73 magazine
for radio amateurs

$1.00
December 1972
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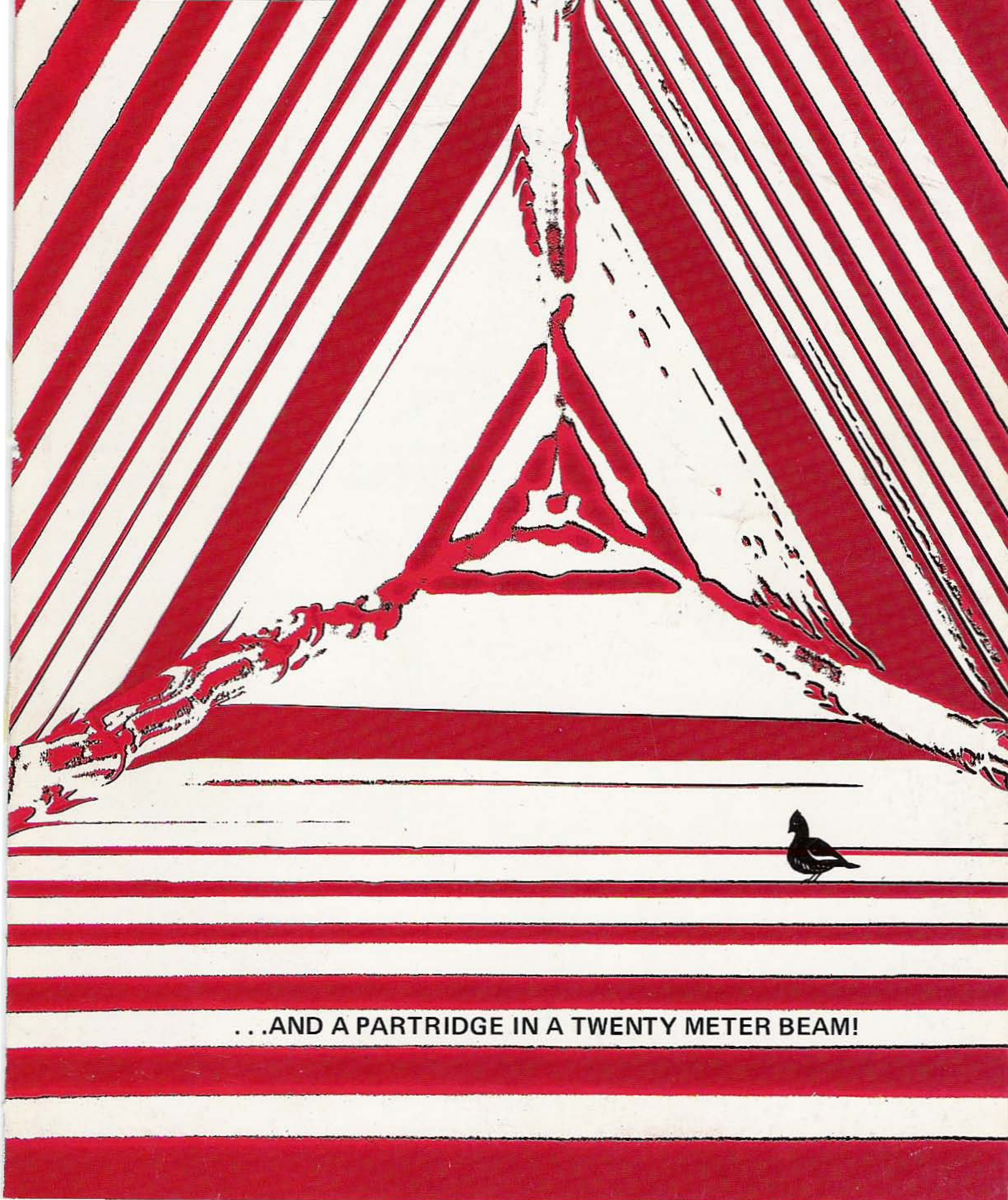


. . .AND A PARTRIDGE IN A TWENTY METER BEAM!

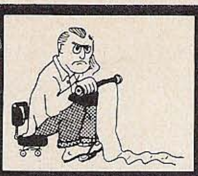
73 magazine
for radio amateurs
#147 DECEMBER 1972

FEATURES

COVER: The pattern of covers from September to October to November obviously was heading us to disaster in December. Amateur radio just isn't ready for a nude cover yet, even if we could arrange such a thing. So, thanks to W2ANT, we have a nice picture of a tower which, hopefully, will not lead to too many adulterous thoughts. If you still have such thoughts, then we suggest a visit to your minister.

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $6 for one year in North America and U.S. Zip Code areas overseas. $7 per year elsewhere. Two years $11 and $12 overseas. Three years, $15, and $16 overseas. Second class postage paid at Peterborough NH 03458 and at additional mailing offices. Printed at Menasha, Wisconsin 54952 U.S.A. *Phone: 603-924-3873.*

You liked the November issue? Something like that could happen again if you don't stop spending money on your hobby and having fun with FM and such. The January issue promises to be another whopper — in case your subscription is running out — or you have a friend who needs a hernia.


NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

OPEN LETTER TO W2TUK

Okay, Harry, you've been president of the League for nine months now and you've had time to get settled into the job.

Your speech at the Hudson Division convention was particularly interesting to me – especially that part about talking with amateurs in other countries from a handy talky via satellite. It would have been gross of me to pop up and ask you right then, in your moment of glory, on what band this great QSO was going to take place. But I sure wanted to.

The main bands that could have been used for this were the amateur 1200, 2300, 3300, and 10,000 MHz bands – all of which were lost for that purpose at Geneva last year. Harry, how are you going to go about getting those bands back again so that mythical contact can take place?

The ITU left us with parts of the low bands – 144–146 MHz – 435 438 MHz, and above 24 GC. There isn't possibly enough room for what you proposed in the 145 and 435 MHz bands, so this sticks it up on 24 GC. Harry, unless you know something I don't, we don't even have a hint of an idea of how to set up anything useful for that band – we don't even have anything in prospect that might someday develop.

My open letter, in lieu of being the gadfly at the ARRL convention, asks you to tell all of us what the ARRL intends to do about getting back the recently lost satellite amateur bands. Since the future you held out in your speech would seem to be possible only by the use of the lost bands, there is an implicit promise of a return of these frequencies.

It is my understanding, in talking with the FCC and many, many others who are intimately involved, that these amateur satellite frequencies have been irrevocably lost – and lost through a lack of preparation for the ITU conference. It comes down to this: either you have some plan for getting back the lost frequencies – or you have some great breakthrough for 24 GC – or you were giving a political speech with nothing to back it up. That would be cruel.

Harry, the pages of 73 and QST are open to you for an answer . . . if you have an answer.

The FCC and ARRL

A quote in a recent issue of CB Magazine is quite illuminating. Richard Everett, attorney for the Amateur and Citizens Division of the FCC was asked: "What is the relation between ARRL and FCC?"

Mr. Everett: *"The ARRL started in 1913 and represents about one-third of the amateurs. They have older members and are very technical minded and file information on rulemaking. None of the older members* (of the FCC) *are now members of the ARRL and most of the staff members have resigned from ARRL, especially the ones in my section."*

What can ARRL do to change its image? How can ARRL regain its lost prestige? Though the number of younger amateurs is down, for several obvious reasons, something really should be done to make the ARRL more attractive to them so the average age of the members doesn't continue to climb – it's over 40 now, isn't it?

The FCC and 220 MHz

A recent issue of *Electronics* had a very interesting special report on the EIA and FCC plans for our band. Quote:

"The FCC is on the verge of taking some action on EIA's proposal, confirms Prose Walker, chief of citizens radio operations at the FCC. But any decision in favor of citizens radio is expected to come hand in hand with a requirement that citizens-band transmitters be equipped with automatic identification circuitry."

Well, there it is. Do you still really believe that the EIA is not able to get action by putting pressure on congress? Do you really believe that the 220 band would not be perfectly safe if amateur radio had a good Washington lobby? There is no question about this in the mind of anyone who knows politics.

You know, if every amateur spent one half dollar a year on a man in Washington, we could have an expert, complete with a healthy expense account, to stick up for us where it counts the most.

NEW YORK SYMPOSIUM DECEMBER 7TH

The first New York FM Symposium will be held Thursday evening, December 7th, at Lazzeras Cafeteria, Maiden Lane and Pearl Street in downtown Manhattan. This will be hosted by the WAS2SUR repeater in cooperation with 73 Magazine and the Repeater Bulletin.

The symposium will be in three parts – the technical sessions – a rap session for groups with inter-repeater problems – and a frequency coordinating meeting for repeaters interested in changing channels.

The technical symposium will come first with discussions of duplexers, circulators, intermod problems (and their solution), narrowbanding receivers, and such.

The gathering will start at 7:30 for dinner. At 8:30 the regular Symposium will start. At the end of the technical sessions there will be an opportunity for the repeater representatives to get together and try to solve their inter-repeater problems. This will be the first forum provided in New York for this. If it seems worthwhile there will be more.

After the hassle and hock session there will be an opportunity for groups in search of coordination to get together and work out channel problems. The frequency coordinators are under a mandate from the recent repeater association meeting not to hold pairs away from repeater groups that need them and are ready to use them.

Would it be possible for the New York repeater groups to start the nationwide swing to one meg splits with 20 kHz separation? They need the 48 channels of repeaters more than any other part of the country – so who knows?

The Symposium is a joint venture of the WA2SUR repeater and 73 Magazine, by the way. If enough people turn out for this meeting and the opinion is that there should be more, there will be more.

HOW MANY REPEATERS?

A group of repeater owners recently cheered when someone got up at a meeting and said he thought 27 repeaters in any one area was plenty.

The discussion had been on suggestions that repeaters change from the present system of being 30 kHz apart and move to 20 kHz spacing – to-

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AC INPUT: TBL-2000: 200VAC-250VAC @ 8 amperes 50/60Hz TBL-2000X: 100VAC-125VAC @ 15A **or** 200VAC-250VAC @ 8A

WEIGHT: TBL-2000: 18 lb (8Kg), TBL-2000X: 20 lb (9Kg)

SIZE: 12¾" W x 11" D x 6½" H. (33cm x 28cm x 16.5cm)

ANTENNA: 50/70 ohms nominally. SWR not to exceed 2:1

METER FUNCTIONS: 0-200mA each tube, 0-2A total plate current, 0-2KV high voltage, 0-200mA screen current, 0-2mA grid current, 0-1000W forward & reflected power.

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TBS **TOP BAND SYSTEMS, INC.**

1839 Redondo Ave., Dept. 8A, Long Beach, Calif. 90804 USA gether with a 1 MHz split between input and output. This would provide about 48 repeater channels where there are presently only 27, and would also make it far simpler to set up repeaters with sensitive receivers.

How many repeaters are best for any one area? There is no way to tell from the pattern around New York, Chicago or Los Angeles, for all are different, and all leave a lot to be desired.

There are about 25,000 licensed amateurs in and around New York City. Fortunately for the local repeaters only about 1500 of these are active on FM so far. Interest is growing rapidly though and the number is escalating. It is possible that we could see one third to one half of the total getting into the FM act in the next two or three years. The rigs are inexpensive – the repeaters are there – and it's loads of fun.

In New York there is one repeater with over 400 active users – WA2SUR. It is a madhouse – typical of New York. There are a few small repeater groups who discourage non-members from using their channels. There are a few medium sized repeaters – perhaps two hundred users, such as WA2KEC and WA2PDJ. Some of the northern New Jersey repeaters are fairly busy too. There are about twenty two meter repeaters in the area at present.

If 10,000 amateurs go FM in the New York area; 27 repeaters will all sound even worse than WA2SUR. Forty-eight repeaters will make a lot more sense.

And what if the number of amateurs should increase and we should find that we have 20,000 FMers in New York? We will sure be glad for 220 MHz!

TAGGED FEEDLINES

Some repeater operators were a bit piqued at the FCC requirement that remote transmitter feedlines and antennas be tagged. They felt that this would help those who might be bent on mischief to cut the right coaxial or control cables at repeater sites. They were also put out that amateurs should have to do this when business repeaters have no such mandate.

The complainers were quieted by others with the argument that, after all, this isn't a serious problem – and since so many other of the new regulations are so much worse and so much more worthy of battling about, that it would be better to swallow a few minor bruises than to fuss about so many things. By accepting this restriction they felt that the FCC might be more inclined to give on the more bitter pills.

STANDARD ID TONE

An excellent suggestion came up the other day for standardizing the tone used for repeater identification – why not use 1020 Hz for this and build rejection filters into our receivers which will keep us from hearing it unless we want to?

Why 1020 Hz? That's the tone used by aircraft, so the filters are already available in quantity at low cost.

It is nice to find out what repeater you are using when you aren't sure, but once you know it is a bore to have to stop and listen every few minutes as it identifies day in and day out.

FM = FRIENDLINESS MACHINE

Have you ever called in on a repeater when you were visiting a new area only to be met by someone with a crabby disposition? It sure sours the experience. It happens to me every now and then.

If you have a regular user of your repeater who takes delight in putting newcomers down, why not form a posse and try to explain that FM is supposed to be fun and friendship – and that putting people down may be fun for him and build up his faltering ego, but it is a drag for his victims.

You can easily set the stage to dump on virtually every new user of your repeater and have a ball making everyone feel bad. For instance, you can set up a rule that says that no one can call in saying "break." Fine. You'll have loads of customers for a put-down, since virtually every FMer has been trained right from the beginning to put in a "break" before jumping onto the channel.

With a no-break rule you can work out a little passion play for your victims. When the visitor calls in for the first time with a break, you exclaim in exaggerated panic – "breaker on frequency – emergency – come in the breaker with the emergency!" While you may not cure the visitor of being an FMer forever, you will certainly have made him wish he had never tried to talk with your group. And don't think that a condescending explanation is going to smooth things over. There is no way to repair the damage you've done.

Another favored put-down is to break in on a conversation on "your" repeater and frostily announce that this repeater is for emergency use and that rag chewing should be done on other channels. This is the YYQ approach to driving people off FM and it has been used indiscriminately. It is guaranteed to make everyone involved madder than hell – if that is what you want. It is insufferable childishness like this that brings on jamming and profanity.

If you have any really raunchy rules for your repeater – rules which are certain to generate more heat than fun, perhaps it is time to think them over and amend them. FM should be fun – fun for the regulars – fun for the visitors – fun for everyone involved. When new FMers call in, expect them to need some help and be nice about it – make FM fun for them, even if they cause a little aggravation the first time around.

Any comments?

SINGLE FREQUENCY REPEATERS

Motorola has a license (KQ2XQU/Ft. Lauderdale FL) to experiment with a single frequency repeater on 557 MHz. We assume that this may be done with a time splitting arrangement via a chopper circuit. If anyone has any details on how this might be done the readers of 73 will certainly be interested.

DXers ARISE!

How are your QSL bureaus doing for you? 73 has received zero letters of complaint, so it is assumed that everything is going smoothly. Funny how no one notices the bureaus much when they work – but when something goes wrong – wow!

The W2NSD/1 cards have been coming through the Northern New Jersey DX Association QSL Bureau without a hitch for quite a few years now. Surely no other bureau can be doing better than this group. Huzza for the dedicated DXers who sort through thousands upon thousands of cards every month – with no pay – and with darned little praise.

If you have worked any DX you undoubtedly have some cards gathering dust in the files of your local QSL bureau. They're listed in QST, so the next time you work a League member, you can ask him to look it up for you. The bureaus normally keep cards for three years before throwing them out. And they really hate filling trash cans with cards from JT, CR9 and other really rare ones – but out they go! If you haven't an envelope with your bureau, better get on it.

What's With RACES?

Non-hams using our precious Fm repeaters? You bet! Apparently I need some more information on just exactly how RACES is set up. I was under the mistaken impression that this was supposed to be an emergency use of amateur bands and that licensed radio amateurs were supposed to be organized in nets – including FM repeater operation.

But apparently in some areas of the country the local RACES director has set up non-amateurs with equipment to work through the repeater using the repeater call and a unit number instead of a regular ham call.

Fellows, when you run up against non-licensed users of our bands please make an inquiry and send all the details you can to *73*. There may be some emergencies where none of us would have any objection to non-ham RACES personnel using our bands, but I think most of us would like to encourage regular users to get their ham licenses.

WINDJAMMER OPPORTUNITY

There is an interesting opportunity for one or two amateurs with marine knowledge and experience to get a half fare rate on the Yankee Trader around-the-world cruise. The regular rate is $18 per day – but someone who could help to operate and service the loran, radar, and radio gear could have the adventure of a lifetime for about $9 a day. The gangplank goes up soon, so get cracking.

Can the Amateur Industry Organize?

There would seem to be some persuasive reasons for the manufacturers of amateur equipment to get together and work out some solutions to the more pressing amateur radio problems – like how to get more hams – how to keep the FCC from taking away the ham bands – how to keep the FCC from cutting back, bit by bit, on amateur privileges.

The industry has attempted to organize in the past, only to be thwarted by the ARRL, which may not do very much to help the hobby grow, but is ever alert to any possible threat to their power.

An investment of one percent of the gross receipts for sales of amateur equipment would provide a fund which could be used to encourage the growth of the hobby. How much would it really cost to have one retired ham, knowledgeable in public relations, who could organize the better ham writers to provide articles and stories about the hobby and sell them to the top magazines? Almost every major magazine would love to have a good ham radio article now and then – unfortunately there is no one (or group) to organize this, so we get no exposure and our hobby is confused with citizens band.

With a little promotion the growth rate of amateur radio would be right back up there where it was in the 50's – maybe better. This would bring new life to our clubs – more enthusiastic operators to fill in the empty bands – and maybe even more QRM on Sunday afternoons, if that is possible. One million amateurs would not seriously strain the spectrum we have available, but it could bring about a great deal more respect from the FCC and perhaps save us from the devastating rule changes.

MENSA NET

More and more amateurs have been joining Mensa and the result is a regular net. It meets on 14.280 at 1800 GMT on Saturdays according to WA6KGP. Amateurs interested in joining Mensa can drop a note to 73 Magazine, Peterborough NH 03458 and get a little brochure telling about it. The only qualification is an IQ of above 152.

MORE COLUMNISTS

There are two more aspects of amateur radio that we would like to cover regularly in the 73 newspages – contests and certificates. It is possible that we might be receptive if someone who was seriously into these things offered to keep the 73 readership informed.

We might even be able to add some pecuniary interest to your amateur radio hobby.

If you have better than average connections on keeping up with certificates and awards, and are interested in preparing capsule facts on them for the 73 newspages, drop a line to us.

Ditto contests. Readers would like to know what contests are being run, when and enough data to get started in them or send for full rules. We do want to leave CQ as the source for exhaustive details on contests and just bring a synopsis to 73. Anyone with good bona fides interested?

NOVICES UPTIGHT

One of the most persistent complaints heard at the Hudson ARRL Convention was a chorus of gripes from Novices about the latest CQ action. It seems that CQ has been sending Novices a note telling them that they will receive a six month free subscription to the magazine. Then, after an issue or two, along comes a note saying that this subscription is an impossible burden and they really should foot their share of the cost and how would they like a two year subscription for $6.00?

ARTICLES NEEDED

Quads. Interest is high in quads and it would be nice if we could run a special issue full of quad articles. How about it you designers and builders?

Matching of VHF beams could use some coverage too – any "experts" out there who own a typewriter? And please write it so the average VHFer can use the material – forget the Smith Charts and gobbledegook and keep it to practical how-to-do-it instructions.

Slow scan – almost anything that hasn't been printed on this should be – we can use a whole bunch of articles.

FM – although we are not packing every issue with FM articles, we still want to keep ahead of all the other ham magazines. Circulators – isolators – solutions to intermod – to desensing, and, like slow scan – anything that hasn't already been published should be. We'll run articles, books, just circuits, whatever you have.

Antennas – if you have any new ideas they should be written up and we hope you'll give 73 first choice.

Novice VFO's – let's go on this one!

Several readers have asked that we try to publish more articles for the beginners, keeping in mind that there are readers who are not only non-engineers, but who are still not really sure about how a volt-ohmmeter works. Some of you readers who have been teaching the General license exam might make a note of the points that need to be covered and provide helpful articles on them. We could also use some simpler construction projects for the amateur who has always wanted to build, but who has been afraid to get started.

Wayne

SSTV SCENE

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

An item of growing interest in slow scan conversations is binary, or computer types of, storage devices. Although present costs are considered high, this should drop in the near future as manufacturing methods advance. MOS Storage, or "memory" units can be used to store a slow scan picture in the form of "bits" of sync and video information. Naturally, this can be "programmed" or "replayed" at will. Quite a group of possibilities, eh? The present cost is approximately 1 (one) cent per "bit" and a typical slow scan picture has around 12,000 "bits" of information, so immediately there's a cost of $120. However, watch this interesting market. A substantial price reduction will no doubt open new slow scan horizons, such as

ZS3B's African cartoon as received by WB6LSX – good detail for such DX.

all electronic I.D. units, or slow scan stored and fast scan reproduced pictures (which could be viewed on your regular TV). And, if this can be accomplished with one frame, it can be accomplished with three – one red, one blue and one green, which again could be viewed on your regular color TV.

W1VRK as seen on the slow scan monitor of ON4DN.

Mohammed, 9K2AM, has been rather active on slow scan lately. If you would like to work him try watching 14.230 kHz around 1200 GMT. This is also a good time to watch for ET3DS and ET3KH, two more newcomers to slow scan.

I understand Mike Tallent is developing a direct sampling circuit for fast scan cameras, that will require no internal connection to the camera. Just connect it to the fast scan output and it gives out with full slow scan. Possibly in 1973 this will become available on printed circuit boards, as his monitor circuit is at present. I can see the results now – slow scanners clamoring to TV stations, sampling rigs in hand, and slapping them on the TV station's switcher output. Then recording a pile of programs with full zoom pictures, studio lighting, special effects – gad, what a ball!

YN3RBD transmitted this slow scan picture to K4TWJ on 20 meters – very little QRM!

I1BNT transmitted this picture to ON4DN on 20 meters – without QRM.

Word is just in from Franco, I1LCF that the third worldwide Slow Scan Contest, sponsored by *CQ Elettronica* of Italy, will be held Saturday, February 10 and Sunday, February 18, 1973. Full rules will appear soon; however no radical changes from last year's contest are expected . . . should be a real blast.

As slow scan Christmas cards whiz to and fro, may I take this opportunity to wish you a very Merry Christmas

73 . . . Dave, K4TWJ

REPEATER ASSN LAYS BIG EGG

It seems likely that Bob Waters and Gordon Pugh bit off more than they could chew when they tried to expand Gordon's Northeast FM Repeater Association to include everything from Maine to North Carolina and out west to Ohio. It didn't jell.

There is an obvious need for associations of local repeaters, but once you get outside of a couple of hundred miles the repeater groups have no need to get toegther – and they won't.

It seems as if what is really needed is repeater councils for areas of the country – and then perhaps a yearly meeting of all of the repeater councils from all over the country.

When the Northeast Repeater Association , Inc., had its annual meeting in Pennsylvania recently only 33 groups had joined out of about 215 in the association area. And when you consider that most of those had joined on a temporary basis, just to see if the idea was worthwhile, the support for the association seems too slim for survival.

As a result of the fiasco, repeater groups in New England are working up a repeater council for the greater Boston area and a similar plan is afoot in New York City.

NORTHEAST LAYS BOMB

The October 7th meeting of the Northeast Repeater Association drew only a handful of repeater delegates, despite its attempts to attract groups from Maine to North Carolina and out to Ohio. The count was 85 present and only 36 out of the approximately 200 repeater groups in the area signed on even temporarily.

There were several reasons why the interest of repeater groups was so low. One of the most important was that no one could think of any substantial reason for the Association to exist. There were no known benefits to anyone to join or come to meetings.

Another major problem was the size of the area covered by the Association. When an organization stretches out so far that it takes the delegates from each end about six hours to drive to a meeting – and six hours back, there has to be some powerful reason for the organization. There is no reason for this organization other than to have officers, dues and bylaws.

Thirdly, the early history of the Association was unsettling. Many of the repeater groups felt that much of the business was done under the table – and their confidence was not improved at the October meeting when the officers slipped a great big one by everyone, apparently laughing up their sleeves at their cleverness.

Readers who are interested in the exhausting details of the sneaky Association doings would do well to subscribe to the Repeater Bulletin, wherein these shenanigans have been covered at length.

