is still working well and in frequent use by JY1.

HALLICRAFTERS QUITTING?

It does appear that Hallicrafters will follow National and Hammarlund, after all these years, leaving the ham business. Old timers will reminisce over the many fabulous receivers and rigs turned out by Hallicrafters down through the years.

220 ANTENNA

Antenna Specialists has a new 1/4 wave car roof mount antenna for only $7.29 to help you get on the 220 MHz band. It comes complete with 17 foot of RG-58/U coax and UHF connector. The whip is only 13" high for this band, so you won't hit those garage ceilings. It'll handle a hundred watts. Let's get cracking on 220.

NEW HT

More and more of the VHF Engineering hundred buck 2m hand transceiver kits have been getting on the air over the New England repeaters and everyone seems delighted with the project.

The next time someone whines that they would like to get on two meters, but it is just too expensive, tell 'em what's what.

READING HOTLINE?

A recent issue of HOTLINE had two nice $15,000 a year job offers – plus some other interesting jobs. Not to mention some inside FCC scoop that really can't be published in something as widely read as 73 – an honest evaluation of an ARRL move, also not for general publication – inside industry news.

JUST WHAT THE WORLD NEEDS !!

another surplus place?

Dear Customer,

We are new, and also a little different. Rather than give you a broad line of parts, we are seeking out exceptional buys on popular hobby components. By concentrating on specific items, you get lower prices, faster service and parts that are thoroughly tested and examined.

To make your life easier we include with each device an application sheet — pinout, important parameters, and representative circuits. These circuits are meant for you to breadboard or use in your projects, with complete parts values. We don't just send a copy of the manufacturer's data book, but then again that's not the only way we're unconventional. We send air mail whenever possible and fill orders within 48 hours. We don't back order you when parts aren't there, we send back your check. And if by some chance we make a mistake with your order, it's important to us that you be happy and that you get the satisfaction you deserve. Just what the world needs. . . another surplus place.

LM 309K 15V 1A regulator $1.20
LM 311M high performance comparitor $1.00
LM 339 dip quad comparitor $1.50
LM 555 timer $.85
LM 723D adjustable precision voltage regulator $.65
LM 741 Mini compensated op amp $.35
LM 747 dip dual 741 $.70
LM 3900 dip quad op amp $.45
LM 4250 TO5 programable op amp $2.00
LM 1558 mini dip dual 741 $.75

ABOVE MATERIAL IS GUARANTEED FUNCTIONAL, RETESTED MATERIAL. USER SATISFACTION GUARANTEED FOR HOBBY AND EXPERIMENTAL APPLICATIONS.

SOLID STATE SURPLUS
BOX 255
MONTE RIO CA 95462

25¢ 50¢ $1.00 SALE

$1.00 Telescoping Antennas $1.00

Part #	Sections	sections open	closed	dia.	Swivil	Hinge
A	11	56-1/2	6	7/16		
B	8★	32-1/8	6	5/16	X	X
C	10	47	6-1/2	11/32	X	X
D	11	26-3/8	3-3/4	3/8		
E	8★	26-3/4	5-1/4	5/16	X	X
F	7	29-3/4	5-1/2	9/32		
G	6	19	5	1/4		X
H	8	30-3/4	6	5/16		
I	✱9★	26	5	11/32	X	X
J	8	32-5/8	5-1/8	5/16		
K	8	32-1/2	6-7/8	9/16	X	X
L	8★	32-1/2	6-1/4	5/16	X	X
M	6	19	4-1/2	1/4		
N	7	24-1/4	4-1/2	1/4		
O	6	27-1/2	6	7/32		
P	Assortment 3/$2.00 No Choice					

★Bottom section used inside case for mount

✱Brass base and top hat

SPEAKERS

8Ω	80mW	2" Round
11Ω	200mW	2¼" Round

50¢ each

8Ω	3W	5x7 Oval
8Ω	3W	4x6 Oval
8Ω	2W	4x4 Square
8Ω	2W	2½x7 Oval
8Ω	800mW	3½ Round

$1.00 each

Standard Size 15/16" body 5/16" thread 1/4" shaft 20K, 100K 25¢. 10K, 500K, 1meg—w/sw50¢. 5K/10K concentric w/sw 75¢. Miniature size 3/4" body 1/4" thread 1/4" shaft 50K 25¢. 5K s/sw 50¢. Miniature size 5/8" body 7/32" thread 3/16" shaft 2.5K 25¢. 5K, 10K w/sw 50¢. Ultra Miniature Transistor Radio Volume Controls s/switch 2K, 2.5K, 5K, 7.5K, 15K. Your choice 25¢ ea. – 5/$1.00.

ANOTHER TON OF GOODIES Over 50 types of audio driver & output transformers for transistor circuits. Micros, minis, "CB" radio size, etc. **$.25 each, 5/$1.00**

PLASTIC BATTERY HOLDERS Your choice 4'C' or 4 'AA' or 4 'A' w/leads. **$.25 each, 5/$1.00**

WE GOT A TON OF 'EM Transistor radio tuning caps for AM, AM–FM. Micros, minis, sealed, open. Over 40 types. **$.25 each, 5/$1.00**

TRANSISTOR RADIO EARPHONES – your choice mini or micro plug, long cord – **$.25 each, 5/$1.00.**

4 PDT RELAY Miniature pcb enclosed in clear plastic. Gold contacts **$2.00**

VIDEO TAPE BONANZA New American made ½" cobalt energized video tape 2400' on 7" reel in nice box. **$21 each, 5 & up – $15 each.**

RUBBER TAPE RECORDER Drive Belt assortment **$1.00**

6 FEET LONG! cord, not shielded with female connector on one end **only $.25**

CAR LIGHTER PLUG w/5 foot cord! **$.50**

RADIO & INSTRUMENT KNOBS over 100 types.**$.05 each.**

TRANSISTOR TAPE RECORDER ½ track mono head assembly for ¼" tape. Consists of erase, R/P heads, pressure pads mounted on base plate as used in MAYFAIR 1802. A steal at **$1.00 each.**

RECORD/PLAY tape heads for 8 track stereo cart & 2 track mono cassette. Your choice **$1.00 each**

LV BRIDGE & ½ BRIDGE RECT. Fine for meters other LV 500 mA. Your choice **$.25**

MINI & MICRO JAX for mic or earphone your choice. 2 circuits w/nc sw.**$.25, 5/$1.00**

4P 3 POS ROTARY SW 5/16" thread ¼" diameter shaft. **$.25**

JUNK BOX SURPRISE All good parts. Quantities too small to advertise. **$2.50**

ASSORTED TRANSISTOR RADIO 455 kc & 10.7 i-f transformers & osc. coils. Over 100 types. Micros, minis, etc. **4/$1.00.** *Specify 1st, 2nd, 3rd i-f or osc. & size, 455 or 10.7.*

GET A GRIP ! Handles – use for mobile mounts. Chrome, 4" x 11", large hole in end **$.25**

SUPER SMALL TRIMMER CAPS - rotational, singles – $.20, duals – $.25, quads – $.50. Terrific for xtal netting. Multis have common "GND"

ASSORTMENT of 110V AC phono, tape, fan motors. Also some DC phono and tape motors **$1.00**

ASSORTED FERRITE ANTENNAS & RODS. Over 50 types. **4/$1.00, 1 of each $10.00**

ELECTROLYTICS

40/20/20	50WVDC	Upright Tab MT	
40/20/5	150/150/25	1-7/8L x 7/8Dia.	
1200/1200	15V	Can	50¢ ea.
1000/1000	20V	Can	50¢ ea.
3300	16V	Tubular	25¢ ea.
500	15V	Tubular	25¢ ea.
500	50V	Tubular	25¢ ea.
500	10V	Tubular	25¢ ea.
470	10V	Tubular	25¢ ea.

Assortment other values 4/$1.00

Over ½ million parts on hand! The boss says get rid of 'em. 50% off if you'll buy all we have of an item!
Top that $1 a pack people.

All sales cash with order, include estimated UPS charge for shipping. $2.00 minimum order. No COD under $10.

COMMUNICATIONS UNLIMITED

9519 MAIN STREET P.O. BOX 463
WHITMORE LAKE, MICHIGAN 48189

STORE HOURS
NOON–6pm TUES.– SAT.