The big one slipped by everyone in October had to do with the Association newsletter. This started out as a typewritten letter for the first two "issues," so the delegates had no way of knowing that anything was afoot when they okayed the sale of copies to anyone wishing to subscribe – it was mentioned that a few people had asked about this. Nor were they alerted when it was asked if anyone had any objection if some advertising was accepted to help defray the cost of publication – who could object to that – every club bulletin has a few ads – right?

Would you expect that these innocent agreements would get you into the publishing business in a big and expensive way? The delegates from the 73 Radio Club sat back and stifled broad smiles as they watched this one slip by. And there in the back of the room was a manufacturer who reportedly had the remaining bones of defunct RPT... in his pocket, desperately looking for someone to publish. The post office takes a very black view of manufacturers who try to publish magazines, the last we heard, so some third party is needed.

The way of the splinter ham magazine is a rough one and we wish luck, of sorts, to the Association in their new role.

NEW STANDARD REPEATER

One of the first production models of the new Standard Communications repeaters was set up at the WA1KGO (73 Radio Club) repeater site in lower New Hampshire. Even though the antenna setup was far below the minimum recommended separation, the repeater worked and worked well. What a pleasure to have a repeater you can take out of a box, connect to twelve volts, plug into a couple antennas, and turn on!

When it first arrived and was unwrapped, it was set up in the 73 offices and plugged in, just to see. The result was an instant repeater which covered about ten to fiften miles – just perfect for any town or small city. The 73 HQ is about 200 feet below the average terrain, as defined by the FCC.

Up on the mountain the Standard repeater was suddenly one of the big boys, permitting amateurs in Boston (80 miles or more) to talk with FMers just about anywhere in that radius. With the proper antenna spacing the rig would work even better and the coverage would probably go out to 100 miles.

The crew at Standard is certainly to be congratulated on putting out a fine little repeater.

AMSAT NEWS

OSCAR

Mike Frye WB8LBP
640 Dauville Dr.
Dayton OH 45429

OSCAR 6 was launched on schedule at exactly 1719 GMT on Sunday, October 15th. THe launch went beautifully and there were few problems. I have picked up the satellite in my area but have so far been unable to transmit through it, possibly because of area conditions.

Monitor CODESTORE on board Oscar 6 and the AMSAT Nets for orbital information. There is also a number you can call in Washington for up to date information (daily between 2300–1200 GMT (202) 386-4483).

AMSAT has a standard reporting form that is available. The form is self explanatory and deals with signal reports, times, and atmospheric conditions. One can be obtained by writing to AMSAT directly, or sending a SASE to me and I will send you a couple of copies.

AMSAT, P.O. Box 27, Washington D.C. 20044.

AMSAT NETS
On Sundays of every week
1200–1300 GMT on 14.280 MHz SSB
1300–1400 GMT on 21.280 MHz SSB
1800–1900 GMT on 14.280 MHz SSB
1900–2000 GMT on 21.280 MHz SSB
On Mondays at 0100 GMT on 1855 MHz SSB

FIGURING ORBIT TIMES

Period of orbit – 115.138 Minutes
Change per orbit – Add 28.81 Degrees
Inclination – 107.76 Degrees
Beacon frequency – 29.45 MHz

Orbit No.	Longitude West	Time GMT*
1	323.97	1824.99
2	352.79	2020.24
3	021.60	2215.48
4	050.41	0010.42
5	079.22	0205.96

*Depends on launch time; add or subtract minutes from 1719 GMT.

OPERATING PROCEDURE

After calculating where the satellite is, the following is a recommended method of using the two-to-ten meter repeater.

When the satellite comes into range begin listening for the morse code beacon on 29.45 MHz. The beacon sends the message HI .....

After you have located the beacon on 29.45 MHz, tune up the band and begin looking for the signals from the repeater in the 29.45 MHz to 29.55 MHz range.

Before beginning to transmit, a few simple steps should be taken to insure that you do not overload the repeater. If you are going to use high power (greater than 80–100 watts erp) transmit your signal a little off the normal repeater passband.

This will ensure that you do not overload the repeater and cause the agc to go into action. It will also make sure you are not using more of the repeater than your share and you won't blank out weak stations that might be trying to call you.

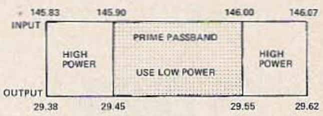
When transmitting, start by sending a test signal, preferably a string of dots, on this frequency (f_2). Listen for your own signal retransmitted from the satellite on the corresponding ten meter frequency (f_{10}) found from this formula.

$f_{10m} = f_{2m} - 116.45$ MHz $\pm f_{Doppler}$

where $f_{Doppler} = +4.5$ kHz near beginning of pass
= 0 kHz at middle of pass
= (–) 4.5 kHz near end of pass.

For example a signal transmitted on 145.92 MHz will be retransmitted on 29.47 MHz ± Doppler. This is where you signal will be, if you can hear it, others can too.

CHART FOR HIGH–LOW POWER AREAS



OSCAR 6 FACT SHEET

Input frequency range – 145.90 to 145.00 MHz
Output frequency range – 29.45 to 29.55 MHz

Passband is not inverting, in other words upper sideband remains upper sideband and vice versa.

Beacon frequency – 29.45 MHz
Beacon modulation – A-1
Repeater bandwidth – 100 kHz flat
120 kHz at 3-dB down points
150 kHz at 6-dB down points
240 kHz at 10-dB down points
Operating modes SSB and CW are recommended. AM, RTTY and SSTV can be used with less efficiency. FM is not recommended.
Repeater power output – 1 to 1.3 watts CW into half wave dipole
Input sensitivity – Approximately

100 dBm (2 mV/m) for full output.
Ground power required – 80–100 watts of effective radiated power produces full output from repeater at maximum range of 2000 miles.
Intermodulation – 20 dB down
AGC
Up to 26 dB gain reduction
0.1 sec. attack time
2.2 sec. release time (highest efficiency with SSB).
Receiving antenna – Dipole can be used but beam is preferable.

WB8LBP

DETROIT ARA ON 220

At the September Board meeting of the Detroit ARA, a proposal was adopted to sponsor a "DARA 22 MHz System" which would include funding to members for constructing transceivers to operate into a repeater. Personal construction was encouraged as part of our educational training, due to the lack of commercial transceivers for this band. The FCC has now released Docket 18803 which allocates the 222-225 part of this band for repeater use. Now it is up to the clubs to follow through and make use of this excellent band which is particically QRM free. This is another area for an excellent autopatch from your car, or a portable system for emergency operations. At least 26 members signed up to work on the project at the last meeting.

73 CRUISE

Plans are firming up for a 73 sponsored Windjammer cruise to leave Antigua on the first of May 1973 for eleven days of sailing and visiting rare Caribbean countries.

Some of the more interesting islands on the route are Dominica, a remote and lush jungle of an island, complete with Caribe indians, a visit to the very French Martinique and a get together with some of the FM7 boys you'd like to work. Your wife will enjoy the shopping and the beauty of the spectacular cliffs and coves along the coast. Captain Bligh's "Breadfruit Isle," St. Vincent, still unknown to the tourists. The beautiful beaches of Grenada – skindiving – fishing. The sandy beaches of Carriacou. Venezuela – will we be able to keep the YV5's from capsizing the boat? – St. Lucia, a combination of British and French – and, don't forget Antigua and the steel drum bands that are world famous.

Will there be a rig set up on the ship? What a foolish question! You'll have the chance to make half the world eat its heart out as you DX. Of course you may prefer to spend your time lying on the deck, soaking up the Caribbean sun – or you may prefer fishing – or skin diving – or visits to islands – to fantastic beaches – or taking photographs for the radio club back home – or you may want to devote your time to eating the great meals.

Whatever you like, you'll be in the company of enthusiastic amateurs where you can swap DX lies and antenna put-downs. After having run two very successful ham tours, we can tell you that traveling with hams is real fun – a whole lot more fun than just any group.

The ship leaves Antigua on May First and returns on May 12th. The weather is guaranteed to be perfect.

The cost, per person, starts at only $290 for the whole trip, including just about everything except the booze. Special cabins are a bit higher – $365, and go up to $410 for the most lavish cabins. First come first served on accomodations.

The yacht is not to be sneezed at, by the way. We will be sailing on the Fantome, formerly Onassis' yacht, which is 262' long – almost as long as a football field. This yacht was built for the Duke of Westminister as a private floating palace. Onassis planned to give the yacht to Prince Ranier and Princess Grace, but it was never delivered. It has private baths, air conditioning and red carpets. There is room for fifty or more on the cruise, which may seem like enough except that almost twenty have alread signed up and the word has hardly been leaked out as yet.

Drop a line to 73, Peterborough, NH 03458 if you want to join this happy group. It will be informal – barefoot – and fun. And do bring the wife. If she has trouble with the sea she should know that this great big boat is very steady and seasickness is virtually unknown on her. If the wife won't go, maybe you have a secretary or good friend who loves the sun and the sea?

MARS

Harry Simpson A4SCF
73 Magazine
Peterborough NH 03458

Harry Simpson A4SCF

People wonder why we keep our ham magazines for years after we receive them. I usually explain that my interests are in a certain sector of electronics at any given time, and an article that was only of passing interest in November, 1970 might be of supreme importance in November, 1975!

This MARS Column is a distinct example – the first effort, printed many months ago, gave an address for Navy MARS that was incorrect, although it was the address printed on the MARS brochure. The same article used my home address, rather than the 73 address in Peterborough. I am still receiving mail addressed to my home, complaining about the inability to contact Navy MARS at the address given! Come to think about it – you are not alone! In spite of numerous phone calls and letters asking for information, and asking that I be placed on the mailing list for Navy MARS publications, I have yet to receive a single word from them! *Quien sabe?* Perhaps that organization is only a figment of some overworked imagination!

Obviously I am being facetious. There *is* a Navy-Marine Corps MARS and it is quite active, its members numbering into the thousands of public-spirited amateurs. It's just that you have to be a member of Navy MARS in order to find out how to join! For the record, here's the latest address I have: *Chief, Navy-Marine Corps MARS, 4401 Massachusetts Ave., N.W., Washington DC 20390, Mail Stop 394.*

To cut down on the workload, let's do it this way – if you would like to join *Army MARS*, and would like further information on this splendid program, write me in care of 73 Magazine. I will answer your questions, and also pass along the name and address of an Army MARS member in *your* area who can tell you about the program on a local basis. On the other hand, if you would prefer another service, I suggest that you contact them directly, since I have already told you all I know about them. For several months I have been sending out an average of two hundred letters per month in answer to your queries, and at my own expense. To the ten hams who included SASE's with their queries – I am grateful.

This article is being written while on vacation in the southeast – at the moment, Pensacola – and the most amazing thing that occurs on each vacation, is the realization of the broadening scope of 2 meter communications! In the Third U.S. Army MARS area – North and South Carolina, Georgia, Florida, Tennessee, Alabama and Mississippi – there are over *thirty* MARS repeaters, covering most of the very large area! Several other machines are being readied, and pretty soon you'll have to turn off your transceiver to get away from it all!

A word about prefixes: In Third Army area, W is changed to A, K becomes AA, WA is changed to AD, WN and WB are changed to AL. KP4 and KV4 are *both* changed to AE6 (a paradox that might cause some trouble in the event we sign up both KP4AA and KV4AA . . . they would *both* be assigned the call AE6AA!).

Listen any evening on 4001.5, 4015, 4020, 4025, 4030 and 4035 kHz for our typical operations, and then write for more details. We'd like to have you!

See you next month . . . *A4SCF*

DEEG DIGS NEW HAMPSHIRE

Here is Fred Deeg K6AEH, the sales manager of Standard Communications, making a nice DX repeater contact from the top of Pack Monadnock, the site of the WA1KGO repeater. The antenna on the side of the fire tower behind Fred is the receiving antenna for KGO – height 2300 feet above sea level and radio horizon about one hundred miles. It took one of the worst muggy spells in the history of New Hampshire to get Fred on his way back to "sunny" California.

The new Standard repeater is now set up in the same tower and providing fine FM coverage for a good deal of New England.

And what hand unit is Fred using? A Standard, of course!

73 FILES PETITIONS

There have been six petitions filed by 73 on the new repeater regulations so far – with more in the offing. The new rules have some advantages, to be sure, but the disadvantages seem to overshadow them and 73 has filed with the FCC on the sharpest points of objection.

For instance there is the matter of the prohibition of cross banding of repeaters. There has been no example known to the 73 staff of any serious problems arising from this practice. To the contrary, those few repeaters which have this function have been most popular and have provided a valuable service interconnecting the groups using one band with those using another.

The FCC, the Amateur Division of the FCC and the Commissioners need to be reminded that this is amateur radio – it is a hobby – and that we need latitude to experiment and develop systems of communications. The Commission deals 99% or more of the time with commercial users and perhaps this has biased their judgment for the new regulations seem more fitted to commercial operations than amateur.

If the Commission would restrain itself and provide regulations only when there is a clearly demonstrated need for them – only when amateurs have demonstrated that they are unable to manage their own affairs, then the growth and technical development of the hobby could move forward relatively unimpeded. The fact is that even though we had no regulations covering repeaters, we had no real need for them. One would wish that the Commission would ignore the requests of amateurs who need the security blanket of exact and detailed rules.

Repeaters have shown, more than any other amateur groups, that they are able to regulate themselves. The cooperation has been epochal. Interference has been kept to a minimum – intergroup hassles have been ironed out just about everywhere – jamming has been coped with – frequencies have been coordinated – standards have been agreed upon and all but a few really hardheaded repeater groups have fallen into line.

In the face of this truly remarkable progres, the FCC repeater rules are an insensitive slap in the face. We have little for which to thank the few amateurs who initiated this action several years ago. Perhaps it is only fitting that Gordon Pugh W2GHR is one of the hardest hit by the new regs.

1973 Friendly Firebird QSO Party

Date: From January 6, 1973 at 1800 GMT to January 7, 1973 at 1800 GMT.

Group: General Motor's World Wide Employees and Retirees.

Call: "CQ Firebird" on phone or "CQ FB" on CW.

Exhange: Signal report, State (or country) and Handle plus Firebird members will send a four-digit number corresponding to his General Motors Operating Unit (i.e., "0101" for AC Spark Plug Division). Send SASE to W9MDW for cross reference sheet.

Scoring: One point per QSO. Work each station only once regardless of frequency.

Multiplier: Number of different operating unit numbers.

Total Score: Total QSO points times total operating unit numbers.

Frequency: Any frequency, but suggest 3.985, 7.285, 14.285, 21.385, 28.785, 50.520, 145.440 MHz and near bottom of each novice band.

Logs: Send to Dick McClain W9MDW, 1613 Cherry Hill Lane, Kokoma, Indiana, 46901 by February 15, 1973.

REPEATER UPDATE

LISTENING
94 76 88 73 70 64 82. . .

CT	W1WHZ	Norwalk	147.99–147.39
IL	WB9INL	Hinsdale	07–67
IL	WB9AET	Wstrn Springs	224.8–222.8
MA	K1JMR		Delete
MA	W1MTV	Westfield	10–70
MA	WA1KHC	Pelham	13–73
MA	W1IFL	Foxboro	31–91
MA	WA1LUT		Delete
MA	W1HEB	Boston	147.96–147.36
NH	K1MNS	Derry	53.58–52.52.98
NJ	W2QW	Martinsville	025–625*
NJ	WB2LPV	Oakland	10–70
NY	WA2UYJ		Delete
NY	WA2MBT	Plattsburgh	22–82
NY	WA2KEC/2	Manhattan	40–147.00
NY	WA2ZWP	Brooklyn	205–805*
NY	WB2ZIO	Staten Island	145.935–146.535*
NY	WA1UYJ		Delete
NY	WA2NVT	Plattsburgh	22–82
NY	WA2PDJ	Bellmore	25–85
NY	W2OQI	Brookhaven	147.12–146.82 58–82
NY	WA2KSB	Wading River	10–70
NY	WA2QNN		Delete
OH	K8ALB	Toledo	Delete
OH	WB8CRL		Delete
OH	WB8CSV	Springfield	13–73
PA	WA3QCE	Pittsburgh	28–88
PA	WA3BJS	Pittsburgh	16–76
PA	WA3BNO	Pittsburgh	37–97

***Looking for a 147 pair.**

UPDATES REQUESTED

The next printing of the full list of all repeaters in the world is scheduled for the April issue of 73. It would be appreciated if every repeater group would send in at least a card giving all possible repeater information for your area – including the frequencies of your repeater, the town it is located in, a mailing address for correspondence – a list of all other repeaters in your area – calls – towns of location and channels used. It is much easier to make up a list with too much information than too little.

The FM Repeater Atlas is updated three times a year, so it is important that all changes in repeater channels, calls, or location be reported as soon as they are known. Thousands of amateurs depend upon this atlas to help them to keep in contact with repeaters as they travel – don't disappoint them by letting your listing or that for your area get behind.

SAROC

Disappointment

The FM program at Saroc last year left a lot to be desired so I offered to set up an FM Symposium for this convention that would hopefully be better. Along about the time I had things nearly organized, I got a call from Leonard Norman, the chap who runs the convention – someone had threatened not to exhibit if I ran the FM program – it was all off, he would set up his own FM program.

Was it an advertiser who has been banned from the pages of 73 or a fellow publisher in a panic after seeing the November 73? Unless I have some very secret enemies, I can only think of about three possible people who could have pulled that one.

Whoever it was saved me a lot of time and expense. They also cut my enthusiasm for Saroc by about 98%. If it weren't for the chance to sit and talk with a whole lot of good old friends, I would pass it up. Las Vegas is a gaudy, expensive, plastic bore. Sour grapes – right?

Wayne

50 MHz BAND

Bill Turner WAØABI
5 Chestnut Court
St. Peters MO 63376

K8LEE reports an opening to South America on the 19th of September around 2240 Z. A few minutes earlier, weak signals had been heard from Florida (W4GDS) and these continued intermittently during the approximately one hour the band was open. Wayne, WA8PEB and K4JBV worked LU8AHW (CW and SSB), LU3EX and HK3OK (AM) during this period. Tapes played over the telephone confirm the excellent signals received. There was apparently no connection between the two openings. Florida was weak E while South America was rather strong TE, peaking at times to S9. Wayne reports these signals were also heard in Indiana but were rather faint there. Did anyone else manage to work this opening?

Jim, K7ZFG/6, passes along some further information relating to the carrier null instability sometimes experienced with the Swan 250. "In mine, the carrier balanced with the start of transmission, drifting to near full carrier after about a minute. Eventually the control was so far off center that the carrier couldn't be balanced even at the start of transmission. My solution was to replace R1305 and R1309 with 47K, 1 watt resistors and replace R1306 and R1310 with 100K, 1 watt resistors. After this, the carrier balanced in the center as it did when new, and hasn't caused trouble since . . . it might be advisable to use 2 watt units for additional stability and also replace R1307 with a 1 watt resistor."

I might add that it is not uncommon to find a new 7360 which will not balance with the original resistors; often it is inconvenient or impossible to try several tubes in order to find one which will work properly. The solution is to reduce the fixed resistance on one side of the circuit and increase it a like amount on the opposite side. The unbalance caused will correct the unbalance within the tube. Decrease the resistance on the side to which the null pot must be turned to come close to a null. The amount of resistance change is determined by the unbalance in the tube. Try 20 0/0 for starters. This change may also be used to temporarily cure the problem in a rig with an old tube which has become unbalanced with age. This will allow you to stay on the air while a new tube is being obtained.

K5MTK writes from Fort Worth to say that he has found the problem in his Globe Hi-Bander and will shortly be back on the air – this time with a new 5 element beam. Elmer also passes along the information that the Arlington Radio Club meets Monday evening at 2000 local on 50.8 and the Tarrant County Six Meter Emergency Net meets every night at 2100 on 50.7.

Lowell, WB4WNV, asks "Do you know of any net type operations on 6 meters in the north Georgia area? How about even any individual stations that operate regularly?" I don't know of any active nets or individuals in your area. Georgia has always been rare in this area either because of the distance or lack of activity. I have always assumed it to be the latter. Perhaps one of our readers will offer your group assistance in getting on the air, and let us know about the local activity, too.

Peter, WA6HXM, writes to say that he and WB6ECD have both worked and confirmed contacts with VE1ASJ. There seems to have been some confusion about the comment in the

Amateur FM Comes of Age

As new as tomorrow! The Tempo Commercial Line VHF transceivers offer commercial performance at amateur prices. Both units include an audio limiter to assure constant deviation at all times and an instantaneous impulse squelch. Microphone, power cord, mounting bracket and one pair of crystals is included.

TEMPO/CL 220

Frequency Range: 220-225 MHz (2 MHz operating range)
Number of Channels: 12 channel capability for transmit and receive
Frequency Stability: ±0.001% (−20° to +60°)
Audio Output: 2 Watts minimum w/internal speaker (at less than 10% distortion)
The price: $329.00

TEMPO/CL 146

Frequency Range: 146-148 MHz
Same general specifications as CL 220
The price: $279.00

TEMPO/fmp

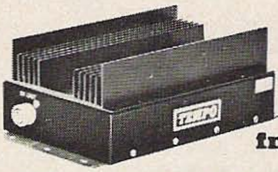
Truly mobile, the Tempo/fmp 2 meter 3 watt portable gives amateurs 3 watts, or a battery saving ½ watt, FM talk power anyplace at anytime. With a leather carrying case included, this little transceiver will operate in the field, in a car, or at home with an accessory AC power supply. The battery pack is included. The price: $225.00 (Accessory rechargeable battery available: $22.00)

TEMPO/ 220 TR

A brand new 220 MHz solid state AM/FM transceiver. The 220 TR's power output is 4 Watts FM, 1.5 Watts AM. The receiver is double conversion with a tunable receiver. Sensitivity is typically .3 microvolts for 20 db quieting. Tuning is accomplished in two bands, 220-222.5 MHz and 222.5-225 MHz. Price $220.00

TEMPO/fmv 2

So much for so little! This little 10 Watt VHF FM transceiver offers high quality performance and features usually found only on more expensive units. Features such as AFC on receive and separate switchable Transmit/Receive sections. Includes mounting bracket, heavy duty power cord and provisions for accessory AC power supply. Frequency: 146-148 MHz, 11 channels, 25 KHz channel spacing. 13.8 VDC ±10% operation (standby −100 ma, receive −150 ma, transmit−3.0 amp.) $199.00



TEMPO/TPL high power fm amplifiers

MODEL NUMBER	POWER INPUT	POWER OUTPUT (min)	BAND	PRICE
TPL1002-3	5 to 25W	100-135W	2M	$220.00
TPL1002-3B	1-3W	80W	2M	$235.00
TPL802	5W	80W	2M	$180.00
TPL802B	1 to 3W	80W	2M	$195.00
TPL502	5 to 15W	35-55W	2M	$105.00
TPL502B	1 to 3W	45W	2M	$130.00
TPL252-A2	1W	25W	2M	$ 85.00
TPL445-10	1 to 2.5W	12W	440MHz	$125 00
TPL445-30	4W	30W	440MHz	$215.00
TPL445-30B	1W	30W	440MHz	$235.00

TCP 12A Control Head . . . $32.00

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. $189.00

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.

Henry Radio

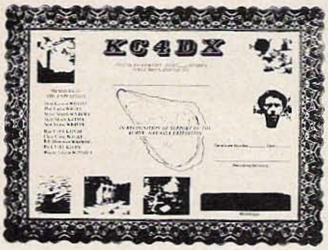
11240 W. Olympic Blvd., Los Angeles, Calif. 90064 213/477-6701
931 N. Euclid, Anaheim, Calif. 92801 714/772-9200
Butler, Missouri 64730 816/679-3127

October column to the effect that Andy had not made a California contact. This comment was in reference to the July 18-19 DXpedition to Prince Edward Island only, not the season as a whole.

The "K2OAW" frequency counter has been in operation for over a month at this writing . . . it works perfectly. I would highly recommend it to anyone in need of a frequency measuring device. The next project for this station will be an outboard mixer to combine the vfo, carrier oscillator and heterodyne oscillator signals and allow continuous monitoring of the receive and transmit frequency. First thoughts are for perhaps a pair of 40673's – comments from those who have accomplished this already, would be appreciated.

The December openings won't be far off by the time you read this – is your rig in good shape and ready for the "Second Season?"

WAØABI



NEW CERTIFICATE THREATENED

It obviously had to come to this: a certificate for making one contact! The Navassa DXpedition crew of KC4DX have announced a certificate which is available to any operator who managed to get through the tremendous pileups and make a contact.

It is hard to believe that anything as nice as this is available for only one dollar! Why, that barely covers the postage and handling, not to mention having a little left over for the Atlanta club to put toward another expedition.