(313) 449-4367

IT ONLY HAPPENS ONCE IN A LIFETIME!

NORELCO VIDEO TAPE RECORDER-PLAYBACKS

tape *YOUR FAVORITE TV SHOWS....*

build *AN INEXPENSIVE LIBRARY OF THE TV SHOWS YOU LIKE BEST...*

*WEIGHS ONLY 26 POUNDS
*LONG LIFE FERITE HEADS
*EXTREMELY QUIET
*USES INEXPENSIVE 1/2" TAPE
*HORIZ RESPONSE 2½ MHz
*OPERATES FROM 110 VOLT AC.
*SOME MODIFIED WITH LIGHT TO INDICATE UNIT IN USE.
*STANDARD AUDIO-VISUAL SIGNALS

BRAND NEW, AS IS. . .$399.00

ALSO, SHIBADEN FP-707 VIDICON CAMERA, WITH CRT VIEWFINDER AND LENSES 12 VOLT D.C. REQUIRED AND EXTERNAL SYNC. . .NEW COST $750.00, NOW **$325.00**

AC POWER SUPPLY AND SYNC GENERATOR FOR THE ABOVE. . .NEW: **$65.00**

HUNDREDS OF ADDITIONAL VIDEO ITEMS, WRITE FOR LIST, SASE

COMMUNICATIONS UNLIMITED

9519 MAIN STREET P.O. BOX 463
WHITMORE LAKE, MICHIGAN 48189

Store hours, noon to 6PM, Tuesday thru Saturday. (313-449-4367)

A&W FM VHF UHF A&W

KAUFMAN BALUN

new and improved
molded plastic

KAUFMAN water tight BALUN

with or without BALUN
1:1 impedance match

Patent No. D219106

For dipoles, beams, inverted "V", and quads

KAUFMAN Center Insulator with BALUN	$12.50 postpaid USA
KAUFMAN Center Insulator without BALUN	7.50 postpaid USA
Dragon Fly antenna construction sheet and drawing	$2.50 postpaid USA

hallicrafters

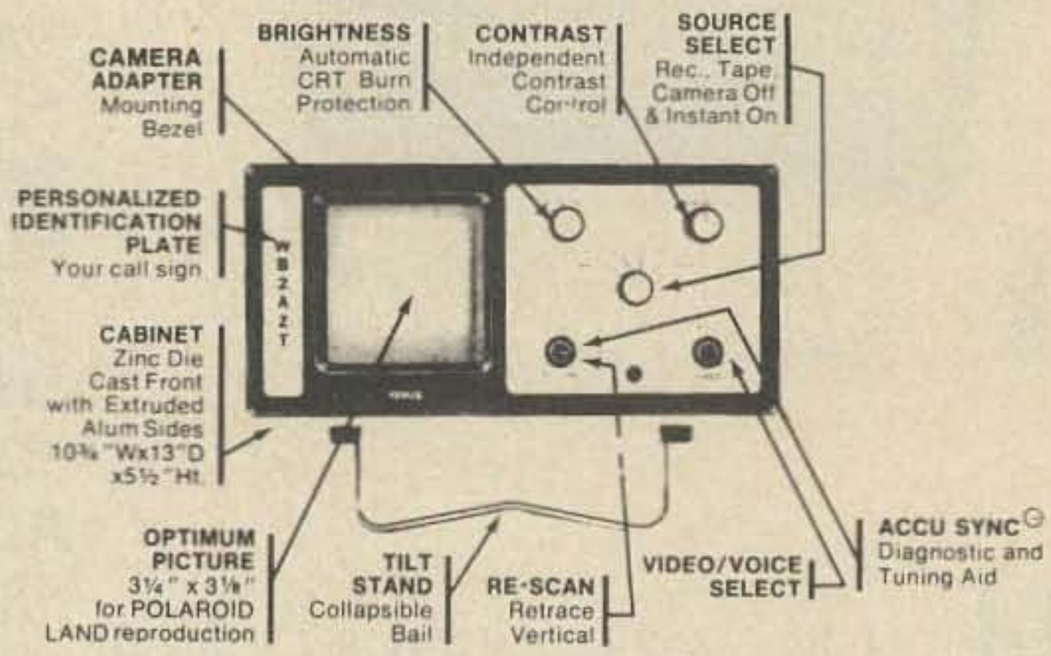
FPM 300

WHILE THEY LAST!

$500.00

Venus Slo-Scan

TV monitor



Regency

Light weight, "Take anywhere"

Model HRT-2

5 Channel, Narrow Band
2.2 watt FM Transceiver

Clegg

FM27B w/ Pwr supply

. . . 479.00

Standard Communications

826MA
12 ch 10 watts
$398.00

SEND FOR OUR CATALOG WITH SPECIAL PRICES

A&W ELECTRONICS

491 Riverside, Medford, Mass. 02155
(617-396-5550)

GODBOUT

BILL GODBOUT ELECTRONICS

BOX 2673, OAKLAND AIRPORT, CA 94614

AUGUST SPECIALS

MAN 1 7 Seg readouts — $3.25. Discrete LED grab bag — 10 for $1.35[

8008 PROCESSOR 8 bit on a chip **$50.00**

TTL SPECIAL 74175 Quad Latch **$1.10**

MOS DYNAMIC MEMORY 1 x 1024 bit MM5260 . . . . . **$5.00**

LINEAR SPECIAL 741 Mini Dip op amp . . . . . **10/$3.50**

DTL SPECIAL 946 quad NAND TTL compatible plug in replacement for 7400 in many applications . . . . . **5/$1.00**

12V 8A Regulated Power Supply Parts Kit. Ideal for powering FM rigs. Everything except the chassis **$17.95**

LM 309K 5V 1A REG **$1.75**

LM 320K NEG Reg available in 5V 12V & 15V **$2.25**

LM 340K POS Reg available in 6V, 8V, 12V, 15V, 24V **$2.25**

4194 TK adjustable dual tracking reg TO66 . . . . . **$3.90**

4195 TK dual tracking reg ±15V TO66 . . . . . **$3.40**

ICs, most TTL & LINEAR in stock — Send stamp for FREE catalog

CMOS DIGITAL

74C00	.60	CD4011	.60	CD4042	2.95	555	1.00
74C02	.60	CD4012	.60	CD4044	2.95	556	1.60
74C04	.85	CD4013	1.25	CD4049	1.25	723T	.95
74C10	.60	CD4014	4.00	CD4050	1.25	723D	.75
74C20	.60	CD4015	4.00	CD4116	1.50	741M	.45
74C73	1.65	CD4016	1.25			741T	.50
74C74	1.25	CD4017	3.20			747D	.85
74C76	1.75	CD4018	3.25			748M	.65
74C107	1.75	CD4019	1.25			1595	1.50
74C151	3.30	CD4020	5.50			1596	1.75
74C160	3.25	CD4021	4.00			CA3028	.75
74C161	3.25	CD4023	.60			CA3065	.75
74C162	3.25	CD4024	3.00			CA3086	.45
74C163	3.25	CD4025	.60			3900	.75
74C195	3.15	CD4027	1.75			4136	2.00
CD4001	.60	CD4029	6.00			4250T	2.25
CD4002	.60	CD4030	.60			5556M	1.50
CD4008	4.00	CD4035	2.50			5558	.90
CD4009	.95	CD4037	2.95				
CD4010	.95	CD4040	5.00				

LINEAR

LM301M	.45
LM311M	1.20
LM318	1.75
LM339	2.00
LM370	1.25
LM371	1.25
LM372	1.25
LM374	2.00
LM380	1.65
LM381	1.75
LM382	1.75
LM399	1.75

ALL ITEMS IN STOCK and will be shipped within 24 working hours of receipt of order!

Include 50¢ postage and handling on orders under $10.00

Sorry, NO C.O.D.'s. CALIFORNIA RESIDENTS ADD sales tax.

7-SEGMENT READOUT
12-PIN DIP

- Three digits with right-hand decimal
- Plugs into DIP sockets
- Similar to (LITRONIX) DL337
- Magnified digit approximately .1"
- Cathode for each digit
- Segments are parallel for multiple operation
- 5 - 10 MA per segment

BRAND NEW

EACH $3.00 4 (12 Digits) $11.00

RCA NUMITRON

EACH.....$ 5.00

SPECIAL: 5 FOR $20.00

DR2010

Potter & Brumfield

TYPE KHP RELAY 4 PDT 3A CONTACTS

24 VDC (650 coil)....$1.50

120 VAC (10.5 MA coil).... 1.75

Power Supply SPECIAL!

723 DIP variable regulator chip 1-40V, + or - output @ 150 MA 10A with external pass transistor--With diagrams for many applications.

EACH....$1.00 10 FOR....$8.95

CT5005 CALCULATOR

This calculator chip has a full four-function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtracts entry from memory), CM (clear memory, without clearing rest of registers), RM (read memory or use as entry).

- 12-Digit display and calculate
- Fixed decimal at 0, 1, 2, 3, 4, or 5
- Leading zero suppression
- 7-Segment multiplexed output
- True credit sign display
- Single 28-pin chip

CHIP AND DATA.....ONLY $14.95
DATA ONLY (Refundable)..... 1.00

5001 CALCULATOR

40-Pin calculator chip will add, subtract, multiply, and divide. 12-Digit display and calculate. Chain calculations. True credit balance sign output. Automatic over-flow indication. Fixed decimal point at 1, 2, 3, or 4. Leading zero suppression. Complete data supplied with chip.

CHIP AND DATA.....ONLY $9.95
DATA ONLY (Refundable).... 1.00
5002 LOW POWER CHIP AND DATA..12.95

All ICs are new and fully-tested; leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 35¢ for handling and postage for smaller orders; residents of California add sales tax. IC orders are shipped within 2 workdays--kits are shipped within 10 days of receipt of order. $10.00 minimum on C.O.D.s (phone in).

MAIL ORDERS:
P. O. Box J
Carmichael, CA
95608

4811 Myrtle Ave.
Sacramento, CA
(916) 334-2161

MONEY BACK GUARANTEE ON ALL GOODS!

SEND FOR FREE FLYER LISTING 100's OF MONEY-SAVING BARGAINS!

BABYLON ELECTRONICS

CTμL SPECIAL:

Complementary Transistor Logic

This logic family is unique in that both NPN and PNP transistors are combined in the same package. Unlike TTL and DTL, the outputs are current sources (in the high state) as well as sinking current in the low state. Those are brand new units, some of which are mismarked with DTL numbers.

CTL 9956 dual 2-input AND buffer
CTL 9953 2-2-3input AND/OR gate
CTL 9952 dual 2-input NOR gate

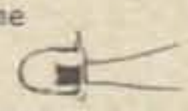
Data supplied; all parts are dual-in-line.

MIX OR MATCH 5 FOR $1.00

LED's

MV50 red emitting 10-4 ma @ 2V — $ .20 / 10 FOR 1.25

MV5024 red TO-18 high dome — $ .35 / 10 FOR 2.95



MV10B visible red 5-7 ma @ 2V — $ .30 / 10 FOR 2.50

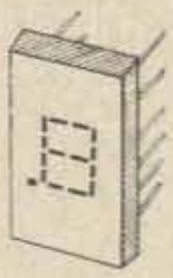
CMOS

CD4001	$ .75	74C20	.75
CD4002	.75	74C160	3.25

3-Amp Power Silicon Rectifiers Marked Epoxy Axial Package

PRV	PRICE	PRV	PRICE
100.....	$ .10	800.....	$ .30
200.....	.15	1000....	.40
400.....	.18	1200....	.50
600.....	.23	1500....	.65

MAN 1



7-Segment, 0-9 plus letters. Snaps in 14-pin DIP socket or Molex. Operates with IC voltage requirements. Long operating life.
ONLY $3.25

7400	$ .25	74L51	$ .30
74H00	.35	74H51	.35
7401	.20	7453	.20
74H01	.35	7454	.25
7402	.35	74L54	.35
7403	.30	74L55	.35
7404	.28	7460	.20
74H04	.35	74L71	.30
7405	.28	7472	.40
7406	.70	74L72	.50
7408	.35	7473	.60
74H08	.35	74L73	.75
7410	.25	7474	.65
74H11	.35	74H74	.80
7413	1.25	7475	1.40
7417	.40	7476	.60
7420	.25	74L78	.80
74L20	.35	7480	.65
74H20	.35	7483	1.00
74H22	.35	7489	4.00
7430	.25	7490	1.20
74H30	.35	7492	.90
74L30	.40	7493	1.15
7440	.25	7495	1.15
74H40	.35	74L95	2.00
7441	1.25	74107	.70
7442	1.20	74121	1.25
7446	1.75	74154	2.30
7447	1.50	74193	1.50
7448	1.50	74195	1.00
7450	.25		
74H50	.35		
7451	.25		

7400 Series DIP

RECTIFIERS

VARO FULL-WAVE BRIDGES

V5447	2A	400V	$ .90
V5647	2A	600V	1.10
MR810 Rect.		50V 1A	.10

Special 811: Hex Inverter

TTL DIP Hex Inverter; pin interchangeable with SN 7404. Parts are brand new and are branded Signetics and marked "811."

Data Sheet Supplied

EACH.....$ .30
10 FOR..... 2.50
100 FOR.... 23.00
1000 FOR... 220.00

MAN 3

0-9 plus letters.

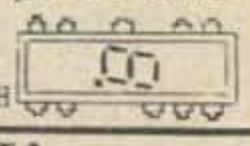
Right-hand decimal point. Flat-pack type case. Long operating life. IC voltage requirements. Ideal for pocket calculators!

EACH $1.25
10 OR MORE 1.00

MAN4

Seven-segment, 0-9 plus letters. Right-hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!

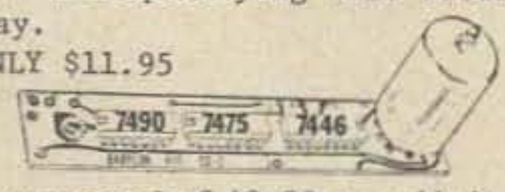
EACH.....$2.75
TEN OR MORE 2.50 EACH



CD-2 Counter Kit

This kit provides a highly sophisticated display section module for clocks, counters, or other numerical display needs. The unit is .8" wide and 4 3/8" long. A single 5-volt power source powers both the ICs and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all 7 segments to light. Kit includes a 2-sided (with plated thru holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR 2010 RCA Numitron display tube, complete instructions, and enough Molex pins for the ICs . . NOTE: boards can be supplied in a single panel of up to 10 digits (with all interconnects); therefore, when ordering, please specify whether you want them in single panels or in one multiple digit board. Not specifying will result in shipping delay.

COMPLETE KIT, ONLY $11.95
FULLY-ASSEMBLED UNIT $15.00



Boards supplied separately @ $2.50 per digit.

LINEARS

NE540	70-Watt power driver amp	$2.00
NE555	Precision timer	1.50
NE560	Phase lock loop DIP	3.25
NE561	Phase lock loop DIP	3.25
NE565	Phase lock loop TO-5	3.25
NE566	Function generator TO-5	4.00
NE567	Tone decoder MINI DIP	4.00
NE567	Tone decoder TO-5	3.00
NE5558	Dual 741 op amp MINI DIP	1.00
709	Popular Op Amp DIP	.45
710	Voltage comparator DIP	.75
711	Dual comparator DIP	.40
723	Precision voltage regulator DIP.	1.00
739	Low noise op amp DIP unmarked...	1.00
741	Op amp TO-5/MINI DIP	.55
747	Dual 741 op amp DIP	1.00
748	Op Amp TO-5	1.00
CA3018	2 Isolated transistors and a Darlington-connected transistor pair...	1.00
CA3026	Dual differential amp	1.00
CA3045	5 NPN transistor array	1.00
LM100	Positive DC regulator TO-5	1.00
LM105	Voltage regulator	1.25
LM302	Op amp voltage follower TO-5	1.25
LM308	Op Amp TO-5	2.00
LM309H	5V 200 MA power supply TO-5	1.00
LM309K	5V 1A power supply module TO-3	2.00
LM311	Comparator TO-5	1.75
LM370	AGC amplifier	2.00
LM380	2-Watt Audio Amp	1.75
LM1595	4-Quadrant multiplier	2.00
MC1536T	Op Amp	2.00

Simply The Best···

ICOM

3—8 Kamikuratsukuri-cho, Higashi Sumiyoshi-ku,
Osaka, Japan.