If you are one of the few lucky and persistent DXers who did contact KC4DX all you have to do to have this outstanding award is send a confirmation of the contact to His Eminence Chaz Cone, Box 11555, Atlanta GA 30305, include one dollar (minimum – no maximum has been set, but the members of the DXpedition do go around on bended knee a lot when hints of donations are made) – why not make it \$2 – you'd spend that on a movie.

HOT GEAR WITH THE FCC

Yaesu FT-101 No. 107036	WA2YSW	4/72
Standard 2m FM No. 102703	W6NPV	4/72
Drake ML2 No. 20189	WB2LLR	4/72
Standard SRC-806M No. 009210	K1TLP	5/72
Aerotone 6M 355LT, No. 685064	RR Police Grd.Ctrl.Trml. NYC	5/72
Standard SRC-806M, No. 102703	C. Mathias 3234 Coronado Ave Imperial Beach CA	5/72
Lafayette HA-410 No. 009210	WA2KDG	5/72
Coll., 62S1 No. 10728	MSU ARC E.Lansing MI	6/72
WRL Duo-Bndr 6010AT302	WA6FCY	6/72
HR-2A, 11 chan., 04-07152	WA1NVC	9/72
Swan Cygnet 270,No. 313022	K4ACJ	9/72
Collins Mic, Mod. MMs, No. 4294	K4ACJ	9/72
Heath HW-100 & AC PS	WA2JGP	10/72
Swan 270B, No. M-395430	W8HST	11/72

RTTY PICTURES

We plan to run a RTTY picture every month in these pages. Have any particularly interesting examples you would like to see published? Send 'em in!

MORE REPEATER RULES

Applications filed after October 17, 1972 – All amateur applications filed on or after October 17, 1972, must comply with the new rules adopted in Docket No. 18803.

Existing stations – A station operating as a repeater station, and/or one authorized for remote control, whose license was granted as a result of an application filed prior to October 17, 1972, should comply with the new rules adopted in Docket 18803 to the extent possible after that date, but must fully comply by no later than June 30, 1973. Applications for such stations received prior to October 17, 1972, will only be granted authorization for operation for the balance of the original license term without payment of additional filing fees. If a renewal or additional privileges are requested, normal filing fees will be required. Applications for station license modification filed after April 30, 1973, may not be processed in time to permit continuity of operation.

Waivers – The granting of waiver requests except under the most exigent circumstances are not contemplated.

Intra-community – The Report and Order and the rules speak of limiting repeater station coverage to intracommunity amateur radiocommunications. In consonance with the rules limiting to two the number of repeater stations operating in tandem, intracommunity is considered the maximum area covered by such a network.

Call signs – Beginning October 17, 1972, a license issued for a repeater station will authorize a call sign having the prefix WR followed by the number of the applicable FCC district. The suffix will be three letters assigned systematically starting with AAA.

AND MORE...

Rules amended to exclude business and commercial third party traffic from amateur operation; new rules proposed to permit limited compensation and to modify logging requirements.

Part 97 of the Rules has been

amended by the Commission to prohibit amateur operators from transmitting messages over amateur radio stations for business and commercial parties (Docket 19245). (Third party traffic is defined as amateur radiocommunication by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of any one other than the control operator.)

In a separate but related action, the Commission issued a Notice of Proposed Rule Making concerning possible limited compensation for amateur club station control operators and possible relaxation of the logging requirement for third party communications.

In a Notice of Inquiry released May 5, 1971, the Commission requested comments on whether any restriction on the use of amateur radio stations by non-amateur organizations was needed, and if so what those restrictions should be. The inquiry resulted from petitions to change the present rule (Section 97.39) which prohibits certain organizations from obtaining amateur station licenses or having an amateur operator use his station in their behalf.

The Commission said that radio communications, the sole purpose of which was to facilitate business and commercial traffic, was not in keeping with the intended purpose of the Amateur Service, and should not be allowed except for emergency communication. Amateur licenses will thus not be issued to schools, companies, corporations, associations or other organizations. The Commission explained that to prohibit third party traffic entirely would tend to stifle one of the basic purposes of the Amateur Radio Service, which is to provide a voluntary non-commercial radio service, but to allow all third party communications would tend to cause increased congestion in the amateur bands.

The rules become effective December 1, 1972.

The provisions of Sections 97.114(b) and 97.112 prohibit the American Radio Relay League's long standing practice of providing compensation to the control operators of station W1AW, which transmits code practice and informational bulletins of particular significance to amateur licensees. In a Notice, however, the Commission proposed rules which would allow this compensation and granted a waiver of the Rules to W1AW to permit it to continue operation pending final action on the Notice. It said that other club stations providing similar services may also apply for waivers. The Commission invited comments on whether to allow any *bona fide* amateur organization to operate a station and provide reasonable compensation to the control operator when the station transmits material solely related to the Amateur Radio Service or whether to create a new class of amateur station.

Comments were also invited on the usefulness of the Section 97.103(b)(3) of the Rules, which requires that an amateur radio station log include a notation of third party messages sent or received, including names of all participants and a brief description of the message content.

Comments are due by December 20, 1972, by Report and Order and Notice of Proposed Rule Making. Commissioners Burch (Chairman), Robert E. Lee, H. Rex Lee, Wiley and Hooks with Commissioner Johnson dissenting.

AMERICAN AMATEURS MAY EXCHANGE SATELLITE DATA WITH GERMAN AMATEURS

The FCC issued a Public Notice on the above on October 5, 1972. The text follows:

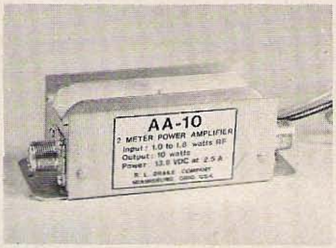
Information has been received by the Commission that the Bundes Post of the Federal Republic of Germany has no objection to the exchange of third party traffic with German amateurs relating to an exchange of technical data in connection with the launch of OSCAR 6 amateur satellite and throughout its orbit period.

Such third party traffic may be directed to other amateur operators in Germany only concerning the subject satellite operation. There is no change in the status of the general conditions relative to normal third party traffic between the Federal Republic of Germany and the United States. The Commission concurs, therefore, with the limited relaxation of third party traffic concerning OSCAR 6 and has no objections to Amaerican amateur operators engaging in such exchanges of information!

How many OM's recognize Rod VK3CR?

NEW PRODUCTS

10W AMPLIFIER FOR THE TR-22



The R.L. Drake Company has finally expanded their FM line with a small piece of gear that will no doubt increase the happiness of a lot of already happy FMers. The specific unit is the AA-10 FM amplifier designed to be driven by the one watt available from a TR-22. Rated at 10 watts output, it will give you that extra punch that is lacking when just using the transceiver. While 10 watts alone is not exactly a high power figure compared to some of the mobiles running around today, the 10 dB gain available from this amplifier is bound to make a big difference in the number of repeaters that you can get through to.

Inside the case nestles a TRW PT4544 transistor mounted on the neatest circuit board you've ever seen. The T/R switching is all automatic through the use of diodes . . . no relays to clutter up things. The instruction book is very good and identifies each part along with complete directions on how to retune the unit if the need arises. I tried touching up the output a bit but was thoroughly disappointed. The Drake people had the audacity to sell us a perfect product! All the coils were exactly pretuned at the factory. There's just no fun in it anymore . . .

The amplifier is rated to operate with inputs between 1 and 1.8 watts. Feeding approximately 2/3 of a watt into it still produced a respectable output of 8 watts. With its compact size, a neat little transceiver could be wired up using those small commercial receiver and transmitter modules. Mount the boards and crystals in an attractive little case and mount the AA-10 on the rear. Right outside where it looks the best. the AA-10 sells for $49.95. Also available is a matching ac supply, the AC-10, for $39.95. From *R. L. Drake Co., Miamisburg OH.*

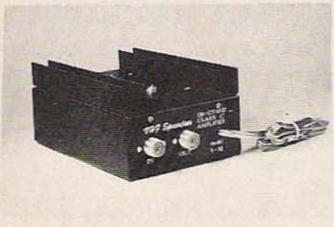
QRP TRANSCEIVER

Heathkit has announced its entry into the QRP transceiver field with a new three band CW rig. The HW-7 is designed for 40, 20 and 15 meters with vfo or crystal controlled operation on all three bands. The receiver is claimed to have better than 1 μV sensitivity, which is pretty good considering that it is not a superhet but a direct conversion Synchrodyne. The transmitter input power is 3W on 40, 2.5W on 20 and 2W on 15 meters. While this is nowhere near enough power to leisurely earn a DX certificate (at home . . . in your spare time) you would be amazed at the contacts possible with only a few watts. In October WB2WYO stopped up at 73 while on vacation and I got a look at his nearly full log book. He runs 2W from a rig inside his camper to a piece of tuned wire strung out to the nearest tree. With this simple setup he manages to work across the country with 579 signal reports!

The best features of low power operation are portability and freedom from external power sources . . . ooops, don't forget fun! The HW-7 is designed to operate from an external ac supply or 12V batteries. Just plug in a fresh set and disappear into the wilderness for a while. What could be more appealing than operating portable VE8 from the banks of a wild river in Canada?

The HW-7 features push button band switching, sidetone and a relative output meter for tuning convenience. It sells for $69.95 from *Heath Company, Benton Harbor MI 49022.*

50W FM AMP



VHF Specialists offer a new Model 5-50 two meter amplifier for the serious FMer. Featuring two Balanced Emitter Transistors, it exhibits extreme sensitivity and tolerance to VSWR changes. No need to worry about damage if your coax is open or shorted. Although the input is rated at 5 watts for an output of 50, the high gain input transistor will amplify only one paltry watt enough to drive the output stage to 40 watts output! With such a wide range of input powers that can drive this amplifier to a respectable output, the unit makes an ideal "universal black box" for FM work. The only possible complication would be the failure of the relay transistor to get enough rectified rf under low power conditions. No real problem though . . . for the circuit manual gives complete instructions on how to compensate for this by trimmer adjustment.

It is amazing when you think about a seemingly small thing like package design in amateur equipment . . . a lot of manufacturers mount their circuit boards in a metal box and just drill holes for the power leads and connectors somewhere near the place of connection to the boards. Whoever packaged this little amp had some idea of what most of us would be doing with it – tucking it up out of the way somewhere. Notice how the power leads and both connectors are mounted on the same side of the case. With its small size of only 5x7x3, one should have no mounting problems. $89.95 from *VHF Specialists, P.O. Box 167, Vienna VA 22180.*

NEW HEATH SCANNER

The Heathkit GR-110 Scanning Monitor brings you up to eight crystal frequencies to cover the active VHF bands in your particular locality.

The GR-110 can be tuned in either a manual or automatic mode. To tune manually, you simply depress the front panel "manual" switch to step to any desired controlled channel 0 through 7, which is read out by the digital channel indicator for fast identification.

In the automatic mode, the monitor scans rapidly through all eight channels and locks on to the first one that starts a transmission. It stays locked on that channel as long as the transmission continues. If transmission stops, the monitor will release the channels after four seconds and resume scanning. To bypass channels during the scan, front panel pushbuttons let you lock out any channels you desire. A priority channel is also provided which takes precedence over all other channels. The monitor automatically locks on to this channel whenever a station is transmitting even though it was already locked on another channel. The scanning monitor works equally well as a home or mobile unit. Line cords are provided for 120V ac or 12V dc battery power. A price of $119.95 and four evenings of your time will get you in on all the repeater action. *Heath Company, Benton Harbor, Michigan 49022.*

NEW BIRD WATTMETER

The new model 4342 Dual Wattmeter-VSWR Monitor displays the three prime rf transmission measurements at once on a single meter face: Forward and reflected power are indicated by individual pointers and VSWR is monitored on a third scale from the intersection of the two power pointers.

Unlike most VSWR meters, the model 4342 does not require *any* adjustments to full scale deflection, or any switching before VSWR readings can be taken. The entire set of three transmission parameters is read out simultaneously during normal rf operations or during maintenance adjustment procedures.

Power and frequency range of the new Bird Dual Wattmeter-VSWR Monitor depend on two plug-in elements selected from more than eighty choices available with the company's popular THRULINE Model 43. Full scale power levels at ±5% accuracy range from 10 to 5000 watts for reflected, in discrete frequency

Continued on Page 62 . . .

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THE AFSA IV SSTV ANALYZER

Slow Scan TV has three key frequencies; 1200, 1500, and 2300 Hz. When receiving, the most critical is 1200 Hz, the sync frequency. When transmitting, the 1500 to 2300 Hz range is the critical area of concern. Here is how to build a unit which will solve both tuning problems.

The ideal method to find out what is happening to an SSTV signal would be to instantaneously analyze every Hertz generated and comparatively display them on an oscilloscope. The limits would be seen, plus gray scale, gamma correction, and transients. As a bonus, RTTY can also be displayed and instantaneous shifting errors analyzed. Complicated? Nope. $10 worth of IC's and transistors should do it, along with a surplus 'scope tube.

Theory

This unit measures the time the positive going portion of each cycle takes. For each Hertz, an oscilloscope sweep is triggered when the incoming signal crosses 0 and starts positive, and a vertical pulse is generated 180 degrees later when the signal again crosses 0 and starts negative. The trace is begun at the right side of the screen near the bottom and continues at a linear, semi-logarithmic or

AFSA as built by K7YZZ. Semi-logarithmic sweep.

logarithmic (your choice) rate towards the left near the bottom. The higher the frequency, the shorter time the Hertz will take, and the pulse will appear closer to the right side of the screen; whereas a lower frequency will approach the left side of the screen the closer it approaches the sweep frequency.

Three previous versions have been built and used by many of the active SSTV'ers over the last two years. AFSA IV uses an active high pass filter/limiter with a gain of 500, and a cutoff of 1200 cps with a rolloff of 40 dB per octave. Following this is a non-critical NPN transistor which acts as an inverting, clipping and interfacing stage to drive two TTL singleshots.

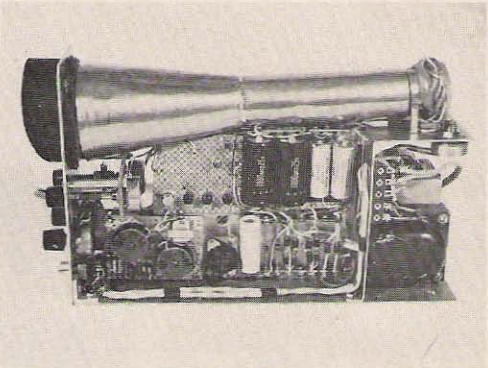
Positive going portions of the incoming frequencies trigger the delayer singleshot. Since the highest frequency of SSTV is 2300 Hz, the pulse at the end of the sweep would always take over 200 microseconds to occur, and if the sweep was triggered at the beginning there would be a considerable amount of wasted sweep. However, by using a variable singleshot delayer, the sweep may be initiated just before the expected 2300 Hz pulse.

The sweep op amp has a circuit which allows the user to select any rate and linearity desired by varying the ratio of two potentiometers, R3 and R4. The ramp linearity may be anything from exponential through linear (sawtooth) to logarithmic. Feedback is taken from the emitter of the high voltage output transistor to both improve the resulting ramp shape and the stability. Previous designs suffered from horizontal drift, but this one stays within 10 Hz from cold to very hot.

Back at the interfacing transistor, when the positive half of the Hertz is done, the vertical pulse generating singleshot is triggered. Size and clarity of the pulse can be varied with R1. Following this IC is a high voltage transistor which drives one 'scope vertical plate.

Construction

At the present time, I don't know of two identical AFSA's circuitwise, much less layoutwise. The 'scope tube may vary from 2 to 5 in., but most prefer the 3 in. size. A 3HP1 would be nice since it has a rectangular face 3 in. wide by 1 in. high. Some AFSA's are built as a separate unit, while I prefer to include it on the same chassis with my monitor.



AFSA of K7YZZ. Inside right view. Utilized AFSA II circuitry. (Toroids instead of active filter, RTL instead of TTL Singleshots, not drift compensated. Used more parts.)

The electronics are very non-critical and similar IC's and transistors may be interchanged with little effect. The ones specified are the simplest and cheapest that I had available. The layout should be in a rather straightforward manner to prevent feedback around the input/limiter stage, but other than that just keep the adjustment pots accessible. My power supplies are part of the monitor, but any reasonably well regulated design should work fine.

If you are building this unit strictly for RTTY usage on the standard mark and space frequencies, lower the active filter resistors from 9.1K to 5.6K and from 4.7 MΩ to 2.5 MΩ. This will then raise the cutoff frequency to around 2000 Hz.

Tuneup

At this point you have to make a decision on what you would like to do with AFSA. If you build AFSA IV as given, then use Table I or Table II to initially set the adjustments. Note that you have the choice of semi-exponential, linear, semi-logarithmic, or logarithmic.

My SSTV choice is semi-logarithmic. This gives an expanded portion around the sync frequency range of 1200 to 1500, but still doesn't crowd the video range of 1500 to 2300 too badly. The linear sweep settings

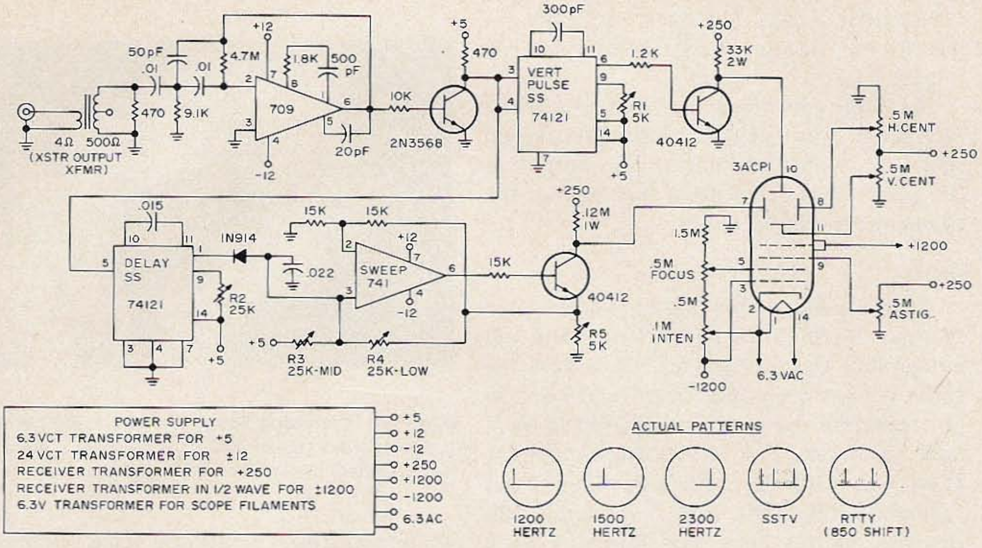


Fig. 1. Schematic diagram of the AFSA IV SSTV analyzer.

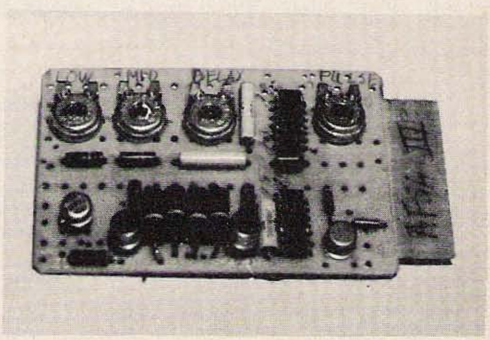
will give a logarithmic display of frequency which seems to crowd the high end. It does give a very good indication of unstable sync pulse frequencies and transients occurring in the range between 1200 and 1500. The logarithmic sweep will produce a linear display of frequency (e.g. 1200–1300 Hz will be just as much separated as 2200–2300 Hz). This display is good for measuring and interpolating frequency departures from the standards.

For RTTY use, logarithmic sweep will enable straddle tuning, but it tends to make 170 Hz shift signals difficult to tune due to the small separation in frequency. Linear sweep produces a nice picture, and a semi-exponential sweep would give even better separation to the narrow shift. However, straddle tuning becomes quite difficult unless fine calibrations are made when calibrating the scope frequencies with linear or semi-exponential shift.

I set up the sweep for SSTV use by using an audio generator at 1500 Hz and adjust the sweep width (R5), horizontal centering, and vertical centering for a horizontal line that just sweeps the entire face of the 'scope about 1/3 up from the bottom. The pulse should appear somewhere around the center of the screen. Adjust the pulse width control so that the pulse is a sharp line extending up from the base line to about 1/3 down from the top of the screen.

Next I set the generator to about 2500 Hz and adjust the delay (R2) to get the pulse just inside the right edge of the screen. After this low sweep (R4) is adjusted to that 1100 Hz is just inside the left edge of the screen. Middle sweep (R3) is adjusted so that 1750 Hz for logarithmic, 1600 Hz for semi-logarithmic, or 1500 Hz for linear occurs in the middle of the screen.

For RTTY, I adjust sweep width (R5) using 2400 Hz. Adjust delay (R2) using 3100 Hz. Adjust low (R4) for 2000 Hz. Adjust middle (R3) so that 2400 for semi-



AFSA III Circuit card of WØLMD. Except for some slight changes, identical to AFSA IV card. Input stage on another card in monitor.

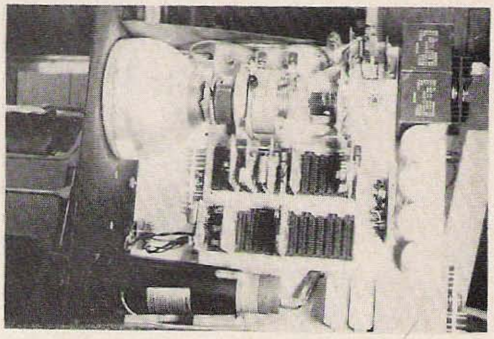
exponential, 2450 for linear or 2550 for logarithmic occurs in the middle of the screen.

Since the adjustments interact, it is necessary to go through the adjustments several times. A 'scope attached to the output of the HV transistor will show the effect of the changing ratio of R3 to R4.

Using

After tuning, swing the audio oscillator through the SSTV or RTTY range. You will notice that the pip will exactly follow the audio oscillator's output frequency. You can now calibrate the screen using a felt tip pen, tape, or decals. For SSTV, calibrate 1200, 1500 and 2300 Hz with long lines. Then calibrate 1300, 1400, 1700, 1900, and 2100 Hz with shorter lines. For RTTY, I place long lines at 2125, 2295 and 2975 Hz. Shorter indications are placed at the crossover points of my TU at 2210 and 2550 Hz.

Now hook up AFSA to an SSTV signal, preferably your own in closed loop at this point. You should notice a considerable amount of "grass" in the 1500 to 2300 Hz region corresponding to the video information. At 1200 Hz there should be a faint pip, brightening on the vertical sync pulse. Now, for a bit of fine reading. You will notice faint pips in the "dead area" between 1200 and 1500. These are transients caused by sync time switching in the middle of a Hertz. Some stations use severe clipping to achieve a contrasty picture. When looking at these on AFSA a world of transients appears. This shows why these pictures sync so poorly. AFSA shows that very few stations use the full video range. Most stations crowd the



Top view of monitor and AFSA IV. AFSA IV card is immediately above 3ACP1 tube socket. Monitor is IC magnetically deflected using a 7 in. tube.

white frequency (2300), the black frequency (1500), or both, which results in a lack of gray scale (naturalness). The correct picture as displayed on AFSA IV will have few transients in the "dead area," no dominant bright lines at 1500 and 2300, but a lot of action in between.

When QRM increases so that the gray scale is not so important, contrast should be increased so that 1500 and 2300 begin to show brighter lines, but not so much that transients appear in the "dead area." Note that your 1200 Hz horizontal sync pulses dance around a bit. Mine are stable within 20 Hz of 1200, but some stations may wobble up to 70 Hz. And that hurts! (Pun intended.)

Those stations with excess transients and sync wobble are seldom copyable except under ideal conditions. I believe the sync wobble is caused by lack of symmetry in the

Table I – SSTV

	R1 (Pulse)	R2 (Delay)	R3 (Mid)	R4 (Low)	R5 (Width)
Linear	2K	18K	20K	13K	4K
Semi-log	2K	18K	10K	22K	4K
Log	2K	18K	5K	25K	4K

Table II – RTTY

	R1 (Pulse)	R2 (Delay)	R3 (Mid)	R4 (Low	R5 (Width)
Semi-exp.	1.5K	15K	25K	3K	4K
Linear	1.5K	15K	7K	4.5K	4K
Log	1.5K	15K	2.5K	9K	4K

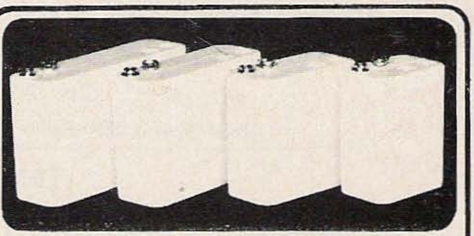
multivibrator section of the camera, too sharp of a filter following the MV, or frequency cutoff in the transmitter or receiver.

With RTTY, a similar situation exists. AFSA should just show bright lines at the mark and space frequencies with less than 25 Hz wobble, and a slight amount of switching transients in the "dead area." Few RTTY stations are this clean. Most show considerable "chirp" caused by dirty and/or corroded contacts, very poor AFSK units and low pass filters, and passband troubles in transmitter or receiver. After seeing all of the "crud" transmitted, it's quite a tribute to the machine. It copies anything. As with SSTV, this is why some stations are wiped out by the slightest interference.

Parting Pips

1. A 709 & 741 in the metal can have a tab next to pin 8.
2. The 74121, and 709 & 741 in the dual in line case have an indentation on the top between pin 1 & 14 (8).
3. Polypaks, Allied & Newark handle most of the parts.
4. The transmitter inverter can be any switching NPN.
5. The output High Voltage Transmitters may be any capable of at least 250V and a few megahertz.
6. AFSA requires a noise and QRM free signal for best frequency discrimination. Avoid giving reports under marginal conditions.
6. A future improvement that I am going to add is a blanking circuit so that only a dim horizontal line is visible compared to the vertical pips. The vertical pips will then also provide an unblanking pulse. For a method of blanking, refer to *73*, June '66, p.15.
8. A dual trace 'scope tube should be considered. On SSTV, use a 5 in. dual gun P7. Use a yellow filter for the SSTV monitor and a blue filter for an AFSA display at the top or bottom of the screen. For RTTY use a dual gun tube with a medium or fast phosphor decay and build a "flipping line" display at the top and AFSA IV exponentially swept at the bottom.

...WØLMD



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Peterborough NH 03458

SINGLE CONVERSION TWO METER FM RECEIVER

Four transistors and an IC

The following is a description of a build-it-yourself two meter FM receiver using two new components to achieve a single conversion job for narrow-band FM amateur use. It produces plenty of good, clean af from a total transmitter deviation of 10 kHz.

The Trend to Multi-Function IC's

Once again the broadcast industry has created a component of considerable interest and utility to amateurs. This is the RCA 3089E chip, in a plastic 14 pin case, ¾ x ¼ x 1/8 in., containing some 63 transistors, 30 resistors, and 14 diodes. The major block functions and transistor count in each follows: i-f amplifier (22); quadrature FM detector (10); audio preamp (13); level detector and meter circuit (15); squelch drive (4); bias supplies (10); agc buffer (1). The price of all this? . . . $3.63.

The Trend to Ceramic or Crystal Filters

This has led to a unit ¾ long x 3/8 in. thick, in a two pin metal case, which furnishes all the selectivity needed for narrow-band FM in the i-f section. This little tin can takes the place of quite a number of tuneable coils and stays right there on frequency at 10.7 MHz. You can't change it even if you want to. It works!

Receiver Block Diagram

Figure 1 shows how simple it all is (?). Here we are back again with a single conversion, after decades of double and triple conversion jobs. The individual circuits of each block, the rf, mixer, L.O., i-f and af, are all shown in detail, with two-terminal connections between each block, so no overall schematic is needed. Many pages could be written on the philosophy of design, but this is a construction article, so here we go right into the thick of it.

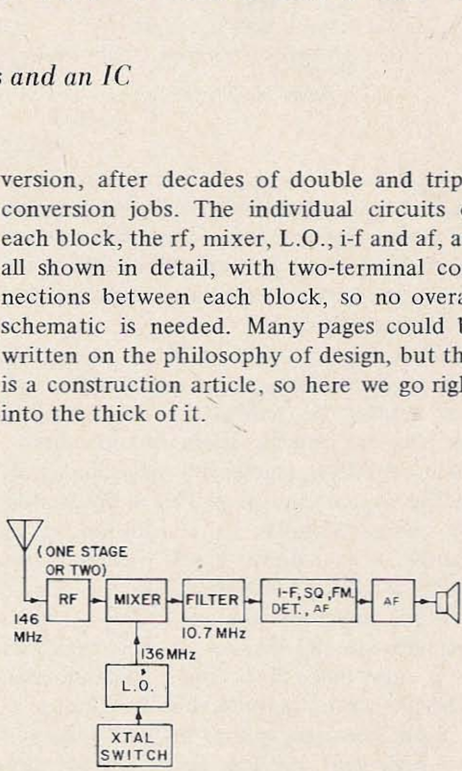


Fig. 1. Block diagram of 2m FM receiver.

The Tuner

Figure 2 shows the rf stage schematic using the "insulated protected dual gate metallic oxide semiconductor field effect transistor" (to give its true full name). You can treat these little gems almost like a tube. The "almost" refers to the need for fixed bias as well as self bias if you want maximum gain as well as anti-spurious, anti-inter-

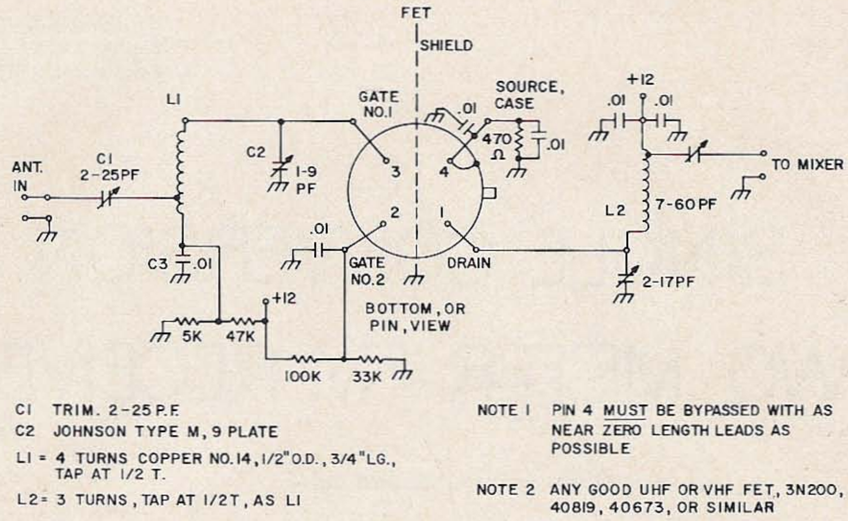


Fig. 2. FET rf stage.

modulation, and anti-overload characteristics all in one tiny package. These features are aided by *separate* bias adjustments for each of the two gates. While this is optional and not critical, it helps.

There is one place in the rf stage you must pay attention to in order to allow full gain without neutralization. You must use the shortest possible leads and low inductance capacitors (preferably no leads at all) on the source bypassing. This is the transistor element similar to a cathode or an emitter. If you don't, it will oscillate when lightly loaded. Fortunately gate No. 2 is so arranged internally that it acts as a shield, somewhat in the manner of the screen grid of a tube. Use short lead bypassing also, although it is not as critical as the source.

With these precautions the FET stage will give high gain and low noise without neutralization. One rf stage is shown, but another can be used for maximum sensitivity and minimum noise figure.

Mixer

This is another dual gate job, with the nice feature of having the signal on one gate and the L.O. on gate No. 2, just like two grids in the old mixer tubes. Here is where careful adjustment of *both* fixed bias voltages will pay off in rejection of spurious, intermodulation, and overloading. You can leave it as is in the schematic, or make checks yourself if special conditions occur at your location. One thing I found (there are always things to trip you up which are not "in the book") that you should watch for, is oscillation due to the fixed bias on gate No. 2 being too high.

Testing of Front Ends

In order to get everything right, promote smooth tuning and operation, determine best component values, whether or not any component or voltage is critical, and to find out in general what makes a given circuit tick, I use a broad-band, low sensitivity i-f for the first go around. With the rf stage in front of the mixer this was simply an AM detector tuned to 10.7 MHz, a dc meter, and plenty of audio. With no limiting, no FM, everything you do to the front end shows immediately. This method also accommodates easily to a low cost signal generator, whose attenuation is never sufficient for a sensitive receiver.

Final Word on Gate No. 2 of the Mixer

Reworking the component values for the mixer, I again ran into oscillation when the dc bias was too high, this time showing up in the rf stage, even though there was no trouble there. So keep your eye on gate No. 2, it's a little touchy if you try to raise the mixer gain by too much bias. It does go up that way but being a form of regeneration, it rapidly becomes unstable. A good stable second stage of rf is much better – and safer.

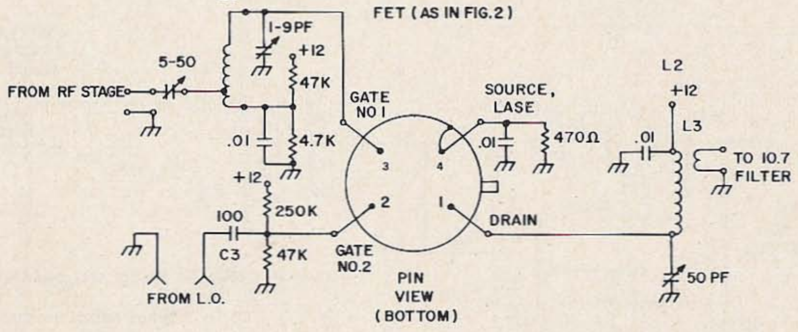
For maximum mixer sensitivity use plenty of L.O. power and gate No. 2 will operate fine without any dc bais. Just use a 47K resistor to ground.

Local Oscillator

This 45.3 MHz crystal oscillator and tripler to 136 is more or less standard, with the exception of the electronic switching of the different channel crystals. Building diode switching into the rig from the start allows you to put the switch anywhere you wish, one of such places being on a small panel under the dash of a car while the rig is out of sight back in the trunk or a similar concealed location. Some number of crystals should be decided on, such as 6 or 12, or leave enough space to install later as many as you decide to use. With this type of channel receiver no other type of tuning is available, so plan ahead.

Figure 4 shows the circuit, and if you haven't yet worked with electronic switching, don't let it worry you, it works. The switching diode is simply in series with the crystal; or rather, there is a diode in series with each crystal, and if no dc is applied to the diode to turn it on, the oscillator feedback path is cut off. When one of the diode resistors is grounded, making it conductive, current flows through the diode and, presto, you're on the air. Yes, there is some attenuation through a single diode, but inasmuch as L.O. power required is never very large, this is not troublesome if you provide for it. L.O. "tweaking'' is provided by capacitor C1, which also is in series with the crystal. C2 also provides some frequency adjustment to the precise center of a given channel. Remember that between various rig and crystal manufacturers, quite a few cycles of variation can be expected – and indeed shows up – between what one considers to be, for example, "146.940 MHz" and the next. Presumably, a properly functioning counter can be used to correct this problem. However, I present the following two facts: Almost all rig makers install tweaking capacitors, and expensive ones at that, on both receivers and transmitters; secondly, two of the strongest repeaters I receive here on "146.940' heterodyne each other at something like 500 cycles. So put those tweakers in your rig, too.

You have only one conversion to think about in this receiver, but then you do have the sharp filter to consider. This is up to the maker, of course, and the first one I tested was well within the capability of the two tweaking capacitors mentioned above. The user (you) will probably think that for around $10 the manufacturer should be able to put it right on frequency, but if you have ever tried to make and sell something for "anybody" to use, you know there is



L1 = 3T. COPPER, NO. 14, 3/8" O.D., 1" LG., TAP AT 3/4 TURN FROM LOW END

L2 = 50 TURNS, NO. 34 DCC ON PHENOLIC FORM 1/8" O.D., 1/2 LG. WITH 6-32 IRON CORE TUNING SLUG OR SIMILAR. TUNE TO 10.7 MHz

L3 = 3 TURNS

Fig. 3. FET mixer stage.

another side to that story. At any rate, it works, and works well.

The tripler gives out with plenty of 136 MHz power, although you must get this into the second gate in proper fashion. After trying various types of cable connections, I found it better to go right into the gate from the top – or hot end – of the tripler coil. Of course, be very sure that the tripler *is* on 136 MHz by using a grid dipper or tuned diode to check this. Do *not* rely on a sensitive receiver. It is best to couple the tripler output into a diode receiver and meter, with audio to check on spurious, and test carefully for smooth tuning of both oscillator and tripler and also for switching and power. Do *not* allow marginal operation anywhere along the line such as "just on" or "just enough power" which will surely cause you trouble later on with a low battery, aging, etc.

The 10.7 MHz Filter

There is not much you can do to this one. It only has two terminals on it, one input and one output, and a ground connection and absolutely no tuning. It's well worth the price if you consider the alternatives of a lot of i-f coils plus tuning up.

The i-f, Detector, and af Preamp Block

The RCA CA 3089E FM i-f system is quite a device, for my money. The internal block diagram is shown in Fig. 5. This little ¾ x ¼ in. flat pack is of course the heart of this whole receiver. The moment I hooked it up and threw the switch, things happened, with no waiting around. Plenty of "interstation" noise, because I always leave the squelch until last, and tremendous sensitivity at the input. One inch or so of wire touched to the input and SW stations all over the world start piling in. With everything flat on a copper clad baseboard and/or in a metal box, it works fine for 3 dB points. This is for the i-f alone, without the front end. FM demodulation is by quadrature detection (of which more later). A logarithmic type meter output (S meter) is buffered, and the delayed agc for the rf is, also. AFC, which you may not use right away, is also brought out, and last but not least the squelch noise amplifier is included as well as the proper af input for the dc it produces.

The quadrature detector deserves and gets special mention here. When used in a BC FM set, its single tuned coil is shunted by a resistor and it is fed from the i-f by a choke coil in order to demodulate total deviations 150 kHz. To demoduate narrow-band FM, down to a total deviation of not more than 10 kHz, a high Q coil, no resistor, and a low value capacitor to the coil from the i-f must be used. The quadrature type detector used instead of a discriminator has seen long service in TV work. It functions, simply put, by virtue of its high Q which stays more or

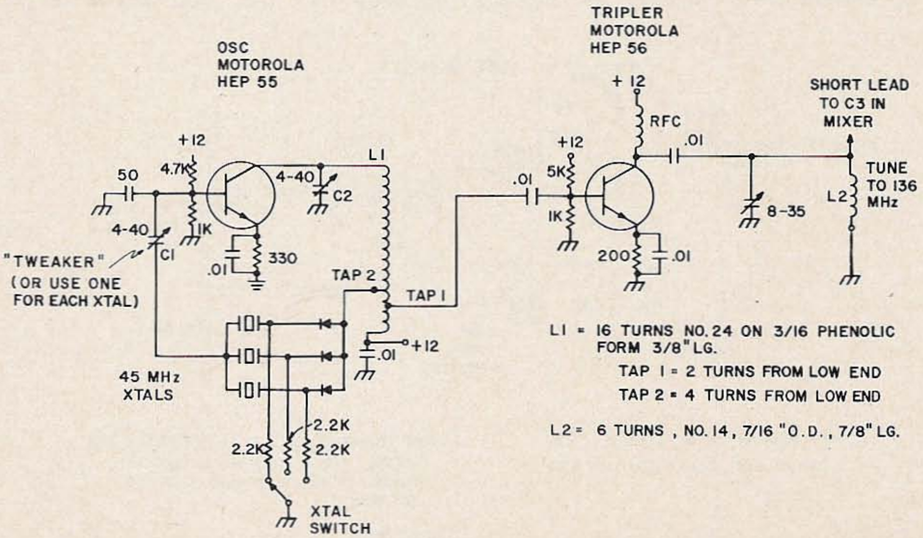


Fig. 4. Oscillator and tripler.

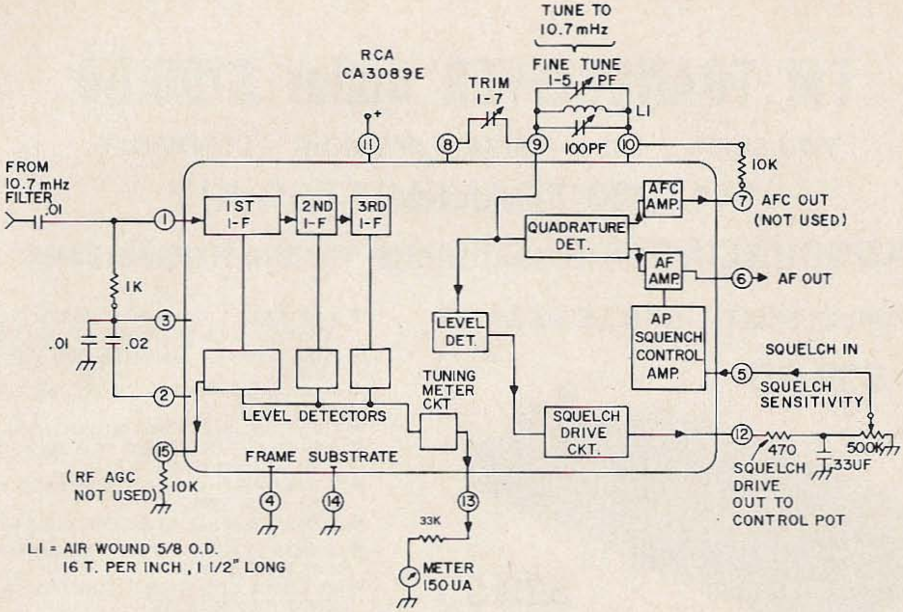


Fig. 5. I-f, audio, and squelch connections to CA3089E.

less on frequency – 10.7 MHz – while the incoming signal dances up and down with FM modulation above and below, unbalancing the detector which then produces nice, clean audio.

In order to do this correctly, the high Q coil must be tuned in exactly at the right spot, at 10.7 MHz, with a precision of a few hundred cycles at least. Actually, in practice, it isn't all that difficult. I just use a small fine tuning capacitor of 5 pF across the main 100 pF capacitor recommended for high Q, and on repeater voice modulation it is no more difficult than tuning a good receiver. And of course you then leave it that way. The series capacitor can be used to sharpen this tuning or broaden it, as you wish. Then it also is left alone. I'm just giving you some of the fine points of tuning up the quadrature detector, which is actually easier than tuning up a discriminator.

Just for fun, Fig. 5 shows you the various functional blocks in that miracle chip. Those "level detectors" shown are summed and sent to the tuning meter. This produces tuning indication even on strong signals, which are limited out at the detector. Detector "side-tuning noise" is greatly reduced by its careful application, all done internally for you by RCA to the squelch output, a nice feature. I recommend RCA Application Note ST-4698, "Advances in FM Receiver Design" for a more detailed description of everything that goes on in those 63 transistors in that little box. *(RCA/Solid State Division, Somerville, N.J. 08876)*

AF

This is the old story here, the tried and true one watt Amperex TAA-300. You can use your own favorite af if you have one. Five watts might be a little better in a noisy car. The Amperex is flat from 25 Hz to 25 kHz, leaving you plenty of room to trim response as you wish.

Results

I have logged so far 13 repeaters here, up to about a hundred miles, with a 38 in. piece of vertical aluminum, gamma matched to some 50 ft of ten-year-old 58/U cable.

This is a practical and working single conversion two meter amateur narrow-band FM receiver. It has been constructed and tested and circuit details furnished for the do-it-yourself crew.

P.C. boards are available from Bill Hoisington.

. . .K1CLL

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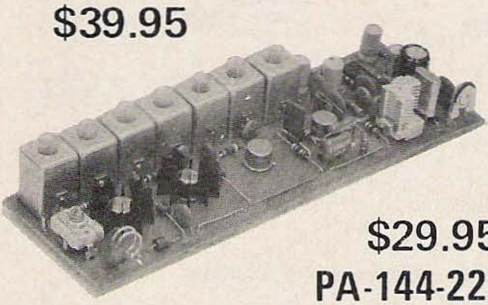

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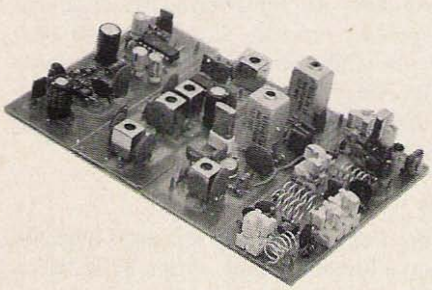

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VHF ENGINEERING W2EDN

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Bob Way WA9VGS
12116 W. Belmar Drive
Hales Corners WI 53130

THE MOS-TONE ENCODER

This tone burst encoder for 2-meter FM repeater access is literally built around an MOS quad NOR gate (RCA CD4001/D or CD4001E), and boasts the following features:

- Miniature size – volume less than 0.5 cu. in.
- Very low current consumption – less than 3 mA with average operating conditions during tone generation
- Excellent temperature stability
- Simplicity – a dozen readily available components
- Versatility – can be easily adapted for multiple tone operation

The photographs tell the story about the compactness of this neat little gadget. W9ZDI's original unit is encapsulated in epoxy and mounted inside the case of his handi-talkie. Incidentally, if the MOS-Tone is used with a battery operated rig, or with any rig with a well regulated power supply, the voltage regulating components R1, C1, and Z1 can be omitted.

W9ZDI ran temperature stability tests on the tone generator, with very pleasing results. At room temperature the unit's output was trimmed to 2,250 Hz, which is the access tone for the local Milwaukee repeater, WB9ADX (146.34/76). The temperature was then lowered in a cold-chamber to -70°F (a little colder than it gets in a car that has been parked outside all day in Milwaukee in January), at which point the tone had increased a mere 7 cycles (0.3 of 1 percent!). When the unit ambient temperature had been elevated to 200°F the tone dropped but 18 cycles (0.8 of 1 percent). Hence we cautiously proclaim this unit suitable for mobile mike installation in most climates. If further information is desired on the temperature compensating features of this integrated circuit oscillator, as well as the derivation of the RC time-constant equation, see RCA Application Note ICAN-6267 (2/70).

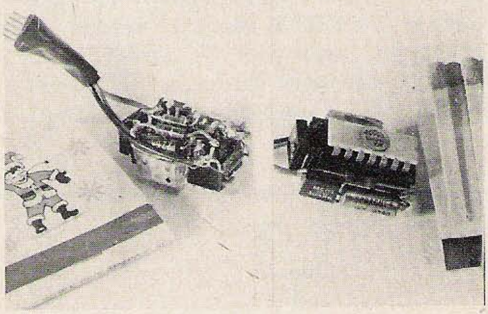

Fig. 1. MOS-Tone assembled by W9LCD measures 1" x 3/4" x 5/8".

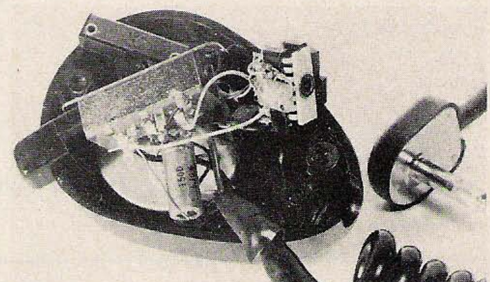

Fig. 2. MOS-Tone built into Regency HR-2 microphone by W9KQD. Long rectangular object in upper left is trim pot.

Theory of Operation

Referring to the schematic diagram of Figure 3, the first two NOR gates (pins 1-6) are connected as a multivibrator, the operating frequency of which is set by the time constant of R3-C2. Table 1 shows the approximate values of R3 for tones from 1,800-2,500 Hz, provided C2 is 820 pF. Fine frequency adjustment is accomplished by varying R2 (see Construction Notes). The third NOR gate (pins 11-13) is a buffer from which the output is taken. The output at pin 11 swings from 0 volts to the full B+ voltage; so R4, R5, and R6 attenuate the tone so that you can "talk over it." To decrease the tone still further, decrease R6 or increase R4. The final NOR gate (pins 8-10) is the timing circuit. The time constant of C4-R7 is about 0.5 second. As C4 charges, pin 9 goes "lo", which is inverted by the NOR gate to a "hi" at pin 10. This "hi" appearing at pin 6 shuts down the multivibrator. The buffer is deactivated in the same manner at pin 13, and prevents any possible chirp on the tone as it is cut off from reaching the output.