Proudly Distributed Warranted and Serviced

By

ICOM WEST INC.
Suite 232— Bldg.II
300·120th Avenue N.E.
Bellevue, Washington, 98005
(206)454-2470

ICOM EAST Div ACS Inc.
Suite 501
13777 N.Central Expwy.
Dallas, Texas, 75231
(214)235-0479

NOW AVAILABLE FROM SOLID STATE SYSTEMS, INC.
LOW-COST FIELD EFFECT TRANSMISSIVE AND/OR REFLECTIVE LIQUID CRYSTAL AC DISPLAY

DESCRIPTION

Only one liquid crystal display provides excellent contrast and readability in diffused light: FELIX. Field Effect Liquid Crystal from Ilixco.

FELIX liquid crystal displays produce superior optical properties than other liquid crystal systems because of their bi-level characteristic. The Felix display system has two distinct optical states, so that display segments are fully off at 3 volts and completely on at 7 volts.

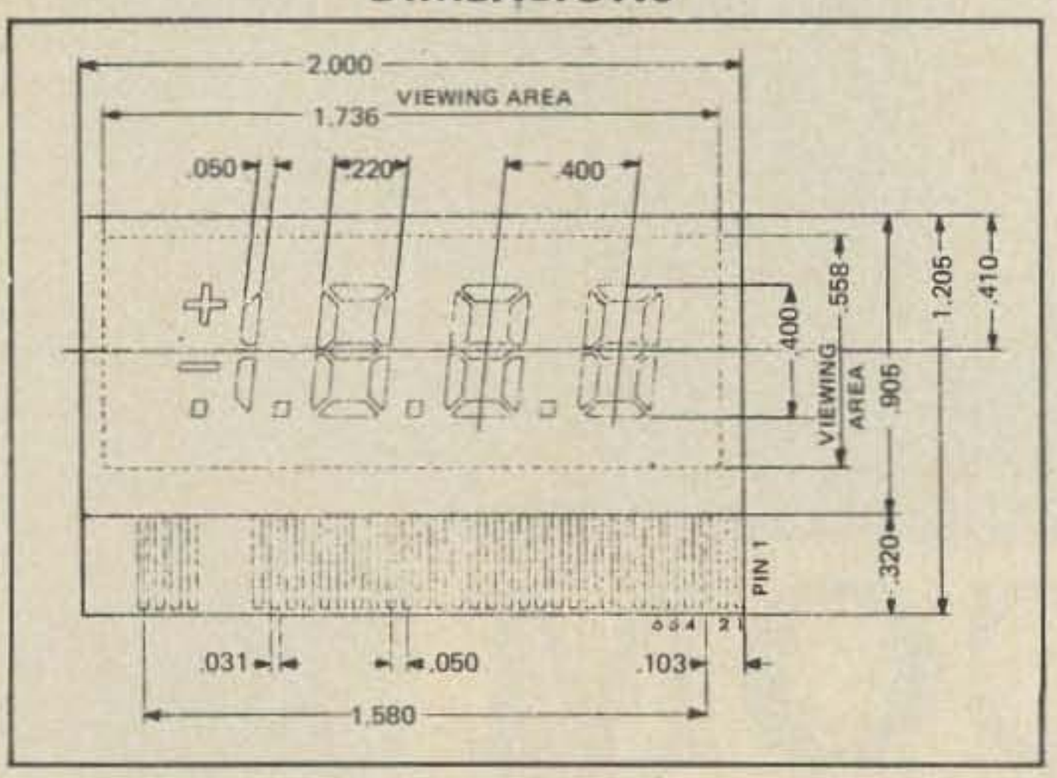
Bi-level refers to the two levels of optical activity present in specially organized liquid crystals. In the quiescent state, the level is referred to as a 90° rotation of the plane of polarized light. That is, when a liquid crystal organized in this manner is inserted between a polarizer and an analyzer which are parallel, the light transmission will be at a minimum. The other level of the bi-level system is zero degrees rotation of the plane of polarized light, which occurs upon the application of a well defined voltage, giving maximum transmission.

Extremely low voltage threshold provides full compatibility with TTL and MOS devices. The power consumption of the ON segment is less than ½ microwatt.

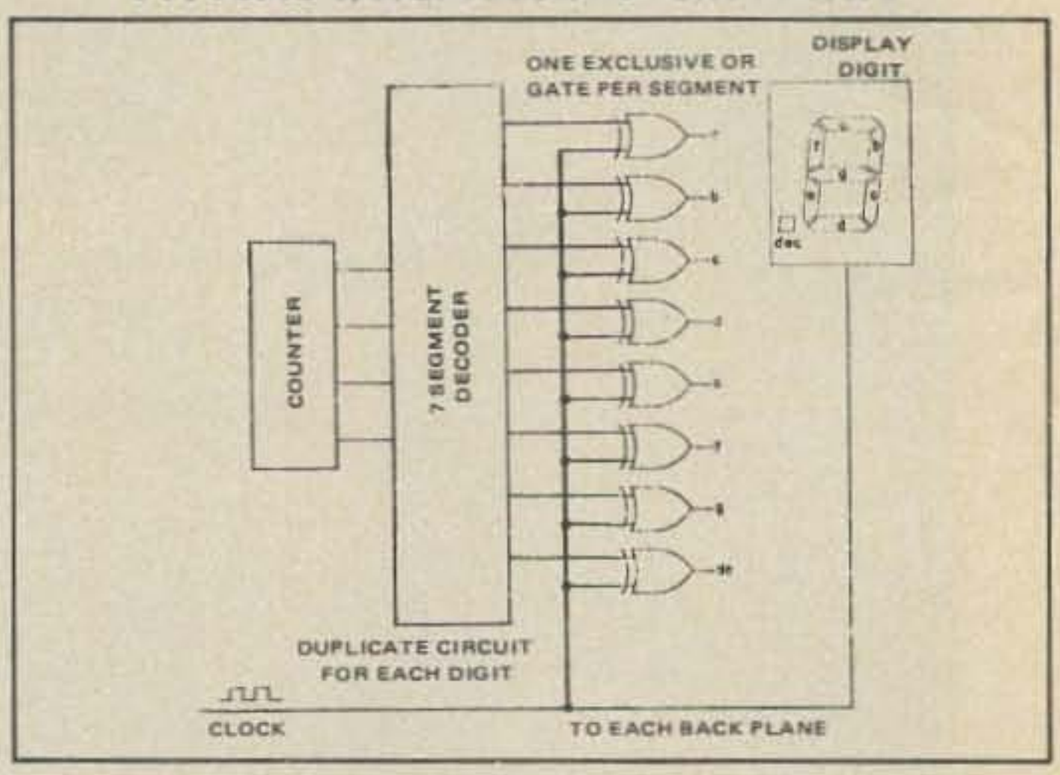
FEATURES

- ★ Excellent contrast in ambient light
- ★ Field effect
- ★ Wide temperature range
- ★ Low voltage operation (7 volts)
- ★ Extremely low power consumption
- ★ Transmitted or reflected light displays
- ★ Operates 60–10 KHz
- ★ Plugable

DIMENSIONS



TYPICAL INTERFACING CIRCUITRY



ASSEMBLED COUNTING BOARDS

Completely assembled and tested counting board, consisting of above display and connector, three decade to 7-segment decoder (7448), seven AC pulse drive generators (7486), and tin plated glass-epoxy PC board with edge connector pattern is available as part number 94-06051.

PRICES

Catalog Number	Description	1-4	5-9	10-24	25 Up
94-06051	Complete Assembly	15.50	14.50	13.50	12.50
84-06051	Display & Connector Only	9.75	9.00	8.25	7.50

PIN CONNECTIONS

PIN	SEGMENT	PIN	SEGMENT
1.	---	21.	b
2.	---	22.	g
3.	b	23.	c
4.	g	24.	d
5.	c	25.	B.P.
6.	d	26.	e
7.	B.P.	27.	f
8.	e	28.	a
9.	f	29.	DEC.
10.	a	30.	1
11.	DEC.	31.	DEC.
12.	b	32.	-
13.	g	33.	+
14.	c	34.	B.P.
15.	d	35.	---
16.	B.P.	36.	---
17.	e	37.	---
18.	f	38.	---
19.	a	39.	---
20.	DEC.	40.	---

SOLID STATE SYSTEMS, INC.