Construction Notes

All components are soldered directly to the pins of the dual in-line IC socket. Those that won't fit between the two rows of pins are left with slightly longer leads and are bent up around the sides, top, and bottom of the socket. The exact arrangement will depend upon the parts you come up with and your ingenuity. While the wiring is not critical, lead lengths should be kept as short as possible since stray capacitance will alter the tone frequency. One-eighth watt resistors are adequate. R3 and C2 should be high quality parts since their temperature coefficients govern stability. R3 should preferably be a thin-film, 1-percent precision type, and C2 a mylar or

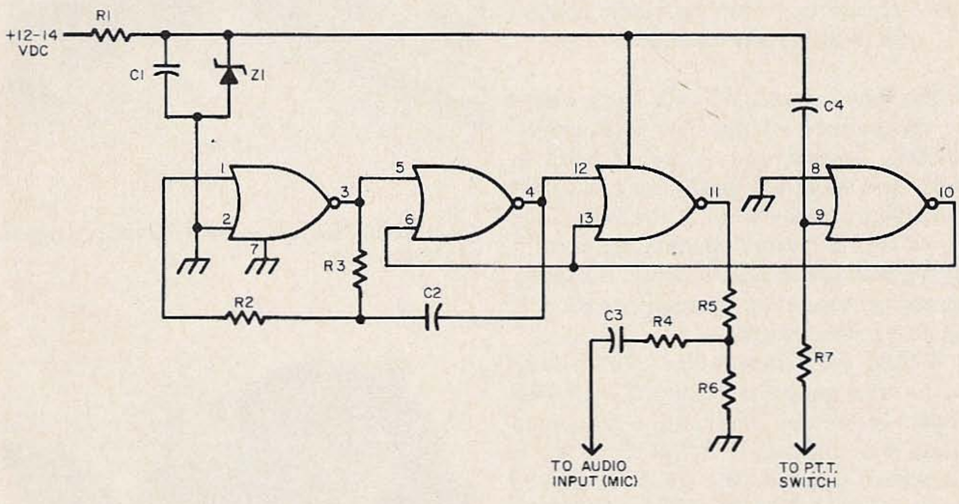

Fig. 3. Schematic of the MOS-Tone generator.

R1 – 1 k	C1 – 5 μf or greater, tantalum
R2 – 910 k - 1.1 M	C2 – 820 pf, mylar or silver mica (see text)
R3 – (see Table 1)	C3 – 0.047 μf
R4 – 51 k	C4 – 0.082 μf
R5 – 51 k	Z1 – 6-10 volt Zener diode
R6 – 510 ohms	
R7 – 11 M	

silver mica. The easiest way to fine adjust the tone frequency, if you have room for an additional component, is to connect a miniature trim pot, (100 k ohms or so) in series with R2 (see microphone photo). If it is desired to have the encoder adjustable to several different tones (for mobiling in areas where there are two or more repeaters), two schemes are available: (1) substitute a pot for R3 or (2) install a multiple-position rotary switch to select from several different small value resistors in series with R3. (These resistors could be 5 percent carbon types.) The switching arrangement shown is for use with rigs that use +12 volts to activate the push-to-talk relay, or the B+ line can be keyed. Still other arrangements are probably possible.

Conclusions

Several of these units have been built up by 2-meter FM ops in the Milwaukee area, and all are giving good service. If you wish an assembled and tested MOS-Tone, write W9ZD1 giving your frequency, tolerance, and size requirements.

Tone (Hz)	R3 (k-Ohms)	Tone (Hz)	R3 (k-Ohms)
1,800	288	2,200	231
1,850	279	2,250	226
1,900	271	2,300	220
1,950	264	2,350	215
2,000	257	2,400	210
2,050	250	2,450	206
2,100	243	2,500	201
2,150	237	2,805	178.5

Table 1. Value of R3 for various tones, when C2 = 820 pF

. . .WA9VGS

John S. Hollar Jr. W3JJU
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Harrisburg, PA 17104

A SHORT TONE BURST DECODER

For simple time control functions

Certainly many articles on repeater control have appeared in the pages of 73 Magazine. Actually, more so than in any other journal both amateur or professional. One thing that you may find interesting, however, is that these unique applications do not necessarily have to apply to FM. All sorts of applications can be devised using small signal activated timers which are accurate, reset themselves, use somewhat standard voltages, and are able to withstand continuous service at very low power drains.

The following circuit was built for a paging application, but serves well in many other applications without modification. It could easily provide accurate control for FM repeaters – as well as something as simple as turning on your front door light with a toot from your (yours alone) auto horn . Other applications include: an automatic answer-back circuit for autostart RTTY, or by switching in a solenoid – snap an automatic picture from a SLOW SCAN MONITOR with the world's first SSTV autoscan.

The Circuit

The outstanding feature of this decoder is that it will respond to a 100 ms pulse of no greater amplitude than -10 dB. Anything greater or longer is a waste of time and energy. The keying bandwidth is less than 50 Hz and that's plenty of selectivity.

The tones activating the decoder, therefore should be relatively high in the band pass and in this case we chose 2805 Hz, because the lower frequency voice components of 100 ms duration could easily trigger the unit.

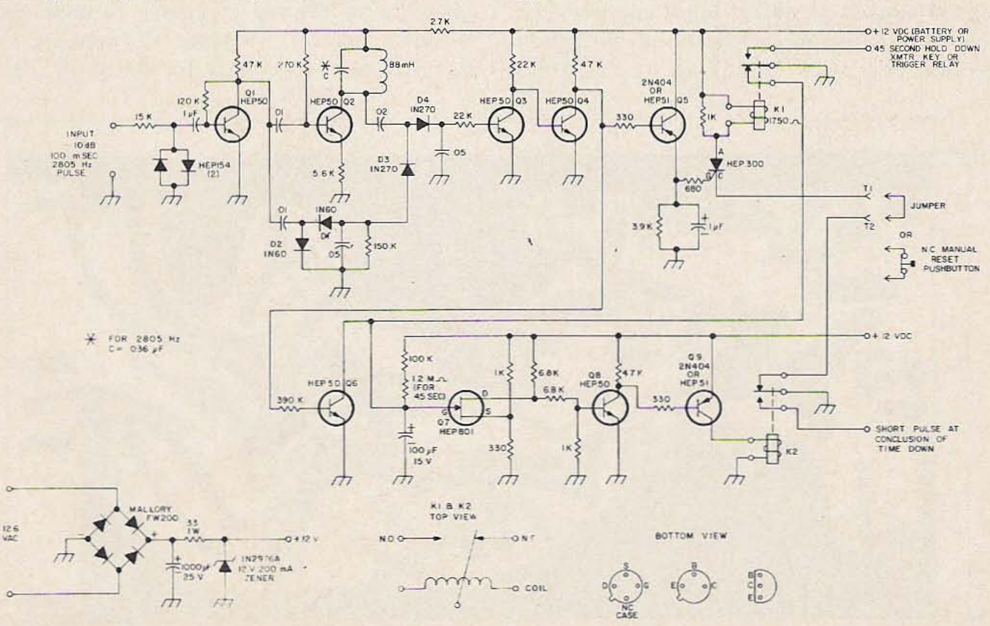
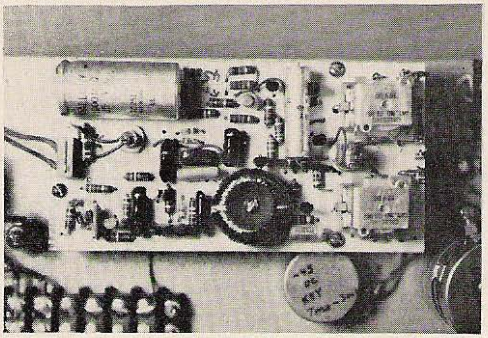


Fig. 1. Schematic of short tone burst decoder.



By sticking together some previous RTTY circuits (see Fig. 1), and using some of the suggested circuits in the current HEP Technical Tip Brochures (HMA-33), plus a few refinements, the following circuit does the job very well.

A signal of very low amplitude is unimatched to the base of Q1 (with clipping added if the level is not controlled). No matching problems were encountered and we have been successful in triggering everything from 3.5Ω to 20K with little or no signal loading or adverse effects in keying. Q1 amplifies the slightly clipped signal and drives Q2 and the 1N60 diode (negative) voltage doubler. Q2 amplifies the signal further and drives the collector LC circuit tuned to the desired triggering frequency. The combined amplified input and insertion loss of Q2 just about equals but is slightly greater than the output of the negative voltage doubler driven by Q1. The positive voltage doubler is connected in its parallel leg, not to ground, but by way of the filtered output of the negative supply. The combination keeps CR4 from supplying base/emitter current to Q3 until the positive voltage derived from the LC leg overrides all other audio on the channel. Q3 is made to conduct switching off Q4. This supplies an amplified pulse to Q5 and Q6. Q5 is normally off and when switched, supplies an inverted gate current to the Thyristor. In my original experimentation, the current draw required to hold the Thyristor into conduction was not enough so the relay K1 was loaded down by the 1K resistor. Although this was not the best thing to do, I later discovered that the very light load on the relay minimized the effects of heating or inductive spikes.

The relays are identical DPST imports made by the Calectro Corp. (DI-967, 12V, 5mW). They were selected because of price and size. The NC pole of the relay holds the timer gate of Q7 to ground until the Thyristor gate is keyed by Q5. The relay then supplies a ground to the NO contacts which can be used to key the transmitter or a slave relay of higher power. Ground to Q7 is released by this action and the 100 μF capacitor is allowed to charge through the 1.2 meg resistor. It takes 45 seconds for C1 to charge sufficiently to "pinch off" Q7,

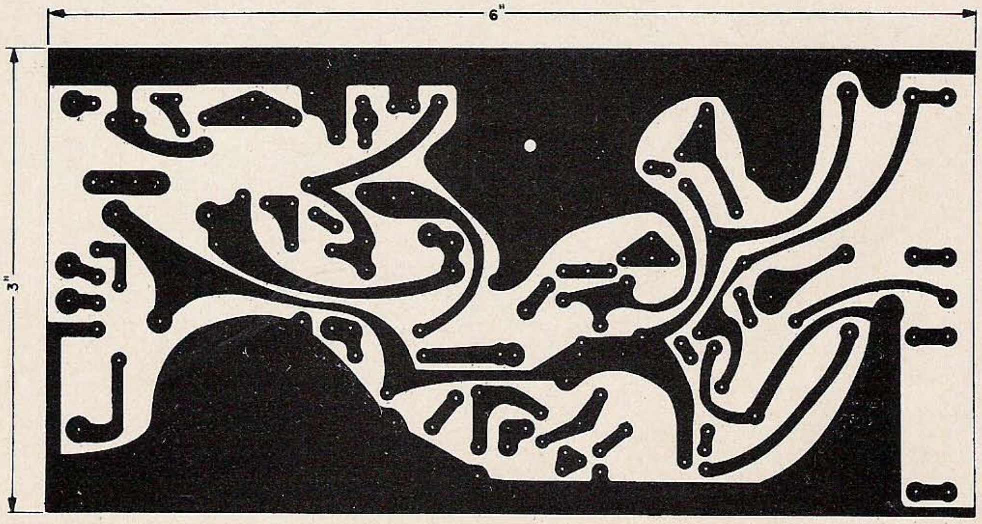


Fig. 2 Circuit board of decoder shown foil side up. (80% reduction)

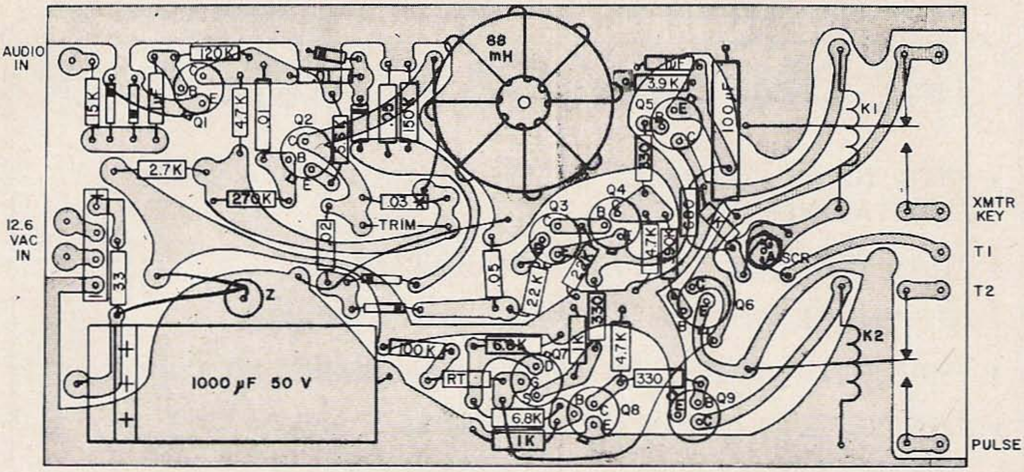


Fig. 3. Short tone burst decoder parts layout.

an N-Channel FET. With Q7 off, Q8 conducts causing normally conducting Q9 to cut off and release K2 momentarily. A short pulse to ground is one result which can operate the time out function, and at the same time the cathode of the Thyristor is momentarily broken with the other relay contact resetting the entire circuit.

Rt (at Q7)	TIME
1.2m	45 sec.
820K	30 sec.
390K	15 sec.

OR: use a 5M variable for 0–2 min.

Should a new pulse be received during the 45 second time down, Q6 switches on providing a fast discharge path to the timing capacitor without dropping out any relays. The general operation then is that the unit will remain on "until 45 seconds after the very last pulse is received." This is a convenient feature for repeater applications as the time of the tone burst can be very short and can be accomplished anytime during the time out period. As can be seen, there is also a degree of fail safe features which protect "stick-on."

Printed Circuit Board

After initial check out, I was concerned that no component would overheat or be in a "marginal state of operation." Long life and dependability were foremost. As can be seen from the photograph as well as the schematic, all components fit snugly on the board with only two over the top cheat wires used. My pc skills are still on the bottom of the learning curve. The board also includes a zener regulated power supply. Any great variation in supply voltage will of course affect the time period and this was considered a must under poor power regulation conditions experienced with repeater outposts. The total dissipation of the unit is 25 mA during standby and about 45 mA during time down.

This small dependable unit was used to control a wire-line controlled transmitter. It was a back-up system to dc control in the event the line would become shunted to ground (not necessarily interrupting audio) the "Phantom" control method might fall out. By preceding each control with a short tone burst, the circuit activates and is paralleled across a normal control relay. If the control relay fails to operate, the decoder takes over. If the relay does operate, the reset function "makes" and the decoder is made to reset at once.

There are all sorts of fancy applications possible with this unit and it is hoped that by making something a bit more simple to understand you will want to take a ham break and build something to amaze your neighbors with your resourcefulness.

. . .W3JJU

Joe Schuermann DJ1SK
805 Freising
Egilbertstr 25
West Germany

A UNIVERSAL IF AMPLIFIER FOR A STANDARD OR PANORAMIC RECEIVER

The key considerations of good receivers are: high selectivity and image rejection; high overload – low cross modulation; and low noise factor.

If you built your own receiver, it also has to be rather easy to put it together and align it.

The described i-f amplifier uses two crystal filters in order to give 500 Hz and 5000 Hz bandwidth. It requires no alignment work, is uncritical to assemble and provides a high image rejection in standard receiver systems due to the operation at 9 MHz.

The gain is 46 dB and it can take.5 volts across the input terminals before cross modulation starts.

You can choose between the 500 or 5000 Hz bandwidth simply by actuating a dc switch.

Using the i-f amplifier in a standard receiver.

Although the intended prime application for this i-f unit is a panoramic receiver for two meters, you can build a standard receiver

The tuner and mixer and local oscillator units can be built in a standard manner. The i-f amplifier described follows the mixer stage, and no AGC is required because of the large signal handling capability. As usually done, AGC should be applied to the rf and also to the second part of the i-f amplifier. This second i-f amplifier does not require any selectivity and provides simply the additional gain needed to drive the detector. Any of the recent op amps or wideband amplifiers that meet the gain bandwidth characteristics may be used.

How to build a panoramic receiver.

This amplifier is ideally suited for VHF panoramic receivers. Figure 2 shows the detailed block diagram. The gain of the rf

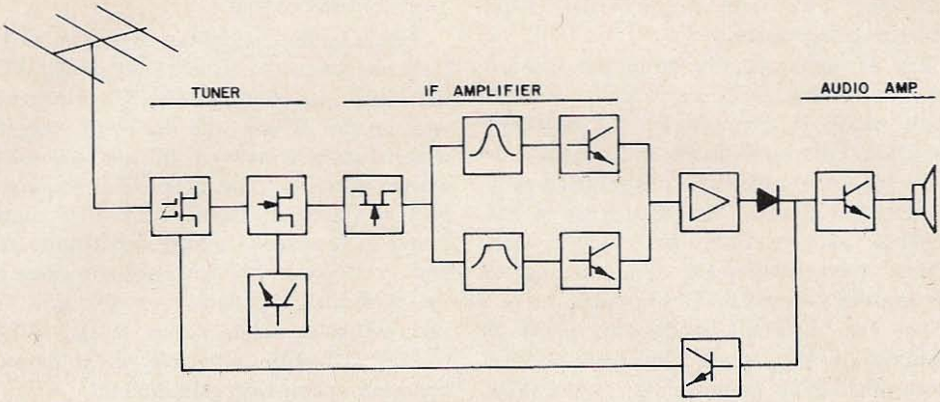


Fig. 1. Standard receiver block diagram.

amplifier and the mixer should be kept relatively low and not exceed some 15 dB in order to prevent overload of the following stages. In panoramic receivers AGC is not recommended, so al stages preceding the selectivity block must have extremely good signal-handling capability. The gain partitioning among the different functions of the receiver has to be made carefully.

The input signal passes the input attenuator which can be a passive and frequency-compensated resistive network. One can also use a dual gate MOSFET as rf amplifier and use several "preset" two voltage gates in order to provide fixed attenuation levels of say 0, -10, -20 and -30 dB.

The mixer should use FET for better cross modulation and low noise performance.

The local oscillator unit consists of the VFO, operating from 21–23 MHz, and an X-tal oscillator at 131 MHz. The oscillator mixer is followed by a band filter to provide the oscillator frequency of 153–155 MHz.

The attachment provides a simple sawtooth driver circuitry using unijunction tran-

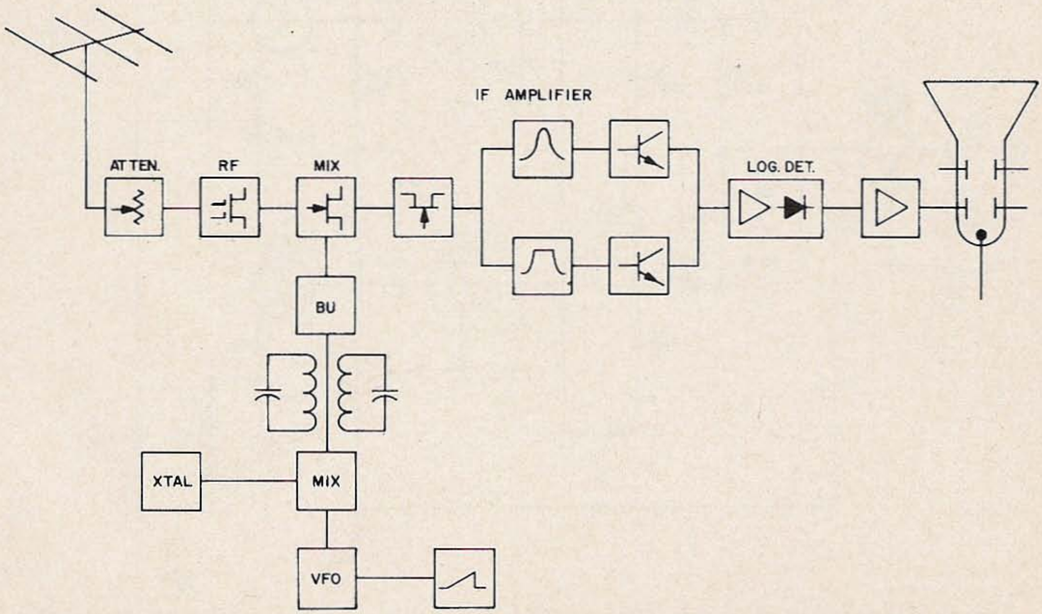


Fig. 2. Panoramic receiver block diagram.

sistor and FET, and the 21 MHz local oscillator using varicaps.

The i-f signal coming from the tuner is fed into the described i-f selectivity and gain block which is followed by a logarithmic amplifier. This logarithmic amplifier can be made by using operational amplifiers combined with diodes or transistors in the feedback path in order to simulate logarithmic characteristic. The dynamic range of this amplifier should be 50 to 60 dB

The two different bandwidths allow: a) scanning of the whole 2m band with a (sawtooth) sweep frequency of 15 Hz which is, depending on the used display tube, just above the level where the flicker effect becomes negligible (the bandwidth in this case is 5 kHz); and b) scanning a section of the whole 2m band and obtaining a high resolution. The bandwidth for this is 500 Hz. This small bandwidth allows an accurate analysis of the signal for instance to determine the modulation depth, the bandwidth, the sideband symmetry, etc.

The i-f amplifier unit.

The complete amplifier is shown in Fig. 3. It consists of a periodic FET preamplifier, the solid state bandwidth switch section, the two crystal filters, and the post amplifier which provides most of the total gain of the whole amplifier. The purpose of putting an FET as amplifier ahead of the filter and the switch is to achieve a high signal/noise ratio and to overcome the losses of the filter and the switching arrangement. Also the FET can withstand high signal levels without causing distortion, especially if the device is operated in common gate mode.

Generally filter losses are in the order of 1 to 4 dB depending on the selectivity and frequency of operation and any losses ahead of an amplifier add directly to the system noise figure.

Other advantages of a common gate mode FET are: a) low input impedance – no tuned circuit is required. In most cases tuner and i-f amplifier are separate "building blocks" which are physically separated. They normally are interconnected by a low

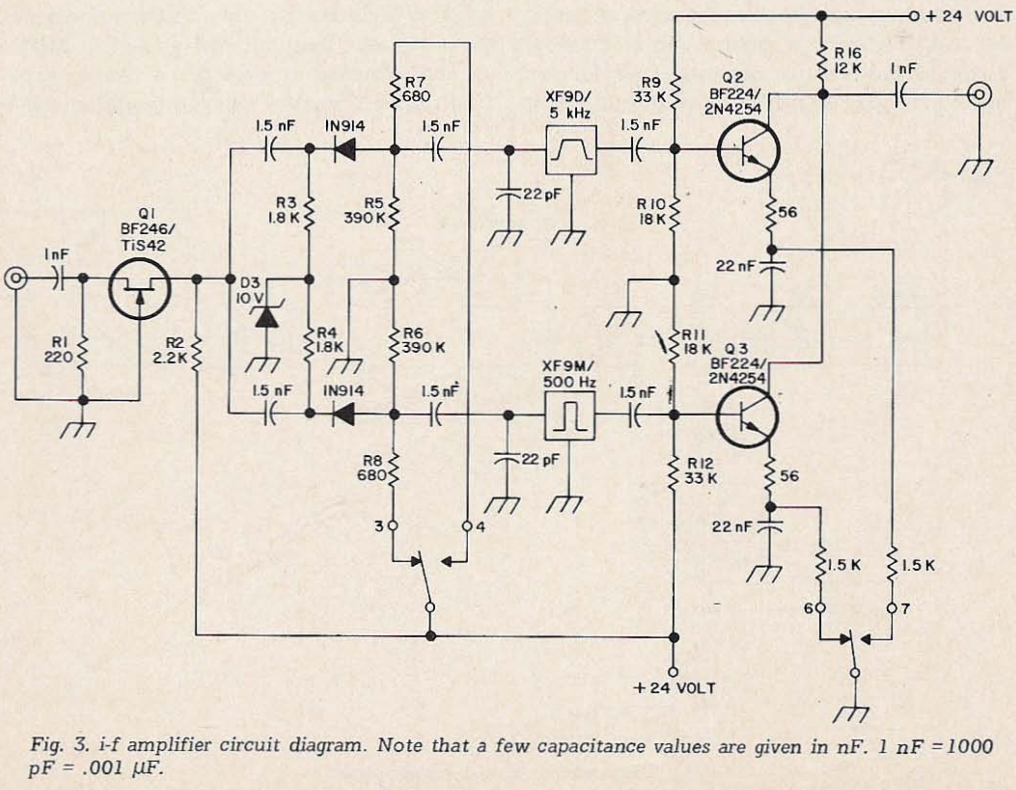
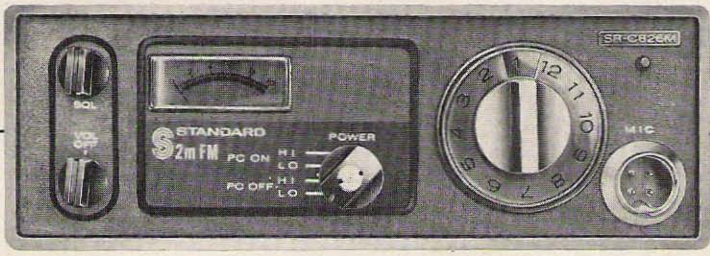


Fig. 3. i-f amplifier circuit diagram. Note that a few capacitance values are given in nF. 1 nF = 1000 pF = .001 μF.