SEND YOUR ORDER TO:

SOLID STATE SYSTEMS, INC.
P. O. BOX 617
COLUMBIA, MISSOURI 65201

OR PHONE (TOLL FREE):

800–325–2595 & 800–325–2981

NEW PRICES

Rather than sacrifice quality and because of several large increases in our raw material costs we are obliged to raise the prices of our PS-12 and PS-24 power supplies – effective immediately. THEY'RE STILL A BARGAIN!

PS–12

12 Amp regulated 2%
50 mV Ripple Max.
Adjustable 11–15 VDC

WIRED $85.95
KIT $69.95

Shipping Weight 12 lbs.

new prices

PS–24

24 Amp regulated 2%
50 mV Ripple Max.
Adjustable 11–15 VDC

WIRED $99.95 *
KIT $85.95

Shipping Weight 21 lbs.

* *PS–24 SHIPPED with BASE PLATE – LESS CASE, AS SHOWN*

2 METER FM PORTABLE

4 CHANNELS 2 WATTS
DUAL CONVERSION

HT-144 kit

still *only* $99.95

RGS ELECTRONICS

AUGUST ONLY

LM3900 Quad amps, 2/1.00

Untested LM709D, 1½ oz. for $1.00 (approx. 45 pcs.)

SOMETHING NEW UNDER THE SUN: "THE CUBE"
Fully assembled subaudible tone generator for your small hand-held or portable FM radio. Works on 9–16 volts; no moving parts; set on any frequency between 98 and 240 Hz with a trim resistor.
0.5" x 0.6" x 0.7" **$19.95**
Set on frequency by the factory, $5.00 extra.

PS 25-1 Zero to 25 volt 1 amp lab type power supply with adjustable current limiting; has remote sensing and remote programming for voltage and current. Instructions included. All parts supplied except chassis and meter(s).

Kit of parts with schematic $14.95

LT-1 Digital logic tester, uses 5 volts, will test TTL, DTL and CMOS. Has internal slow clock. All parts supplied except power supply, chassis, panel and board.

Kit of parts with schematic $19.95

8008 COMPUTER KIT with manual, wire-wrap board and power supply parts. $300.00 after discount. Manual only – $25.00.

TTL

7400	$ .25	7476	$ .65
7401	.25	7483	1.25
7402	.25	7485	1.40
7403	.25	7486	.50
7404	.30	7489	3.25
7405	.30	7490	1.00
7406	.50	7492	1.00
7407	.50	7493	1.00
7408	.30	7495	1.00
7409	.30	7496	1.00
7410	.25	74107	.60
7411	.30	74121	.60
7413	.90	74122	.60
7416	.50	74123	1.10
7417	.50	74125	.65
7420	.25	74126	.65
7430	.25	74141	1.25
7432	.30	74151	1.10
7437	.50	74153	1.40
7438	.50	74154	1.70
7440	.25	74157	1.40
7442	1.10	74164	2.00
7446	1.45	74165	2.00
7447	1.45	74166	2.00
7448	1.45	74176	1.60
7450	.25	74177	1.60
7451	.25	74181	4.50
7453	.25	74192	1.75
7454	.25	74193	1.50
7473	.50	74195	1.15
7474	.50	74200	9.00
7475	1.00		

WIRE WRAP SOCKETS

14 pin	$ .55
16 pin	.65
24 pin	1.30
28 pin	1.40
40 pin	1.85

wire-wrap socket pins
$ .05 $4/100

¼ WATT RESISTORS $ .05 $4/100

We have most 10% values.

OP AMPS

301T	$ .50
301M	.45
307T	.70
307M	.65
318T	1.50
709D	.20
709T	.30
709M	.25
739D	1.00
741D	.35
741T	.50
741M	.45
748M	.40
747T/ 5558T	1.05
5558M	1.00
4131M	1.00
4132M	1.25

M = miniDIP — D = DIP — T = TO-5

TRANSISTORS	1–9	10+
NPN TO-18 gen. purpose silicon	$ .15	$ .10
PNP TO-18 gen. purpose silicon	.15	.10
2N2222 (NPN) TO-18	.25	.20
2N2907 (PNP) TO-18	.25	.20

JUNCTION FETs, TO-18 case

N-CHANNEL:	SIMILAR TO:	
NJF10	2N4416, MPF102	3/$1.00
NJF11	2N4091-93	4/$1.00
NJF12	2N4338-41	4/$1.00
NJF13	2N3089	3/$1.00
NJF14	2N4221-22	4/$1.00
P-CHANNEL:		
PJF11	2N3382-86	4/$1.00
PJF14	2N2608	4/$1.00

All FETs come with data sheets.

LED PACKS

LED 10R – Ten discrete red lens LEDs, various MV5020 types $1.50

LED 10C – Ten discrete clear lens LEDs, various MV5020 types $1.50

Application note included.

1N914 EQUIVALENT DIODES
$ .10 $8/100

RGS ELECTRONICS
3650 Charles St., Suite K • Santa Clara, CA 95050 • (408) 247-0158

We sell many ICs and components not listed in this ad. Send a stamp for our free flyer.
TERMS OF SALE: All orders prepaid; we pay postage. $1.00 handling charge on orders under $10.00. 10% off on orders over $25.00. California residents please include sales tax. Please include name, address and zip code on all orders and flyer requests.

CALCULATOR KIT

Kit contains NORTEC calculator chip 4024,21 driver transistors, 8 LED's, 7 segment readout by EXITON, 3 LED for overflow, low btry, over-range, a keyboard by FLEX KEY. All this $45 value for only ..... $16.50 2 for $27

BASIC CLOCK KIT

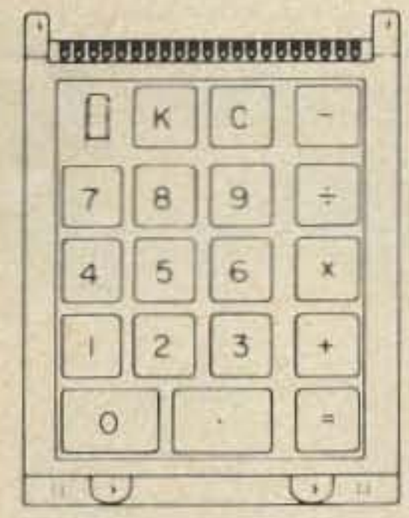
We furnish clock chip CT7001 and 4 first line LED readouts .3 inch hgt. You furnish the misc. minor parts. A $35 value for $19.95

LIQUID CRYSTAL WATCH

Build a wrist watch or desk clock with this liquid crystal display. Recently written up in several magazines. Display with special socket reads hours and minutes ..... $15 2 for $25

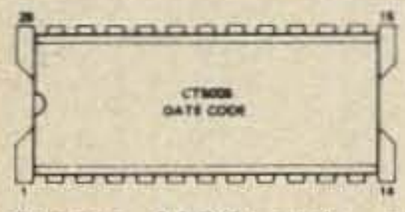
UNDERWATER LISTENING

Brand new by OLIN. Use it for a swim pool monitor-alarm, use it on lake or ocean listening to underwater noises, fish, etc. Complete with hydrophone, 50 ft. mike cable, speaker-amplifier console. Operates from 115 volts AC or 15 volt dry cells. 12 lbs $25



CALCULATOR KEYBOARD

only $1.49



CT 5005 CALCULATOR CHIP

Single MOS chip with all logic required for 12 digit 4 function desk top calculator with extra storage register for memory or constant. Multiplexed 7 segment outputs for LED, Incandescent, Fluorescent, or Gas Discharge displays. Brand new, bargain priced, with specs.

$8.00 each, 2 for $15.00

AM-FM RADIO $5.50

Due to the West Coast ship strike they came in too late for the customer. Now it's your bargain. Use it as is or build it into your own cabinet, desk, wall, etc. All built, ready to use, with AC supply. To make it portable all you do is power it with a couple of "D" cells. Fully assembled solid state chassis with AC power supply, less speakers. Covers full AM as well as FM broadcast. The price . . . an astounding meager $5.50

313,344 CORE MEMORY $125.00

From SPECTRA computer, visually OK. 64 x 68 x 4 x 18 core stack. Figures out to 35K Byte.