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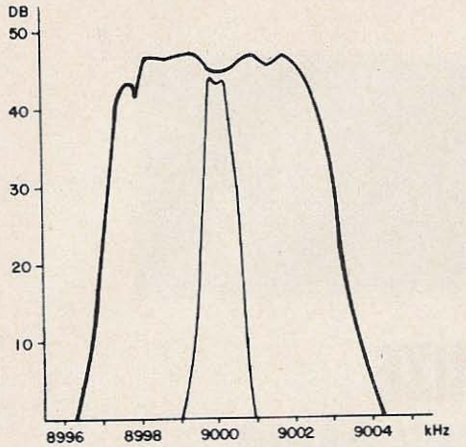

Fig. 4. Amplifier filter response curves.

impedance coaxial cable. b) The stability of an FET in common gate is excellent. and c) The biasing is extremely simple, the gate of Q1 is tied directly to ground and only R1 of 220Ω is needed to set the drain current at approximately 8 mA.

The voltage gain is Vu = Yf x RL where RL is the equivalent parallel resistance of R2, R7 and R3 respectively, R2, R4 and R8.

The selectivity and bandwidth is switched from 500 Hz to 5000 Hz by the two switching diodes D1 and D2. If D1 is switched on, by applying a positive supply voltage to the terminal 4, D2 is automatically reverse biased by -10 volts due to the

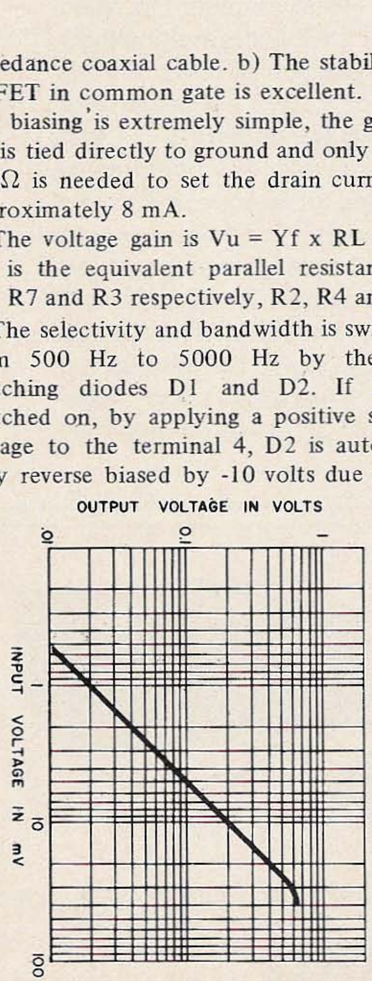

Fig. 5. Signal transfer characteristic curve.

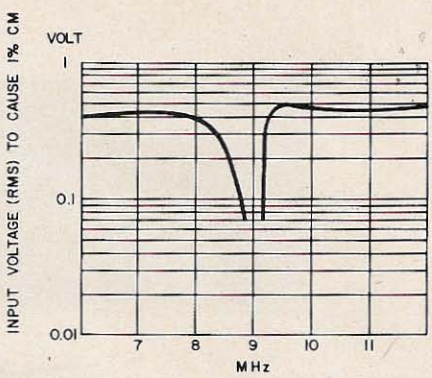

Fig. 6. Cross-modulation performance curve.

zener diode, D3, and the biasing resistors R4 and R6.

The passband characteristic is very sensitive to the matching conditions and both filters are matched at the input and output terminals to see 500Ω and a parallel input capacitance of 30 pF.

The actual filter response is shown in Fig. 4. The two curves were taken across the input and output of the amplifier unit. The flatness is only 1 dB for the 500 Hz and 3 dB for the 5000 Hz filter.

Q2 and Q3 are individual amplifier stages for the two filters. Using individual amplifiers adds significantly to the channel separation. D1 and D2 are switched on for the 5000 Hz channel, while D3 and Q3 are in the off stage and vice versa for the 500 Hz channel.

The voltage gain is 46 dB and the output swing is linear up to 5.5 volts RMS. This corresponds to an input level of 27 mV. The transfer characteristic of the amplifier is given in Fig. 5 while the cross modulation performance can be seen in Fig. 6. The measurement condition for this test were set as follows: the desired signal is 1 mV across the 50Ω input terminal. The undesired signal was 100% modulated. The undesired signal to produce 1% cross modulation is plotted as a function of the frequency deviation. The graph shows that cross modulation only occurs at input level of 400 to 500 mV RMS. If one uses a 16 db tuner, the input level can be as high as 83 mV at the antenna terminals.

. . .DJ1SK

Gene Mitchell K3DSM
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Devon PA 19333

TOUCHTONE AND TELEPHONE CONNECTING ARRANGEMENTS

Until recently, auto-patch connections to the telephone lines have been on the shady side. Most hams prefer touchtone. Bell Telephone has approved tariffs for the use of customer-provided tone address signaling (touchtone dialing). Bell's "automatic voice coupling arrangement" type C2ACP must be used. It is available for $10 installation and $3 per month.

This coupler is a two-way device providing the customer with a contact closure when ringing is received, with a control lead to seize or operate the coupler, with limiting and isolation to protect the telephone network, and with dialing connections if touchtone is not available. It is worth the effort and price to have a legal patch that can be shown to anyone.

Figure 1 shows it connected to WA3IGS repeater/auto-patch. All leads are designed on the diagram.

Bell Telephone will provide you with a Technical Reference #PUB42207 when you order the coupler, if you request it. It gives full details of operation and interconnections.

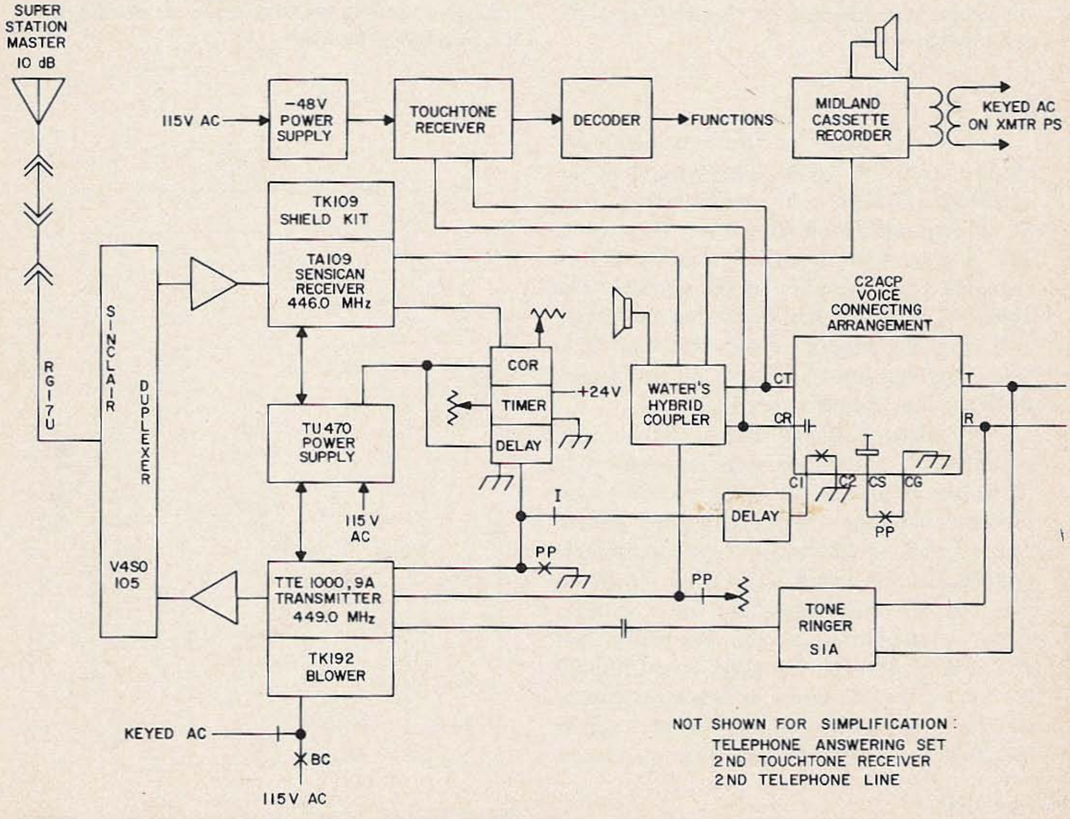
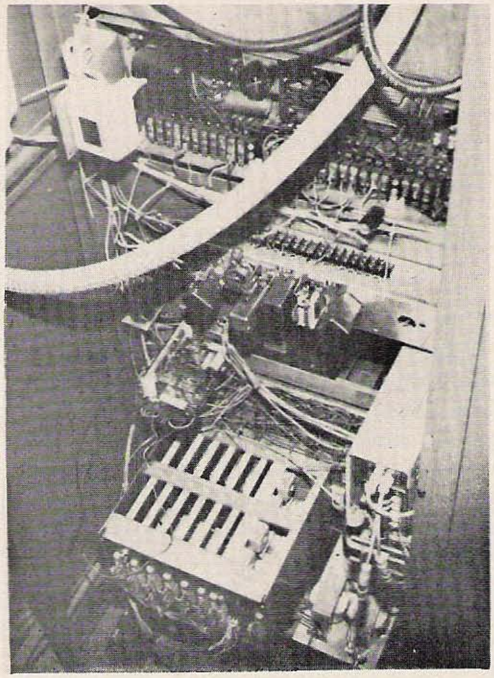


Fig. 1. Block diagram of the WA3IGS auto-patch repeater.

Touchtone dial mounted on the front of a HT series handie-talkie.



Rear view of the WA3IGS repeater showing the A3 Touchtone decoder.

Pads

Touchtone pads for the auto-patch are readily available from many suppliers, including Greybar in Philadelphia and Stromberg Carlson in Rochester, New York. The 35A3A type dial (ITT #3200G450) is available from Greybar for about $21. The Trimline miniature dial type 82A2A is available from Stromberg Carlson for about $24. These are identical to Western Electric types. Both are the 12-button version.

The picture shows the Trimline dial mounted in a minibox and attached to a Motorola H24DCN HT. This makes a neat portable telephone that even AT&T envies. The 11 and 12 buttons are used to enable and disable the patch. If you are afraid to drill the HT cover, you can order another from Spectronics at a very reasonable cost and drill it up. The Trimline is not limited for use to the HT series. It will work just as well with any other FM rig. Figure 2 shows the Trimline schematic and its connections.

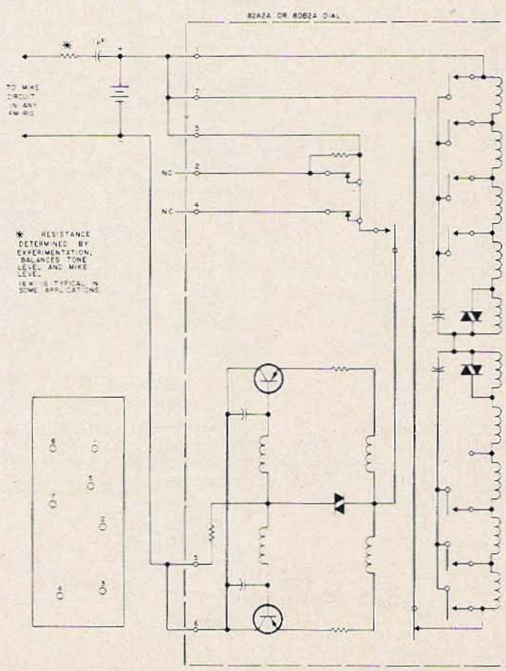
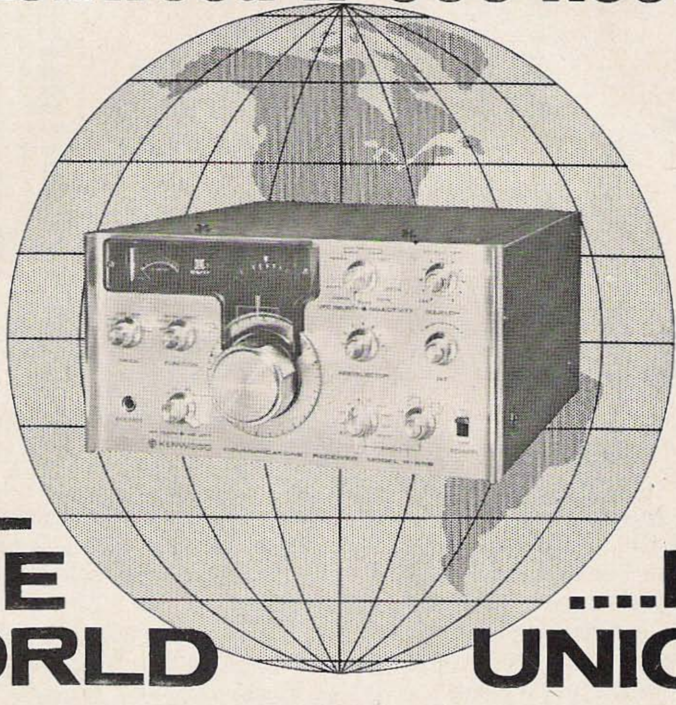


Fig. 2. Trimline schematic and its connections to an FM rig.

Decoders

Touchtone receivers are needed in a

The Kenwood R-599 Receiver



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2nd The R-599 is more versatile. It copies SSB, CW, AM and FM. And it copies them well. One half microvolt sensitivity on SSB means you hear any signal audible on any other receiver regardless of price.

3rd The R-599 has greater frequency range. All amateur bands 160 through 10 meters as supplied and including 6 and 2 meters with accessory self-contained converters.

4th The R-599 is part of a system. When operated with its companion T-599 transmitter you get full transceive operation.

5th The R-599 literally screams value. Dollar for dollar you can't buy another receiver anywhere that will match the R-599.

6th The R-599 can be operated directly off your 12V battery . . . with very low drain. It is also an ideal novice receiver . . . having standard provisions for crystal controlling the T-599.

The Price . . . $349.00

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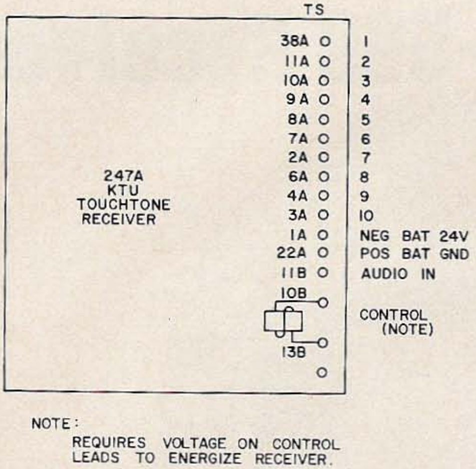


Fig. 3a. Connections for the 247A Touchtone receiver.

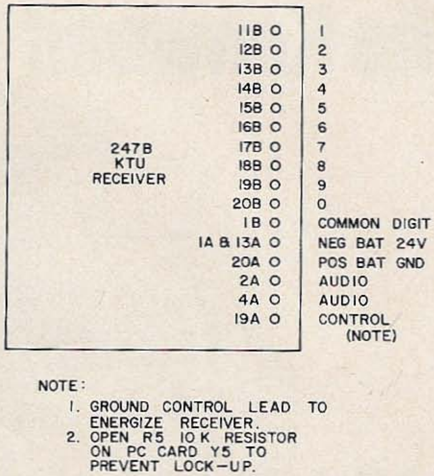


Fig. 3b. Connections for the 247B Touchtone receiver.

touchtone auto-patch system to enable or disable the system. Basically, they are nothing more than 7 or 8 tone receivers (L-C circuit preceding an amplifier) with logic connected to the output. Although they are relatively easy to build, most hams prefer to scrounge one of many types available.

One source is Digitone in Ohio. They also offer many other items useful for auto-patches. Other sources included Stromberg Carlson and various surplus houses. Western Electric no longer sells outside the Bell system.

Many types of decoders are available. The 247A and 247B types are used primarily on customer intercom systems. The A3 is a standard Central Office decode. Hundreds of A3 types are either floating around or

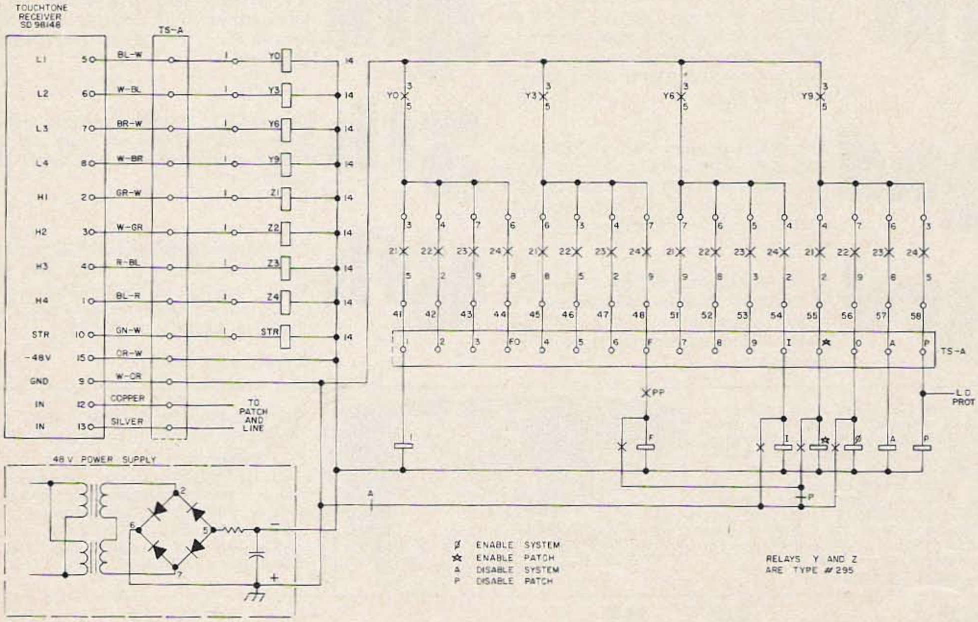


Fig. 4. Connections for the SD98148 receiver.

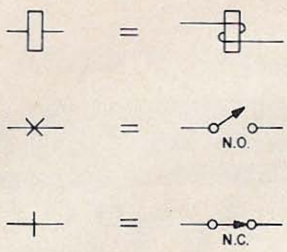
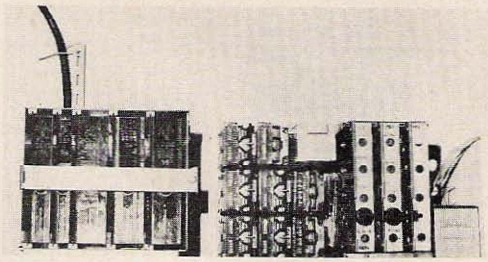


Fig. 5. Legend for the connection diagrams.



The 247A and 247B Touchtone decoders.

smashed as a result of changing the military Autovon Network from 4 wire #5 crossbar to electronic switching. These were 16-button decoders which had one additional tone (4 digits). Out of 73 decoders from a Philadelphia military exchange, only 16 could be saved from the sledgehammer. AT&T felt that this was enough, since previously released equipment showed up in commercial service again in another area. That's what happens! Others were released in other areas, so keep your eyes open. Please don't ask for any from this area. They are all in use.

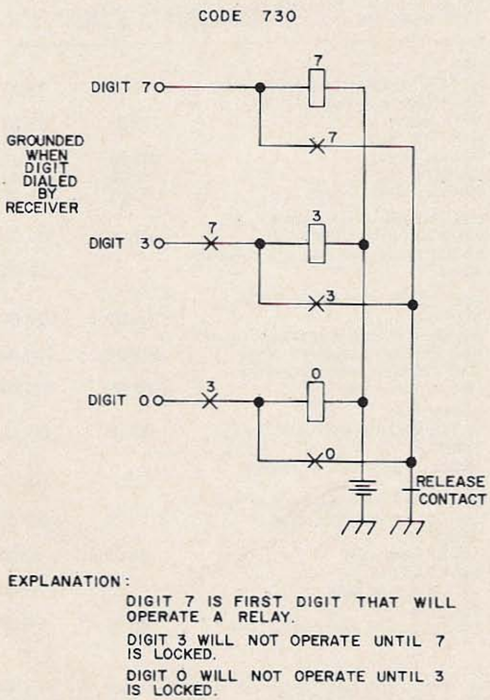


Fig. 6. Simple circuit for converting digits to functions.

The photo shows the 247 A & B types. Figures 3, 4 and 5 show hook-up connections to get them operating. Figure 6 shows a simple circuit for converting digits to functions. There is no limit to building out the codes.

Protection

Protection for auto-patch long distance calls is simple. The Bell system has in most areas the prefixing of digit 1 for toll calls. A gate that detects dial tone (350 and 440 cycles) and the digit 1 at the same time simply disconnects the patch. See Fig. 7 for an example. In the event you want protection and you don't have dial 1 prefix, you can actually decode entire telephone numbers or the first 3 digits and kill the call if the number dialed is other than what's in the program. Your tape recorder log is your best insurance policy.

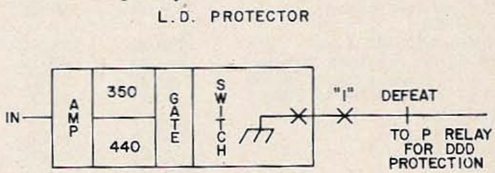


Fig. 7. Protection circuit to guard against toll calls.

Conclusion

Since no two auto-patch systems are the same, I have generalized in some areas. Every one has his own way. Anyone desiring schematics of WA3IGS may have them upon supplying a self-addressed, stamped envelope and cost of reproduction. It took three of us to get this system working properly over a three-year period. I recommend this type of system only to skilled organizations and not as an individual's private system.

. . .K3DSM

Harold Balyoz W6YBP
5651 Hesperia Avenue
Encino CA 91316

THE SIMPLEST AUDIO IC YET!

Audio Output IC's have been coming out thick and fast. Practically every IC manufacturer has one in his catalog. However, my choice for simplicity, performance, and lowest parts count is National Semiconductor Corporation's LM38ON.

Just look over Fig. 1. Would you believe just six parts plus heatsink and battery? And it's a dandy! It is rated for 2 watts output at 18 volts. Mine has put out over 2½ watts with 18 volts, and just over one watt at 13 volts. Since it can take 22 volts without damage, yet still work at 8 volts, it is perfect for mobile use without any worries about either weak or overcharged car batteries. The output looks very clean on a scope and the manufacturer rates the typical total harmonic distortion at only 0.2%. Quiescent supply current is only 7 mA at 18 volts and bandwidth extends to 65 kHz. (It was really designed for a simple, high quality record player system. Two LM380N's, a ceramic stereo cartridge, two speakers, and the result, easy stereo!

In connecting it up, pin 7 is the official negative connection for the power supply. However, since it needs about six square inches of copper clad board for a heatsink, I soldered pin 7 along with heatsink pins 3, 4, 5, 10, 11, and 12 right to the foil side of a copper clad printed circuit board 2" x 3" square. The rest of the components were soldered to insulated terminals bolted to the board. The 5 μF capacitor from pin 1 to ground reduces ripple, but the circuit works even without it!

The price for the LM380N is only $2.25 each when you buy one at a time; really a bargain!

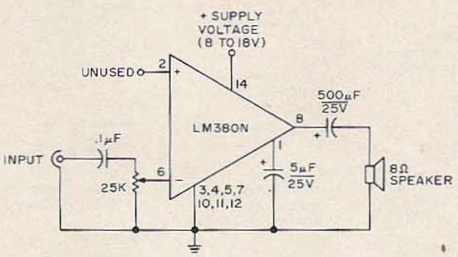


Fig. 1. The simplest audio IC yet.

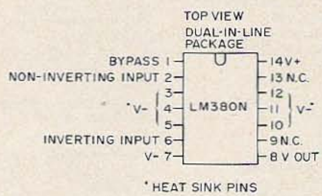


Fig. 2. Top view, dual-in-line package.

Figure 2 shows the pin connections viewed from the top of the IC. You can bend the heatsink pins to lay flat on the board before soldering and bend the others up, away from the board for connection to the rest of the circuit. If you solder to the IC quickly with a hot iron, no damage will result as the lead temperature is rated at 300°C for 10 seconds during soldering.

You can bet that my unit is going to be the beginning of a tiny SSB receiver for portable and mobile operation.

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TUNING TIPS FOR USING VOLTAGE VARIABLE CAPACITORS

The use of inexpensive varactor diodes to provide linear and versatile tuning schemes for homebrew oscillator projects is described in detail. The information is applicable to circuits for HF transceivers as well as those for VHF equipment.

Voltage variable capacitors or varactors have been available, basically, since transistors were used. The base-collector junction of many transistors (one example is the 2N3565), as shown in Fig. 1, can be used to form a voltage variable capacitor usable over a range of 10–15 pF.

The effect of having a diode junction, either as part of a transistor or as a separate diode, forming a capacitance which varied as the voltage impressed across the junction, was supposedly discovered by accident rather than by any scientific research aimed in that direction. At any rate, varactor diodes specifically meant for use as voltage variable capacitors are now available in a large range of capacitance values from many manufacturers at very reasonable prices. It is rather surprising, therefore, that so few amateur equipment designs employ these diodes and rather stick to old-fashioned air variable capacitors. Hopefully, the material presented in this article may assist various

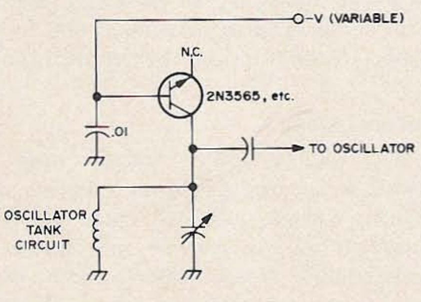

Fig. 1. Transistor diode junctions can serve as varactor diodes. Several receivers/transceivers have used such schemes for incremental tuning.

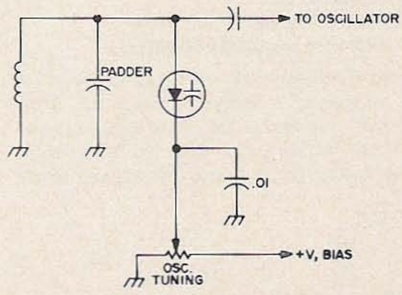

Fig. 2. Basic use of tuning diode. One side of diode is dc grounded through the oscillator tank coil.

readers to more easily utilize these very useful diodes.

Particularly for the tuning of oscillator circuits, varactor diodes when combined with the proper type of potentiometer control offer tuning possibilities and variations which would be impossible, or at least extremely difficult and costly to achieve, using conventional air variable capacitors and mechanical tuning systems. A number of examples are presented later which illustrate the various tuning possibilities possible with varactors. A good basic understanding of what varactor diodes can do and what their specifications mean is, however, basic to successfully using these diodes.

Basic Operation

Varactor diodes as voltage variable diodes function basically on the idea that when a diode junction is reverse biased with an increasing voltage potential, its depletion region increases and its capacitance value decreases. The increasing potential can be viewed as pulling the plates of a capacitor further apart and thus decreasing its capacitance. The usage of such a diode in a simple fashion as the tuning capacitor for an oscillator is shown in Fig. 2. The diode is tuned by the potentiometer which, since it controls only the dc voltage impressed across the diode, may be located at any distance from the diode. The dc ground return for the other side of the diode is made through the grounded end of the oscillator coil. The whole scheme would be almost ideally simple if it were not for the fact that the diode's quality as a capacitor (Q) depends upon the frequency of operation and the diode's capacitance variation is not directly related to the rotation of the potentiometer arm.

Practical Diodes

The varactor diode usually does not exhibit a linear capacitance variation with applied voltage, although there are some variations to the general rule. Usually a diode exhibits a capacitance variation which varies as some exponential relationship with the applied bias voltage. Diodes are usually classified by their nominal capacitance value at some reference bias voltage. For instance, the graph of Fig. 3 shows a "47 pF" diode, the capacitance value which it has at a reference bias voltage of −4V. The capacitance range of the diode, a 1N3628, is actually from 25–125 pF. The capacitance variation is shown by the graph and is characteristic of diodes produced by many manufacturers. Unfortunately, the capacitance variation is not linear or logarithmic with the applied bias voltage and no potentiometer taper is available which will directly provide a linear capacitance variation with linear rotation of the potentiometer shaft. A number of ways can be employed, however, to correct this situation as described shortly.

Figure 4 shows the capacitance versus bias voltage curves for two diodes which have a capacitance range that many amateurs would find useful in building oscillators for the HF frequencies. The 1N3627 is classified as a 22 pF diode (at −4V bias). Its useful capacitance range is from 12 pF (at −20V bias) to 50 pF (at −.1V bias). The BB103 is a European type made by Siemens and available here. Its capacitance is quoted as 29 pF (at −3½V bias) and its effective capacitance range is from 13–52.5 pF. The two curves are shown to illustrate how the characteristic curves of two diodes from different manufacturers can vary slightly. If one wanted to build an oscillator, for instance, with a very linear readout it is a good idea to obtain the characteristic curve of the diode family from a manufacturer.

Just to illustrate the interesting types of varactor diodes which are available for tuning purposes, Fig. 5 shows an unusual dual diode made by Siemens, the BB107. The diode costs around $5 and is designed primarily for use in AM receivers. The diodes have a common anode connection and the capacitance of diode section D1, for the same bias voltage, always has a capacitance a fixed amount different than that of the other section D2. The graph illustrates this variation. Such a diode could have some very interesting application for oscillator tuning. Operated over a smaller capacitance range than the total available, the diode exhibits an almost perfectly linear capacitance variation with bias voltage. By switching from one diode section to the other in a

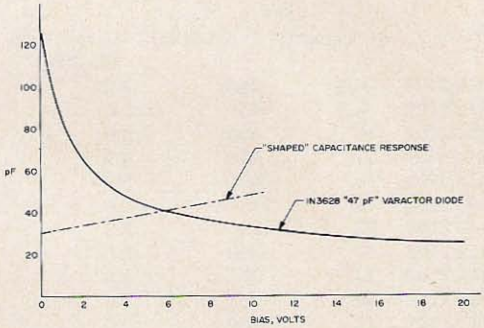

Fig. 3. Response of a typical "47 pF" tuning diode (solid line).

properly set up oscillator circuit, one can switch back and forth between the CW and phone portions of a band. For a LF converter, the diode can be used exactly as it was intended – one diode section controlling the tunable oscillator and the other the input tuning to a mixer stage.

As with many electronic components these days which are a bit advanced, the question of availability often becomes a problem when one finally decides to build a piece of equipment. Unfortunately, only a very few varactors designed for voltage tuning usage as capacitors have standard 1N numbers. Most cannot because the capacitance/bias voltage relationship varies from manufacturer to manufacturer and the assignment of 1N numbers implying interchangability would not make sense.

One "family" of varactor diodes that should have special appeal to amateurs is the Motorola MV2000 series. The available types are shown in Table I. They are available from any large distributor of Motorola semiconductors (Allied Radio, for instance) at only 90¢ each. The diodes will have a capacitance curve similar to that shown in

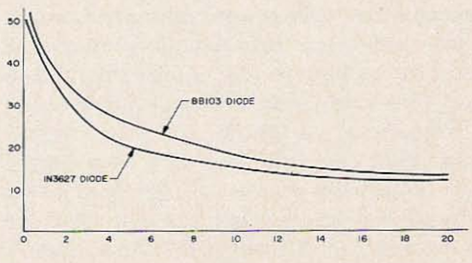

Fig. 4. Response curves of two typical 22–29 pF labeled diodes.

Table I

Type	4V Capacity	Q (50 MHz)	Tuning Ratio (2–30V)
MV2101	6.8	450	2.7
MV2102	8.2	450	2.8
MV2103	10	400	2.9
MV2104	12	400	2.9
MV2105	15	400	2.9
MV2106	18	350	2.9
MV2107	22	350	2.9
MV2108	27	300	3.0
MV2109	33	200	3.0
MV2110	39	150	3.0
MV2111	47	150	3.0
MV2112	56	150	3.0
MV2113	68	150	3.0
MV2114	82	100	3.0
MV2115	100	100	3.0

Motorola MV2000 varactor diode family. At 90¢ each, these diodes should appeal to many amateurs.

Fig. 3 but one can always send to the manufacturer for the specific curve for any diode *(Motorola Semiconductors, McDowell St., Phoenix AZ 85001)*. The tuning ratio refers to the capacitance variation between the bias voltage stated. This drops as the capacitance value increases but any of the diodes would be suitable for HF application. The smaller capacitance diodes would still be useful into the VHF range. If the Q is 300 at 50 MHz, it would drop to 30 at 250 MHz, etc. Table II shows the essential characteristics of the smaller family of diodes available from Eastron Corp. at $1.50 each (except for the VC6204 which is $1.80). Eastron will sell directly to amateurs, postage prepaid. Write to *Bill Slusher, W1ZYX, Eastron Corp., 25 Locust St., Haverhill MA 01830.*

Shaping the Capacitance Variation

Suppose one wanted to construct a really good 5 MHz oscillator for use with an existing transceiver so one could achieve independent receiver and transmitter tuning. Many transceiver manufacturers offer such separate oscillators but unfortunately their cost runs easily over $100 and can represent a significant fraction of the original transceiver cost. Building such an oscillator as a home-brew project can represent a very cost-savings project and yet not lead one down any too difficult paths. Also, there is no danger of incorrect operation on out-of-frequency segments of a band because the home-brew oscillator is only used for receiver tuning.

By searching through past issues of various amateur radio magazines one can find many excellent circuits for transistorized 5 MHz oscillators. One can also of course just duplicate the circuitry of the oscillator found in an existing transceiver, if the oscillator appears stable enough. Duplicating the actual circuitry of an oscillator usually presents no great problem. The problem develops when one considers how to duplicate the mechanical tuning aspects of the oscillator where a dial mechanism allows linear readout to 1 kHz segments, etc. The use of varactor diodes can greatly simplify this problem if one can develop the oscillator circuits such that the oscillator frequency as a function of bias voltage applied to the varactor diode used to tune the oscillator has a linear relationship.

The simplest case is if one chooses an oscillator circuit where the frequency output is linear with the capacitance variation of the capacitor used to tune the oscillator circuit. In this case, the varactor diodes capacitance variation has to be linear with the bias voltage change applied to it. There are two ways to achieve this effect. The simplest is to vary the bias voltage across the varactor only over a range over which the capacitance variation remains linear. For instance, in Fig. 5 varying the bais voltage from −10 to about −4V produces an almost perfect linear capacitance variation. Varying the bias voltage over a smaller range of from −10 to −8 or to −6V in Fig. 4 produces a similar linear effect but the capacitance variation is rather small and would only suffice for oscillators designed to cover a 100–200 kHz segment of a band at a time.

The second way to make the capacitance variation of the diode linear with applied

Table II

Type	4V Capacitance	20V Capacitance	Q (30 MHz)
VC6204	4pF	2 pF	60
VC6233	33	17	60
VC6156	56	29	60
VC6299	100	55	60

The smaller but interesting varactor diode selection from Eastron Corp. Diodes may be ordered directly from the manufacturer (see text).

bias voltage when it is not inherently so is to use a voltage shaping network for the applied bias voltage. As was mentioned before, the voltage versus capacitance variation of a diode does not match the taper of any potentiometer. Therefore the shaping network must be arranged to use a linear taper potentiometer with an auxiliary network to change the bias voltage at points where its linear variation deviates too far from the non-linear variation of the diode's capacitance/bias curve. In essence, one tries to match a number of straight line segments to the changing curve of the diode characteristic.

The procedure is not difficult especially if not too great a capacitance range is desired. A simple example will be used to illustrate the point. For instance, if the diode shown in Fig. 3 was desired to be used such that its capacitance change with bias supply voltage change (as supplied by a linear taper potentiometer) was desired to be linear over the approximate capacitance range of 30–50 pF, the shaping circuit of Fig. 6(A) is used. The diode has to be biased from both "sides" rather than having one side grounded because the capacitance variation of the diode changes most rapidly at low bias voltages *across* the varactor diode. This point will become clear if one follows through on the example. With the circuit shown and until the variable bias voltage exceeds 6V, the 6V fed through a switching diode can be considered to be out of circuit. So, as the variable bias voltage varies from 0 to about 6V, the voltage across the varactor is 12V (fixed bias values minus the variable voltage). The capacitance can be plotted as shown in Fig. 3 (dashed line). In this case, the "bias, volts" line on the graph represents the value of the variable bias voltage and *not* the voltage across the diode. When the variable bias voltage exceeds about 6V, the diode in the 6V bias line is forward biased and conducts. As the variable bias voltage now increases, its rate of change is determined by the voltage divider network formed by the two 100K resistors. The bias voltage across the varactor diode for any given value of the variable bias voltage can be found by simple ohm's law calculations (remember that the varactor diode is never conducting). The plot of variable voltage versus capacitance is shown by the dashed line in Fig. 3 and found to be quite linear.

The bias voltages shown in Fig. 6(A) may appear numerous but they are all easily obtained from one supply using dropping resistors and zener regulators. The shaping network values can be determined by trial and error to obtain the most linear response. As an approximation for the intermediate bias value (6V in Fig. 6(A)) take the bias voltage necessary to achieve a mean capacitance value for the total capacitance range desired. In the example, the total range was 30–50 pF, making 40 pF the mid value for which the required bias voltage (from Fig. 3 solid line) is 6V. The resistor in series with the variable bias voltage should remain 100K and one can then try differenct values for the resistor in series with the intermediate bias voltage to obtain the most linear response. A few plots on graph paper will quickly reveal the best value.

If one desired to make the capacitance variation linear with variable bias voltage over a larger capacitance range, it can be done by the circuit of Fig. 6(B). The circuit works on the same idea as the simple shaping network just described. It appears a bit more complicated but is actually quite economical since each intermediate bias voltage is obtained from one source via zeners. Extremely linear capacitance variation can be obtained over at least a 100 pF range, depending upon the diode involved.

Rather than describe in detail here the procedure for calculating all the bias voltage involved, it is suggested that the reader sent for Application Note No. 6 from Eastron Corp. If one has a capacitance measuring bridge, excellent results can be obtained by first making each bias voltage variable via a potentiometer from the main supply, measuring the capacitance variation for different settings, and then finally using zeners for the intermediate bias voltages.

Frequency Shaping

The above procedure has described how to make the capacitance change of a varactor linear with the variable bias voltage. However, one may have an oscillator circuit where the frequency output is not linear with the capacitance variation in the oscillator tank circuit to begin with. In this case, frequency shaping via the varactor diode bias can be done and, in fact, represents one of the major advantages of using varactor diodes for capacitance tuning. A linear *frequency* output can be obtained with a fraction of the effort required using elaborate mechanical tuning schemes, special oscillator coils and air variable capacitors, etc. This feature can also be combined with a very simple readout scheme for frequency settings.

Frequency shaping is obtained in basically the same manner as the linear capacitance method. However, in this case, a graph similar to Fig. 3 is drawn which represents oscillator output frequency (instead of diode capacitance) versus bias voltage supplied to the diode. The output frequency of an oscillator being built can be monitored on any available receiver or transceiver. Once the curve is drawn, a shaping network similar to that previously described is calculated so that the oscillator output frequency versus bias voltage applied to the diode has a reasonable linear

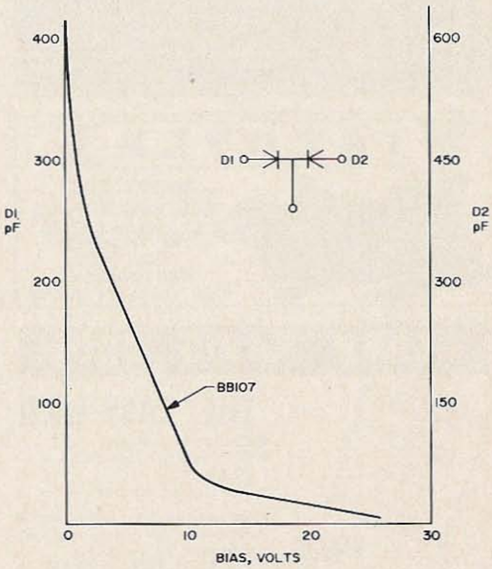

Fig. 5. Response of an unusual but handy dual tuning diode made by Siemens in Germany and available in the U.S.

relationship. The accuracy of the shaping network can always be corrected by monitoring on a calibrated receiver.

Once a linear relationship has been achieved between output frequency of an oscillator and bias voltage, tuning of the oscillator via variable bias networks, frequency readout, etc., are greatly simplified. The following paragraphs present only a few ideas. Many more can be developed depending upon individual requirements.

Tuning and Readout Systems

With a linear output frquency/bias voltage relationship for a varactor tuned oscillator, the tuning problem reduces itself to the simple rotation of the linear taper potentiometer which supplies bias voltage to the diode. If the potentiometer rotation through the usual 270° varies the oscillator frequency by 250 kHz, it can be driven via a simple 10:1 gear reduction drive. In this case, each degree of basic potentiometer variation covers 250/270 or .926 kHz per degree. The 10:1 drive means that each 360° rotation of a tuning knob provides 360/10 or 36° of basic shaft rotation. The frequency variation in this case would be 36° X .926 kHz per degree or about 33 kHz per tuning knob rotation. By using greater reduction tuning ratios or smaller basic oscillator frequency coverage (100 or 200 kHz segments), extremely fine tuning can be obtained which easily allows 1 kHz or less readout divisions on the skirt of a large tuning knob. An important consideration is that extremely fine bandspread can be obtained with reasonable gear reduction ratios for the bias potentiometer (10:1, 20:1, etc.) so that the gear reduction drives are both inexpensive and have minimum backlash. One can also switch the bias voltage to a tuning diode between a potentiometer driven via a gear reduction drive and a directly driver potentiometer to provide a fine bandspread tuning or a quick band-scan tuning. The extra cost is only that of a simple potentiometer and only single dc line voltage switching is involved.

Another approach not to be overlooked is that of using multi-turn potentiometers for bias voltage tuning. Such potentiometers,

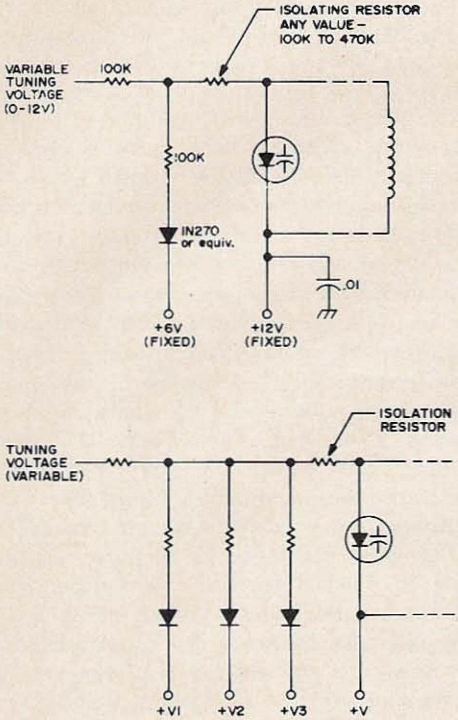

Fig. 6. Simple (A) and complex (B) shaping networks which can be used to "linearize" basically non-linear response of a tuning diode.

usually in the 10 turn variety, are available from a number of surplus outlets (PolyPaks) at a cost of only a few dollars. These potentiometers are of commercial quality and provide excellent resetability combined, of course, with their built-in fine tuning advantage. Such potentiometers when combined with even a simple gear reduction drive provide extremely simple but excellent tuning possibilities. For instance, a 10 turn potentiometer combined with a 6:1 reduction drive means approximately that a tuning knob, for the example previously given, would cover only 6 kHz per tuning knob revolution. This type of extreme bandspread can be achieved without any great mechanical difficulty whatsoever.

Frequency indication can be achieved by the use of relatively simple meter movements. Basically, once the frequency output is linear with bias voltage change a measurement of the bias voltage via any simple voltage meter is directly proportional

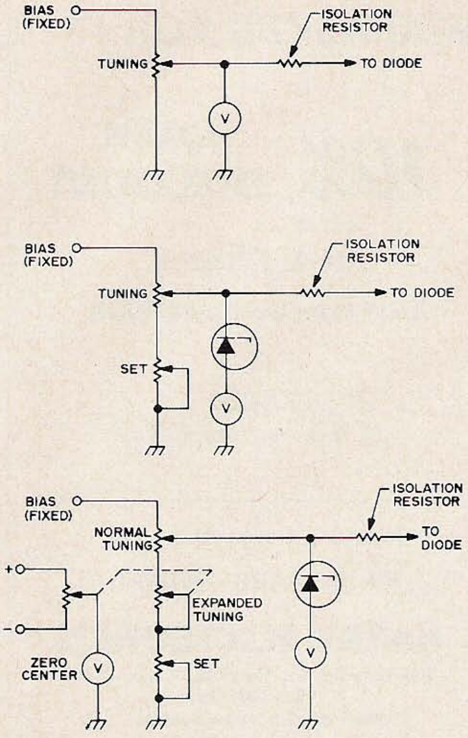

Fig. 7. Various ways of using simple voltmeters as frequency readout devices in conjunction with voltage tuned diodes.

to the oscillator output frequency. The meter can be placed across the bias supply to the diode as shown in Fig. 7(A). The meter scale can then be remarked to indicate frequency, or if the scale is carefully chosen, it might be used directly. For instance, if one is building an oscillator to cover 5.0 to 5.5 MHz and the bias voltage change is 5V to cover this range, the 1V divisions on the meter scale can represent 100 kHz. In most cases, however, things aren't that simply done since the tuning diode is operated over a certain voltage range which doesn't always start at zero. But meters can still be used effectively. For instance, in Fig. 7(B), the main bias supply voltage and the "set" potentiometer are adjusted so the desired range of bias voltage is available at the potentiometer which tunes the diode. Say, a range of 4–9V is used to keep within the linear range of the diode shown in Fig. 5. A 0–5 scale voltmeter can still be used by placing a zener diode of 4V in series with it to form "voltage expander" scale on the meter. One should refer to an article on meter scale changes possible via zener diodes to learn of various other possibilities, all of which are too extensive to cover here.

Perhaps one last example of the versatility possible with various tuning arrangements with diodes is worth while. In tuning an auxiliary oscillator which provides independent receiver tuning for a transceiver, suppose it is desired to have one tuning control which tunes the oscillator in a normal fashion with reasonable bandspread but, in addition, have another tuning control which electronically "magnifies" any small tuning area around that to which the main tuning is set. In other words, the main tuning may cover 30 kHz per knob revolution but the auxiliary tuning takes any frequency to which it is set and expands it either lower or higher in frequency at the rate of 5 kHz per knob revolution. The circuit for doing this is shown in Fig. 7(C). The resistance range and gear reduction drive (if used) on the expand potentiometer is chosen to vary the oscillator frequency any desired small amount. The other potentiometer gauged to the expand potentiometer simply drives any center zero meter so one can return the expand potentiometer to its center position easily before using the main tuning potentiometer again. The scale on the zero center meter can be calibrated in terms of frequency change, plus and minus, if desired, but the indication on the main tuning meter also changes when the expand potentiometer is used so there is never any doubt as to in which direction the oscillator frequency is being changed.

Summary

The ideas presented here are only a few that can be applied to the use of tuning diodes. Other bandspread schemes, automatic band scanners via a triangular voltage to drive the diodes, quick switching between bands for spot checks, and many more are readily possible. The main advantage is that these varied tuning possiblities can be done with simple components at very reasonable costs and an available receiver or transceiver with good calibration used to align the necessary circuits.

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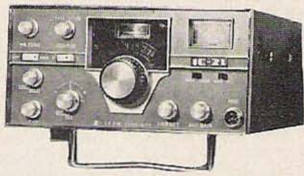

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LETTERS

Subject: the cover on the 73 October magazine. My husband has numerous magazines coming into our home with *acceptable* covers. Mr. Shera DOES NOT buy magazines with *unacceptable* pictures. I object to your putting that unacceptable cover on the 73 magazine and sending it into American homes where there are men who choose to live without feeding on adulterous thoughts.

Mrs. Philip Shera
Kansas City MO

How did you like the November cover??

Really enjoy your magazine, would like to see more articles, 200 MHz and above and SSTV. But I would subscribe anyway just for the cover!! "OCT 72 COVER TERRIFIC"

Jess B. LeBow K8LJQ
Pinckney MI

73 still the *greatest – far* superior to all others! Cover on current issue here has to be the best yet. Keep up the fine good work!