CLOCK/CALENDAR ALARM CHIP

These large scale integrated (LSI) chips eliminate literally thousands of components or hundreds of chips in the construction of a clock. For most applications only a single supply and a minimum of components are required.

☐ 7001 Chip - Features 28/30/31 day calendar, 12/24 hour clock, 24 hour clock, 24 hour alarm, snooze alarm, 6 digit display, direct drive to luminescent anode tubes or LED segments, single transistor interface with Sperry displays. Segment and digital outputs can be "wire" or "D" to share calculator displays ..... $9.95 each, 2/$18.00

IC SALE YOUR CHOICE 3 for $1.00

μl 900 BUFFER TO-5
μl 914 DUAL 2 INPUT GATE TO-5
μl 923 JK FLIP FLOP TO-5
μl 926 Hi speed JK FLIP FLOP TO-5
μl 931 JK/RS FLIP FLOP (DIP)
10 pin socket for TO-5 IC

GIANT NIXIE B7971

Used $1.00 Brand New $2.00
With schematic for GIANT clock.

CALCULATOR CHIPS

5001 LSI (40 pin) Add, subtract, multiply divide 12 digit. With data $6.95
Data alone ..... 50 cents

CMOS 4814 HEX INVERTER

CMOS HEX INVERTER, dual inline package. 3-18 volt range, dual diode protection against static charge. Dielectrically isolated complimentary MOS. $1.00 each 12 for $10.00

DUAL 16 BIT MEMORY

Dual 16 bit memory, serial MOS by Philco TO-5 case, brand new with 2 page specs.
#PLR 532 $1.00 each $10/12

8 TRACK STEREO TAPE DECK

With built-in stereo pre-amp, 115 volt drive motor, channel indicator lamps. Unused, original boxed, less cabinet. Customize your stereo music center with one of these tape decks.

#46 ..... $14.00

RCA INJECTION LASER DIODES

Another SUPER SCOOP by Meshna. Brand new RCA packaged, considered obsolete by RCA but what an exotic opto-electronic device for the sophisticated experimenter. Only several hundred on hand. Values shown are approx. as each diode characteristic varies. Each is marked with correct value.

6 WATT $10.00
10 WATT $15.00

Postage Extra on all items

JOHN MESHNA JR. ELECTRONICS P. O. Box 62 E. Lynn, Mass. 01904

NATIONAL LINEAR OP AMPS — BUY ANY 3 — TAKE 10%

☐ LM-300	POS V.R. (super 723) TO-5	$ .91
☐ LM-301	Hi-performance op amp (A)	.41
☐ LM-302	Voltage follower TO-5	.91
☐ LM-305	Pos. voltage Reg. TO-5	1.19
☐ LM-307	Super 741 op amp (A)	.41
☐ LM-308	Hi-Q fet type op amp TO-5	1.19
☐ LM-309H	5V Volt-Regulator TO-5	1.19
☐ LM-309K	5V Volt.-Reg. 1 Amp TO-3	1.85
☐ LM-310	Voltage-Follower TO-5	1.25
☐ LM-311	Hi-perf. Volt. Comp. (A)	1.19
☐ LM-319	Hi-speed Dual Comp. DIP	1.50
☐ LM-320	MINUS 5, 12 or 24V V.R. TO-3	1.50
☐ LM-339	Quad Comparator. DIP	2.50
☐ LM-324	Quad (4-741's in DIP)	2.50
☐ LM-350	Dual peripheral driver	.41
☐ LM-370	AGC Squelch op amp, TO-5	1.19
☐ LM-373	AM-FM SSB I.A.D, TO-5	3.50
☐ LM-374	AM-FM SS IVAD TO-5	3.50
☐ LM-377	Dual 2-watt audio amp	3.00
☐ LM-380	2-watt audio amplifier TO-5	1.69
☐ LM-381	Low noise dual pre amp DIP	1.95
☐ LM-382	Low noise dual pre amp DIP	1.95
☐ LM-703	RF-IF amp, TO-5	.55
☐ LM-709	Operational amplifier (A)	.36
☐ LM-710	Differential amplifier (A)	.45
☐ LM-711	Dual Differential Amp (A)	.36
☐ LM-723	Voltage Regulator (A)	.69
☐ LM-725	Instrument Op Amp	.95
☐ LM-733	Differential Video	1.75
☐ LM-741	Freq. Comp. 709 (A)	.41
☐ LM-741CV	Mini DIP 741C	.45
☐ LM-747	Dual 741 (A)	.89
☐ LM-748	Freq. adjustable 741C (A)	.44
☐ LM-1303	Stereo pre amp DIP	.95
☐ LM-1304	FM Stereo Multiplexer	1.25
☐ LM-1307	FM Multi. Stereo Dem. DIP	.91
☐ LM-3028	Differential RF/IF amp	1.50
☐ LM-3900	Quad "current mirror" amp	.95
☐ LM-4250C	Programable op amp	2.50
☐ LM-75451	Dual peripheral driver	.44
☐ LM-75453	Dual peripheral driver	.44
☐ LM-75492	Hex digit driver, 250ma, DIP	1.85

(A) TO-5, Dip or mini Dip

1,000,000-PC INVENTORY

LINEAR Op Amps

• FACTORY GUARANTEED — FACTORY TESTED • FACTORY MARKED

☐ 531	Hi slew rate op-amp (TO-5)	$2.50
☐ 532	Micro power 741 (TO-5)	2.50
☐ 533	Micro power 709 (TO-5)	2.50
☐ 536	FET Input op amp (TO-5)	2.95
☐ 550	Precision 723 voltage reg. (DIP)	1.17
☐ 555	Timer 2 u Seconds to 1-hr. (A)	1.25
☐ 556	5 Times faster than 741C	2.10
☐ 558	Dual 741 (DIP)	1.00
☐ 560	Phase lock loops (DIP)	2.95
☐ 561	Phase lock loops (DIP)	2.95
☐ 562	Phase lock loops (DIP)	2.95
☐ 565	Phase lock loops (A)	2.95
☐ 566	Function generator (TO-5)	2.95
☐ 567	Tone decoder (A)	2.95
☐ 702C	Hi-grain, DC amp (TO-5)	.49
☐ 704	TV sound IF system	1.50
☐ 711C	Dual diff. comp (A)	.33
☐ 723C	Voltage regulator (A)	.69
☐ 741CV	Freq. comp 709 (Mini DIP)	.44
☐ 748C	Freq. adj. 741C (A)	.44
☐ 753	Gain Block	1.75
☐ 739-739	Dual stereo preamp	1.98
☐ 741-741	Dual 741C (TO-5)	.89
☐ PA265	5-Watt voltage regulator	1.00
☐ ULN2300M	Op amp with SCR	1.00
☐ CA3065	Video Audio system	1.00
☐ RC4195	Dual 15V Tracking V.R.	2.50
☐ 4136	Quad 741's (DIP)	1.95
☐ RC-2556	Dual 555's	2.25

(A) TO-5 or DIP — Buy any 3 — Take 10%

WRIST WATCH LIQUID CRYSTAL DISPLAY

***3-1/2 digit. 7 segment *Only 1-1/16 x 11/16 x 1/4"**

See POPULAR ELECTRONICS (Jan., 1974) for building your own electronic digital wristwatch using the Liquid Crystal Display (LCD) as its basic. Easy to see, 3½ digit display, requires less than 1/1000 of power as LED'S. Visibility increases with ambient light. Difficult reading of LED'S in light. Pulsates SECONDS in center of display. NO NEED OF TRANSISTOR-RESISTOR interface, as LED'S, thus smaller package. Chip contains holder, tiny connecting terminals, and "slide-in-place chrome spring face plate". Size of display in holder: 1-1/16 x 11/16 x ¼". Operating freq. 32 hertz. 45-microwatts of power. Operates from 1.5V hearing aid cell. Uses the new and latest C MOS micro-circuitry. We include copy of write up from PE magazine.

Only ☐ **$19.95**

HIGH POWER TRANSISTOR WITH HEAT SINK

☐ **$1.49** 3 for $3

Removed from new equipment! Includes popular 2N174 'doorknob' transistor TO-36, germanium PNP. 150 watts, VCBO 80V, 15 amps, 40 hfe. For ignition, high power transmitters, etc. Mounted on heat sink 5 x 2¼ x 1¼".

"THE PRO" — HI-Q DYNAMIC

PENCIL MIKE

☐ Only **$6.95**

Sold elsewhere for over $10. All metal construction, with stand, 6-ft. cord, and standard mike plug. By General Electric. NO IMPORT! Highly polished with chrome trim. Omni-directial, 20,000 ohm imp., 60 to 100Khz freq resp. Crisp, ultra-sensitive, high quality, hi-fidelity. Ideal for PA, CB, and all HAM equipment. May be hand-held too! Mike 5" long 1" dia., with taper. Heavy-duty grey metal stand, 2½ x 2¼ x ½". Ideal for our 60w stereo Amp. wt. 1-lb.

Brand New

Inflation-Fighting ECONOMY IC PRICES

Buy 3 or more, 10% discount

• Factory Marked — Order by type number! Spec sheets on request "ONLY" — Buy 100 — Take 20%

Type	Sale
☐ SN7400	$0.30
☐ SN7401	.30
☐ SN7402	.30
☐ SN7403	.30
☐ SN7404	.35
☐ SN7405	.35
☐ SN7406	.45
☐ SN7407	.55
☐ SN7408	.35
☐ SN7410	.30
☐ SN7411	.35
☐ SN7413	.95
☐ SN7416	.55
☐ SN7420	.30
☐ SN7421	.55
☐ SN7422	.35
☐ SN7425	.50
☐ SN7426	.55
☐ SN7430	.30
☐ SN7432	.55
☐ SN7437	.55
☐ SN7438	.55
☐ SN7440	.30
☐ SN7441	1.40
☐ SN7442	1.50
☐ SN7443	1.50
☐ SN7444	1.50
☐ SN7445	1.50
☐ SN7446	1.65
☐ SN7447	1.45
☐ SN7448	1.50
☐ SN7450	.30
☐ SN7451	.30
☐ SN7453	.30
☐ SN7455	.55
☐ SN7462	.35
☐ SN7464	.30
☐ SN7465	.50
☐ SN7471	.55
☐ SN7472	.50
☐ SN7473	.55
☐ SN7474	.55
☐ SN7475	1.00
☐ SN7476	.65
☐ SN7478	.95
☐ SN7480	.65
☐ SN7481	1.25
☐ SN7482	.99
☐ SN7483	1.25
☐ SN7486	.55
☐ SN7489	3.50
☐ SN7490	1.49
☐ SN7491	1.35
☐ SN7492	1.35
☐ SN7493	1.35
☐ SN7494	1.35
☐ SN7495	1.35
☐ SN7496	1.35
☐ SN74100	1.65
☐ SN74107	.70
☐ SN74108	.95
☐ SN74112	.95
☐ SN74113	.95
☐ SN74114	.95
☐ SN74121	.60
☐ SN74122	.95
☐ SN74123	1.20
☐ SN74125	.71
☐ SN74126	.71
☐ SN74140	1.25
☐ SN74141	1.95
☐ SN74145	1.55
☐ SN74148	4.50
☐ SN74150	1.61
☐ SN74151	1.25
☐ SN74153	1.60
☐ SN74154	2.10
☐ SN74155	1.55
☐ SN74156	1.45
☐ SN74157	1.55
☐ SN74158	1.55
☐ SN74160	1.95
☐ SN74161	1.75
☐ SN74163	1.95
☐ SN74164	2.95
☐ SN74165	2.10
☐ SN74166	2.05
☐ SN74173	2.50
☐ SN74175	3.20
☐ SN74176	2.10
☐ SN74177	2.10
☐ SN74180	1.20
☐ SN74181	3.95
☐ SN74182	1.20
☐ SN74185	2.50
☐ SN74192	1.95
☐ SN74193	1.95
☐ SN74194	1.95
☐ SN74195	1.25
☐ SN74196	2.50
☐ SN74197	2.50
☐ SN74198	2.65
☐ SN74200	9.95

* "DIP" Packages

7-SEGMENT LED Readouts

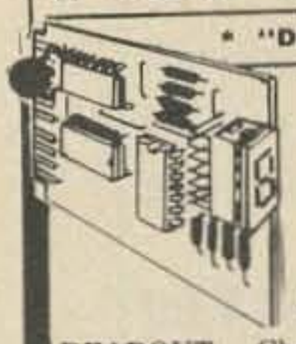
(All "LED" TYPES)

Type	Char.	Each	Special
☐ MAN-1	.27	$3.75	3 for $9.
☐ MAN-3	.12	1.49	3 for $3.
☐ MAN-4	.19	2.50	3 for $6.

REFLECTIVE BAR TYPES

☐ 707*	.33	2.50	3 for $6.
☐ 704*	.33	2.50	3 for $6.
☐ SLA-1**	.33	2.10	3 for $5.
☐ SLA-3**	.70	4.95	3 for $13
☐ SLA-11**	.33†	3.50	3 for $10
☐ SLA-21**	.33††	3.95	3 for $10.

*By Litronix. **By Opcoa, equal to MAN-1 or MAN-4 specs. Color - RED. †Green. †† yellow



LED MITY DIGIT "DCM'S"

Buy 3 — Take 10%

Only **$9.99**

Scientific Devices "Digital Counting Modules" outperform any other DCM on the market today. More features than ever before! Not gaseous, not incandescents, not nixie but the modern LED. Choose from such famous manufacturers as Monsanto's MAN-1, MAN-4, Litronics 707 and 704, Opcoa's SLA-1 (the last 4 having character heights of 0.33 at no extra charge). Each kit includes 3x2" p.c board with fingers for a FREE edge connector, side-mounting dip socket, LED readout of your choice, resistors, 3 IC's, and Molex connectors (this ELIMINATES SOLDERING YOUR IC's), and booklet. **INCLUDES P.C. EDGE CONNECTOR — FREE!**

READOUT	Char.	Maker
☐ MAN-1	.27 h.	Monsanto
☐ MAN-4	.19 h.	Monsanto
☐ 707*	.33 h.	Litronics
☐ 704**	.33 h.	Litronics
☐ SLA-1*	.33 h.	Opcoa

* Pin-for-pin MAN-1, ** Pin-for-pin MAN-4, elec. char. same

METAL-ENCASED

☐ **$3.50** 3 for $9

6.3 VOLT 3 AMP

Heavy-duty, 110VAC to at 3 amps filament transformer. 3 x 2½ 2½ With color-coded wires.

POLY PAKS BLUE RIBBON Policy INCLUDES

20-Years of Business INTEGRITY

20-Years of Money-Back GUARANTEES

20-Years of Economy! LOWEST PRICES!

NOW! 48-HR. SERVICE

SANKEN HYBRID AUDIO POWER AMPS

Mfgr's Type	Watts	Sale
☐ SI-1010Y	10	$ 8.88
☐ SI-1025E	25	18.88
☐ SI-1050E	50	29.95

Used extensively in hi-fi systems, tape decks, FM tuners, record players, stereo components, musical instruments, P.A., etc. All amplifiers, flat within ½ db from hz to 100,000. Each unit properly heat-sinked, with heavy-duty connecting tie lug connections. Single-ended pushpull output. Power supply required 24VDC. Output to 8 ohms. Order by Stock No.

SILICON TUBES

☐ 5U4	$1.49
☐ 5R4	3.95
☐ 866	7.95

HIGH VOLT 1AMP

PIV	SALE
☐ 2000*	1.00
☐ 3000	1.35
☐ 4000	1.65
☐ 5000	2.25
☐ 6000	2.96
☐ 8000	3.50
☐ 10000	3.95

EPOXY FULL WAVE SILICON BRIDGE RECTIFIERS

Code: 2 amp TO-5 case

PIV	2 Amp	6 Amp
50	☐ $.69	☐ $.88
100	☐ .79	☐ .99
200	☐ .95	☐ 1.25
400	☐ 1.19	☐ 1.50
600	☐ 1.35	☐ 1.75
800	☐ 1.59	☐ 1.95
1000	☐ 1.79	☐ 2.25

6 Amp ½ x ½ x 3/16 sq

SCRS! TRIACS! QUADRACS! SAME PRICE SALE!

10-Amp Power Tab Plastic Units

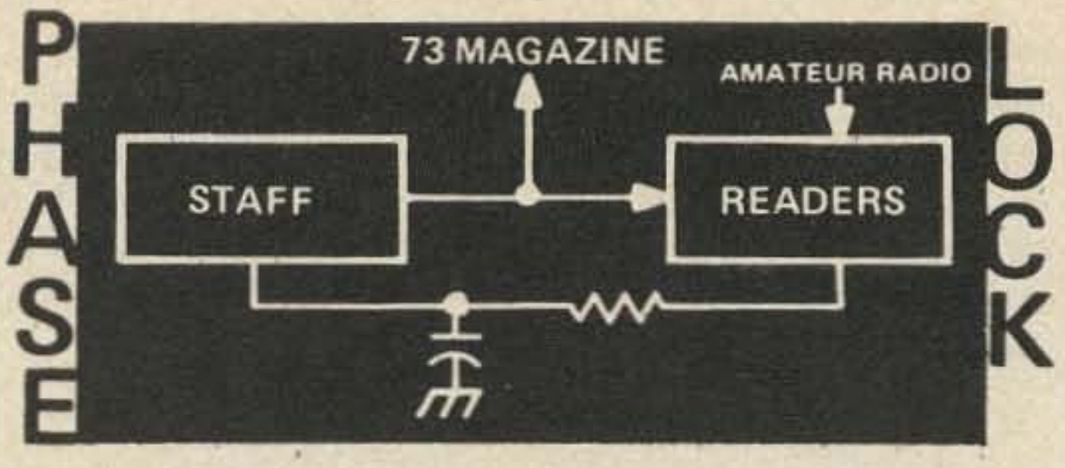
PRV	Exclusive Sale
☐ 50	$ .75
☐ 100	.95
☐ 200	1.25
☐ 300	1.50
☐ 400	1.98
☐ 500	2.25
☐ 600	2.50

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

☐ 15¢ CATALOG on Fiber Optics, 'ICs', Semi's, Parts

POLY PAKS

P.O. BOX 942A LYNNFIELD, MASS. 01940



In this issue, do you think there is a need for more

	Yes	No
Simple construction projects	☐	☐
Complex construction projects	☐	☐
General interest articles	☐	☐
Humor articles	☐	☐
Specialized columns	☐	☐
Operating news	☐	☐

Please use the following space for comments on the articles and newspages in this issue. If you have a specific idea of what you feel would improve 73, please send it to us. If you have *two* ideas, the space below will probably not be sufficient. Instead of attaching a separate sheet (which would be bulky and awkward), you can vastly simplify the process by buying another copy. This second copy should be kept in a safety deposit box as insurance against fires, floods and thefts by nonsubscribers.

Do you receive 73 from subscription ☐
newsstand ☐

Fill out this form immediately and mail it with the Reader Service coupon on the reverse side (or vice versa)

READER SERVICE

Please either tear out this list of advertisers and send it in to 73 with as many boxes checked off as you would like to see brochures, data sheets or catalogs. . .or else make a copy and send that in. Include your zip code, please. Send money directly to advertisers.

ADVERTISER INDEX

☐ *NEWSSTAND* ☐ *SUBSCRIPTION*

***Reader service inquiries not solicited. Correspond directly to company.**

AUGUST 1974

Reader's Service
73 Inc., Peterborough NH 03458
Please Print or Type

Name_____ Call _____

Address_____

City _____ State_____ Zip_____

Coupon expires in 60 days . . . . .

PROPAGATION CHART

J.H. Nelson

Good (open) Fair (□) Poor (0)

August – 1974

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14	14	7A	7	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	14	7B	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	14	14	14	14	14	14A
ENGLAND	7	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	7B	7	7	7	7	7	14	14	14	14
INDIA	7	7	7	7	7B	7B	7	7	7A	14	7A	7
JAPAN	14	7A	7	7	7	7	7	7	7	7	7	14
MEXICO	14	7A	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	7A	7B	7B	7B	7B	7B	7	7	7	7	14
PUERTO RICO	14	7	7	7	7	7	7	7A	7A	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	14	14	14	14	14	14	7A
U. S. S. R.	7	7	7	7	7	7B	14	14	14	14	14	7B
WEST COAST	14	14	7	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	7	7	7	7A	14
ARGENTINA	14	14	14	7	7	7	7A	14	14	14	14	14A
AUSTRALIA	14	14	14	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7	7	7	7	7	14	14	14	14	14A
ENGLAND	7	7	7	7	7	7	7	7	7A	7A	14	14
HAWAII	14	14	14	7	7	7	7	7	14	14	14	14
INDIA	7A	7A	7	7	7B	7B	7B	7B	7	7	7	7
JAPAN	14	14	7A	7	7	7	7	7	7	7	7	14
MEXICO	14	7	7	7	3A	3A	7	7	7	7	14	14
PHILIPPINES	14	14	7A	7B	7B	7B	7B	7	7	7	7	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	14	14	14	14	14	7A
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	7

WESTERN UNITED STATES TO:

ALASKA	7A	7A	7A	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	14	7	7	7	7	14	14	14	14	14A
AUSTRALIA	14	14A	14A	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7	7	7A	7A	14	14
HAWAII	14	14A	14A	14	7A	7	7	7	14	14	14	14
INDIA	7A	14	14	7	7B	7B	7B	7B	7	7	7	7
JAPAN	14	14	14	7A	7	7	7	7	7	7	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7B	7	7	7	7	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7	7	7	7B	14	14	14	7A
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	7	7
EAST COAST	14	14	7	7	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

Savoy

$3.75
Postpaid in U.S.A.

TYPE 900 A TYPE 901

HIGH ACCURACY CRYSTALS
FOR OVER 30 YEARS

Either type for amateur VHF in Regency, Swan, Standard, Drake, Varitronics, Tempo, Yaesu, Galaxy, Trio, Sonar, Clegg, SBE, Genave.

Quotes on request for amateur or commercial crystals for use in all other equipments.

Specify crystal type, frequency, make of equipment and whether transmit or receive when ordering.

BASSETT

efficiency mobile portable antennas all amateur bands, MARS, CB, URITY, LIC SERVICE, RINE, AND 'ERNMENT USE.

-6-10-15-20-40-75

dentical size, cost, nd appearance

LY ADJUSTABLE TO FREQUENCY IN FIELD

Low weight, low drag, high strength fiberglass

Polished chrome brass standard ⅜-24 thread

High gain collinear on 2 meters

MODEL DGA-2M

$29.50 postpaid in U.S.A.

BASSETT VACUUM TRAP ANTENNA SYSTEM

Complete packaged multi-band antenna systems employing the famous Bassett Sealed Resonators and Balun from which air has been removed and replaced with pure helium at one atmosphere. Operating bands are indicated by model designation.

MODEL DGA-4075	$59.50
MODEL DGA-204075	$79.50
MODEL DGA-2040	$59.50
MODEL DGA-152040	$79.50

BASSETT VACUUM BALUN

The famous sealed helium filled Balun . . . employed with the DGA Series Antenna Systems. Solderless center insulator and easily handles more than full legal power while reducing unwanted coax radiation. Equipped with a special SO-239 type coax connector and available either 1:1 or 4:1.

MODEL DGA-2000-B . . . $12.95
Postpaid in U.S.A.

CONTACT YOUR DISTRIBUTOR OR WRITE FOR DATA

Savoy Electronics, Inc.

P.O. Box 5727- Fort Lauderdale, Florida - 33310

Tel: 305-563-1333 or 305-947-9925

Incomparable
FT-101B
Proven Performance
SOLID-STATE 160-10 METER TRANSCEIVER

ASK THE AMATEUR WHO OWNS ONE
AND LEARN WHY ACTIVE AMATEURS
WORLD-WIDE CHOOSE YAESU

"THE TOTAL PERFORMANCE LINE"

VISIT YOUR DEALER FOR DETAILS AND OUR NEW CATALOGUE

All Yaesu products warranted by the selling dealer
Complete after warranty factory service available

YAESU MUSEN USA INC.
7625 E. Rosecrans Ave., Unit #29, Paramount, CA. 90723
(213) 633-4007