Stan W4VMR
Valparaiso FL

Your October 73 cover is by far the finest I have ever seen. From one who studied art, loves the outdoors and amateur radio, and is a normal male, Mary Jane Trokel is a shapely, pleasant personality, merged with a healthy outdoors and a healthy hobby. In short, the cover is very pleasant and in good taste, and she would make any artist want to paint her in oils.

For summer, how about a cover of her in a bikini with the radio controls for a model boat, or perhaps at the helm of a boat using 2-way radio communication?

Also, how about a cover in color of your pretty and shapely wife? She certainly deserves the honor for putting up with one of us nuts.

I hope the beautiful October color cover sets a precedent for future issues, and please keep the ham-built construction articles coming.

Zoltan T. Bogar
Silver Spring MD

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bands from 2 to 2300 MHz (for increased resolution, the reverse power element is ten times more sensitive than the forward power element). Model 4342 Insertion VSWR in 50Ω systems is a low 1.035 to the point of measurement. A choice of QC Quick-Change connectors permits mating with N, BNC, TNC, UHF, C, SC, LC, HN, LT, GR Type 874 and 7/8" EIA lines without the need for performance-degrading adapters. The price is $265, with plug-in elements ranging from $30 to $75. Contact the *Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon) OH 44139.*

In a recent issue one of your readers stated that Pete Stark K2OAW, did not answer his mail. I must be living right, because he sure answered my request.

I put in a request for the layout of his VHF frequency counter. It required a SASE. By habit, I put Canadian stamps instead of U.S. stamps. Pete put his own stamps on the return envelope and mailed it anyway!

There is the possibility that your reader's letter might have gotten lost in the mail. If hegivesPete another try, I'm sure a reply would be forthcoming.

Tom Webb WA9AFM/VE8
Winnipeg, Man., Canada

This letter is in response and a rebuttal to the letter written by (W1JSS) a Mr. Dineen, as published in 73, the Sept. issue, in which Mr. Dineen complains about the bad cooperation on the part of the author of an article which was published in your magazine, and the author is Mr. Stark (K2OAW).

I, for one, disagree wholeheartedly with W1JSS, as to the response from K2OAW. Mr. Dineen does not evidently know what he is talking about and I say this from experience with K2OAW. I was as dumb as they come when it came to the solid state IC's. I knew you put them together and you expect them to work, everything is fine up to this point, but when I got into trouble, I did not know where to begin to look for my solution and I did not know what the different functions of the different IC's were. At this point I wrote Mr. Stark, explaining my problem, and by return mail he explained quite a few things, and since then I have had the occasion to write Mr. Stark on different problems and he very patiently answered all of my letters very promptly, in fact if the tables were turned around and he was asking me the questions, I would be tempted not to reply, but not Mr Stark, as he has spent quite a bit of time and money to help me and what I know now about IC's, which is quite a bit, I owe to the patience of Mr. Stark. For the record, I have been a ham since 1925, so you see I am not a novice at this game.

J.J. Daris K9VKD
Sterling ILL

WA9TCR's letter in the October issue prompts me to write this letter. I have just rejoined ARRL after a lapse of about 8 years. I dropped out in protest of their speaking in my name without my knowledge in their representations to the FCC. HQ claims to speak for so many thousand amateurs and the only way to dispute it is not to have your name on their list. However recently I decided maybe now there is enough of a movement going that a voting membership could help.

Here is my request. Please introduce a regular column devoted to ARRL news. I am sure you have contacts the rest of us don't have and would be able to publish what QST doesn't. I realize you do this on an irregular basis. This would include a rundown on the directors when they come up for election. In the past I have voted but really they were just names on the ballot and information about them was just hearsay. I and I am sure a lot of others would like to use our vote intelligently. Huntoon won't like it but that shouldn't scare you off, how about helping us?

I think a regular feature or section in your editorial each month would be best so we don't overlook it.

Orbra W. Bliss W9GEK/EL2N
Verona WI

Sounds like a good idea. Maybe we could run a regular ARRL column in the newspages each month to report the behind-the-scenes action at HQ! If anyone has any interesting information that he feels the rest of us should know about, send it in and we will gladly pass it along to the rest of the world.

Sometimes I wonder why you don't reprint some of the extra good "oldies." I appreciated "Mobile Power – The Alternator" and "Solid State Regulator" both in Aug. 1967 issue. With so much mobile activity, keeping your battery "up" should be of prime importance.

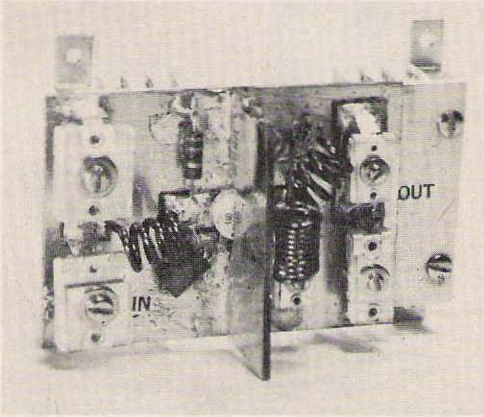
Neil W2OLU
Tappan NY

It is important! Just think of all the OMs out there with dead batteries . . . just because they didn't cash in on our back issue bonanza offer with a subscription renewal.

Continued on page 127....

Herman Cone III, WB4DBB
1320-12 Kings Arms Apts.
Chapel Hill NC 27514

TWO METER 18 WATT AMPLIFIER



This amplifier is designed to be driven with power levels slightly less than is available from many solid state FM transceivers. The RMV transmitter puts out 5 watts, and one can easily get 18 watts of output when using it with this amplifier. Other lower power rigs (3–6 watts) work well, but do not drive it with more than 6 watts.

The amplifier is built on a piece of double sided glass epoxy board and all the foil is left in place except for the thin areas surrounding the seven pads, which are used for solder joints. All leads should be as short as possible. All five trimmers should be soldered directly to the board. The mica compression type work well and are available at most electronics dealers. They are relatively inexpensive, too.

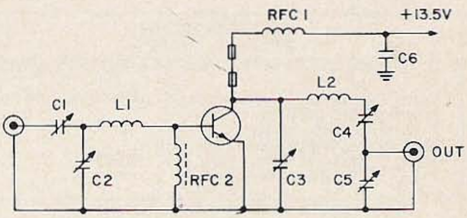


Fig. 1. Circuit of 18 watt amplifier.

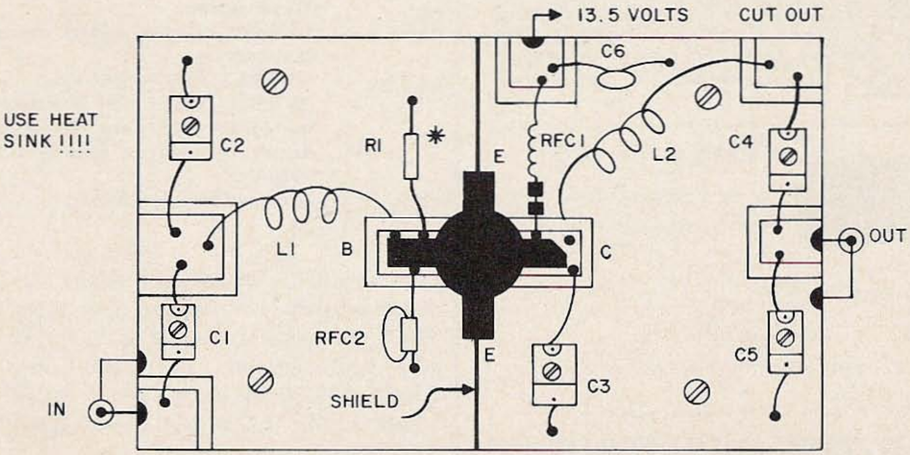


Fig. 2. Full size circuit board showing parts placement. Components mounted on copper side.

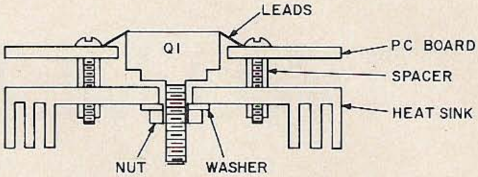


Fig. 3. Side view of heat sink mounting.

Care should be taken when mounting the transistor. First, prepare the board by making the pads and drilling a hole for Q_1. Then mount the board to the heat sink (use a big one) with 4 screws and spacers. Then mount the transistor, using a good heat sink compound. Be sure not to overtighten the transistor's mounting nut. Now, after the board and transistor are secure, solder the 4 leads in place. Both emitter leads go to ground. Then solder the shield (metal or PC board) over the transistor so that it is vertical. Be sure to cut a notch in the shield so that it clears the transistor.

To tune the amplifier up, start with reduced voltage (8–9 volts) and low power (1–2 watts). Tune the trimmers for maximum output. If instability is noticed, you may need to add R_1. When operating properly, the amplifier should provide 5–6 dB of gain with 13.5 volts.

PARTS LIST

Q_1	2N5591 or S3007
C_1, C_2	7-60 pF (ARCO 462)
C_3, C_4	4-40 pF (ARCO 403) 20-250 pF
C_5	(ARCO 424)
C_6	.02 μF ceramic
RFC_1	10 T #18, ¼" I.D., tightly wound, 2 ferrite beads
L_1, L_2	4 T #14, ¼" I.D. x 5/8" long
$*R_1$	20-100Ω – use if unit is instable – start with 100Ω and reduce when stability is achieved; goes from base to ground.
RFC_2	2 turns in ferroxcube bead

A complete kit of parts minus the heat sink is available from *Circuit Specialists, Box 3047, Scottsale, Arizona 85257,* for $24.95 plus $.50 shipping. They also carry the S3007, $19.50; the circuit board, $4.50; and ferrite beads, $1.00 per dozen. Add $.35 shipping with parts orders.

. . .WB4DBB

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

SIDEBAND SNIFFER

Years ago when one modulated an 813, pair of TZ40's or whatever, it was nice when testing seemed called for to get a hearing of one's own transmission. This needed nothing more than a diode, pick-up loop of a few turns, and a minimum of other items, Fig. 1. At first I used to put audio into the TX mike circuit from another af source. Later, I used to put the diode output into a tape recorder, and afterwards listen for a minute or two to this reception of the TX signal.

With CW, you can do a similar thing, rf from the TX activating a tone generator.

With the change to SSB on some bands, and separate TX and RX, the latter could satisfy the question about whether the outgoing signal was intelligible, provided rf into the receiver was kept well down, and rf and i-f gains were at minimum.

With the advent of the transceiver, there was alas no handy means at all of making easy checks of what other people were hearing. The SSB Sniffer shown here was built to overcome this.

Method of Working

In the interests of stability, the Sniffer works on one crystal controlled frequency only. The frequency can depend on what old crystals are on hand. Figure 2 is the complete circuit of the Sniffer or spot frequency sideband receiver, which is what it really is. Here, the crystal oscillator is on 3.55 MHz. Its output and a bit of SSB from the transmitter go to the twin diode product detector. The audio output goes to a tape recorder, af amplifier or to headphones.

It is handy to have the Sniffer on a favoured band. If lengthy tests are to be made, it is only fair to put the TX output into an artificial load for their duration. Otherwise eavesdrop on a bit of your own transmission or QSO.

If the transmission sounds satisfactory on the Sniffer frequency, there is every reason

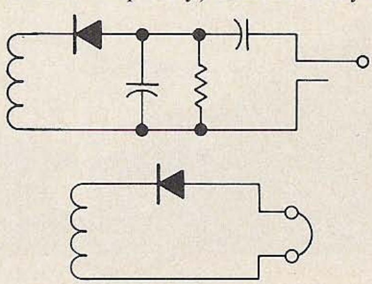


Fig. 1. Simple monitors for checking modulation.

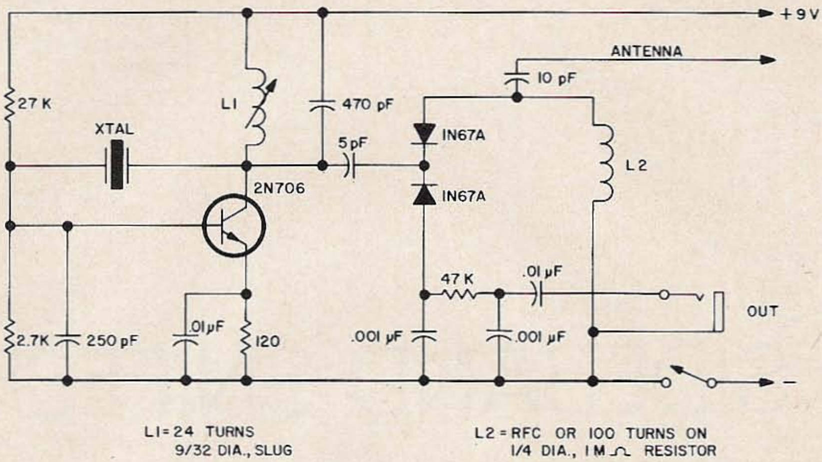


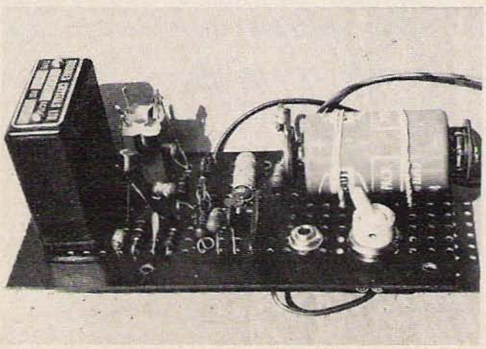
Fig. 2. Circuit of the SSB Sniffer.

for supposing it will also be satisfactory on other frequencies or bands – provided you duplicate conditions of correct PA loading, drive, PA meter peak readings and voice level or mike gain. After all, if you ever used Fig. 1 with a grid modulated PA or other touchy AM circuit, you did not need to make a new check every time you changed frequency.

Building It

The circuit can be wired on any suitable piece of insulated board, the photo is a layout plan for anyone requiring this.

For 80Ω crystals, L1 is 24 turns of 32 enamelled wire, on a 7mm or 9/32" diameter former with adjustable slug, and has a 470 pF parallel capacitor. Some other L/C combination which will tune up would



do as well. With a 9V battery, current was about 1 mA with no oscillation, rising to 4 mA with the slug adjusted for maximum oscillation. Need it be said that nothing can work if there is no oscillation.

The 10 pF capacitor is not an isolator, but gives some protection against shorts. Place the "TX" lead near the artificial aerial load, coupler, or aerial circuit somewhere, so that the transceiver S-meter reads about S9 with the gear at receive, and tuned to the Sniffer frequency. (This does not apply with a separate TX, where you naturally provide some rf pickup from the TX to the Sniffer.)

Now switch to transmit, and make the appropriate adjustments to make gain, grid drive, PA tuning, and loading. You may have to adjust the transceiver tuning minutely one way or the other, since you can't tune the Sniffer, and you should in any case move the Sniffer antenna to get a suitable level of rf pickup, as shown by best results. Be sure not to get too much SSB into the Sniffer – this will produce a result sounding like grossly overmodulated AM.

. . .G3OGR

Nat Stinnette W4AYV
Umatilla FL 32784

CRYSTAL FREQUENCY AND ACTIVITY CHECKER

The crystal checker described here evolved from an idea by W2OZH in and old issue of *Hints & Kinks*. It has gone through several stages of refinement, which is usual with homebrew gear. A more sophisticated version is now on the drawing board. Besides checking crystal activity, it measures the difference in frequency of two crystals up to 30 kHz. This difference frequency is read directly on a meter.

Figure 1 shows the circuit diagram. The circuit consists of two identical Pierce oscillators which work in the range of 3–9 MHz using a 6J11 tube. The input capacitance of each oscillator is 32 pF which seems to be the standard for FT-243 crystals. The output of each oscillator is coupled to a 12AT7 mixer stage. The output of the mixer, which is the difference frequency of the two crystal oscillators, is fed to a 6AU6 limiter which presents a square wave signal of constant amplitude to a counter circuit consisting of a meter, two diodes and associated capacitors. A function switch puts the meter in the grid circuit of either oscillator for checking activity. In the center position both oscillators are on, the counter circuit switched in and the difference frequency read on the meter. A range switch selects ranges of 30, 10, 3 and 1 kHz. These were chosen because the meter available was calibrated in these scales. Other ranges should work equally as well, possibly up to 100 kHz.

Construction layout is not particularly critical except that the two oscillators should be symmetrical. As seen in the photo, the counter circuit is built on a sub chassis. This is not necessary – in fact it would facilitate servicing if all components were mounted on the same chassis. The transformer T_1 is used in reverse to provide a better impedance match and more drive.

The capacitors in the counter circuit are critical and the values were determined by "cut and try." If you use different ranges from those shown, the values given will

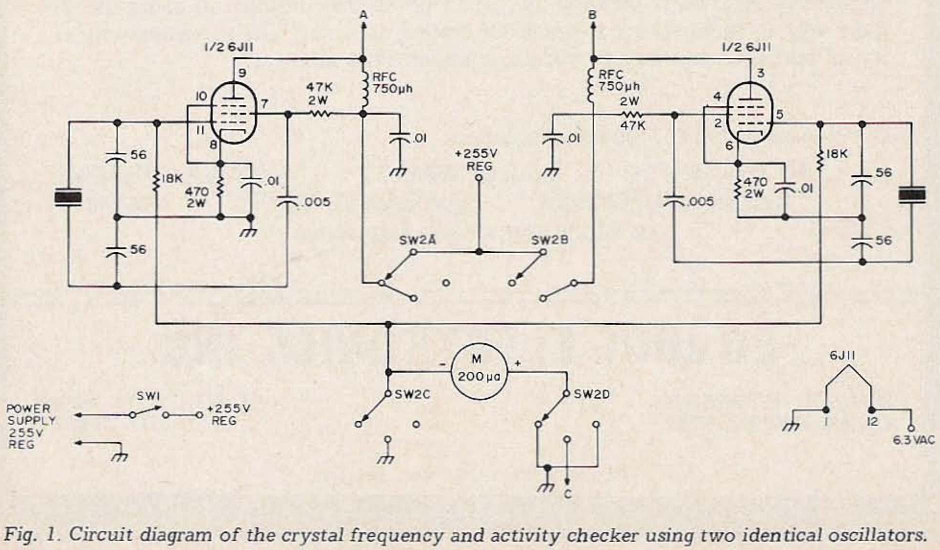


Fig. 1. Circuit diagram of the crystal frequency and activity checker using two identical oscillators.

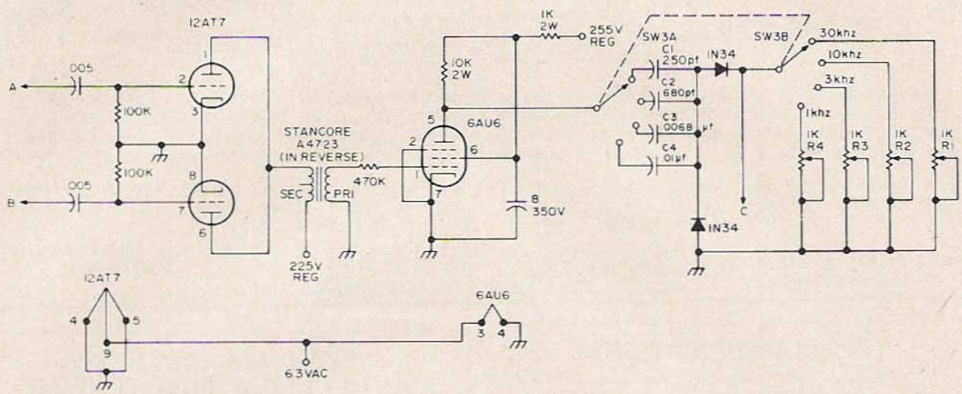


Fig. 2. Circuit of the mixer and limiter stages.

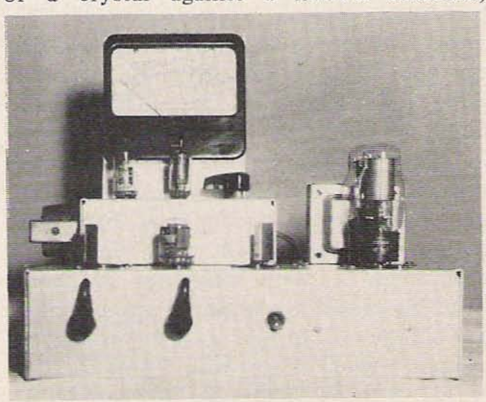
provide a starting point. Use good quality condensers. A little extra investment here will pay off in added accuracy.

After double-checking the wiring, test the oscillators first. Insert a crystal of known good activity in one oscillator. With crystals in the 7–8 MHz range the 200 μA meter should read half scale with the components and voltages shown. Now check the other oscillator. It should give the same reading. If it does not, it is likely that the two halves of the 6J11 are not equal. In this case, adjust the grid and/or cathode resistor in one oscillator to achieve the same readings with the same crystal. The frequency should remain the same with either oscillator.

There are several different ways to calibrate the counter circuit. One simple method is to use four pairs of crystals with exact frequency separation of 30, 10, 3 and 1 kHz. Frequencies outside the ham bands in the 6–8 MHz range will work fine and can be secured at an economical price from surplus dealers. First, use the pair that is exactly 30 kHz apart. With the range switch set for 30 kHz and the function switch in the frequency measuring position, adjust R_1 (the meter shunt) for full scale reading. Now the frequency separation of any two crystals can be read directly on the meter scale, up to 30 kHz. The other ranges can be calibrated in the same way.

Another method of calibration is to use an audio oscillator which is accurate and which will work up to 30 kHz. Feed a signal in at point X which has been disconnected from the transformer. The mixer tube should be removed. Set the audio oscillator at 30 kHz with full output and adjust R_1 to full scale reading. The limiter can now be checked by reducing the audio oscillator output to a point where the meter just begins to drop off. This is the threshold point and the audio oscillator output should always be above this point in order to present a constant amplitude signal to the counter circuit. Now move the audio oscillator to 20 kHz and then to 10 kHz, checking the meter on the 30 kHz scale. If the readings are not linear, adjust C_1 up or down for linearity over the entire scale. The other ranges can be calibrated in the same manner.

Caution: When measuring the frequency of a crystal against a known standard,



The crystal checker. Controls left to right: On-off test, function switch, ac on-off.

remember that the output of the mixer is the *difference* frequency so it must be determined if the frequency is above or below the known standard. For example, the known frequency is 7150 kHz and the meter reads 10 kHz. This can be either 7160 kHz or 7140 kHz.

If, after calibration, the crystal checker does not agree with readings taken on a BC-221 frequency meter, the BC-221 may be suspect. If it is several years old, the spread between check points in the calibration book may be too great. The military instruction book says that check points should be within 1.8 dial divisions on the low band and 1.2 on the high band. This error is not too great when using the fundamental range on the high band but becomes quite significant when multiplied four times. A wide difference in check points is caused by aging of components. One solution is to feed a 100 kHz crystal calibrator (which is zero with WWV) into the BC-221 with its 1000 kHz oscillator on in the "check" position. Many more check points can now be heard. For example, you will hear a check point at 7150 kHz, which would not otherwise be readable. Always choose a check point as close as possible to the frequency being measured. The accuracy of the checker is only as good as the accuracy of calibration so close attention to this is highly recommended.

This instrument has been in daily use here at W4AYV for over a year and the performance has been most gratifying. It would be especially useful for those doing any serious work with crystal SSB filters. For instance, it is possible to more nearly match crystals for zero separation than listening on a BC-221 or receiver. For such jobs only one frequency range would be needed, perhaps the 5 kHz range. This would simplify construction and calibration. In fact, for just matching crystals, no calibration is necessary. It is indispensable when etching crystal blanks for filters. A separation of, say, 1.8 kHz can be read precisely which beats trying to measure such separation on a BC-221.

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425	1000	50 U	<0.3	34.0	52.0	>70	LPF	Radio Amateur TVI Filter	24.95
426	1000	70 U	<0.3	34.0	52.0	>70	LPF	Radio Amateur TVI Filter	24.95
427	1000	50 U	<0.3	55.0	63.5	>70	LPF	Radio Amateur 6 Meter Filter	29.95
419-80	100	50 U	<0.3	5.6	7.0	>45	LPF	Harmonic 80 Meter Radio Amateur	15.00
420-40	100	50 U	<0.3	11.2	14.0	>45	LPF	Harmonic 40 Meter Radio Amateur	15.00
421-20	100	50 U	<0.3	22	27.5	>45	LPF	Harmonic 20 Meter Radio Amateur	15.00
422-15	100	50 U	<0.3	30	36	>45	LPF	Harmonic 15 Meter Radio Amateur	15.00
428-80	1000	50 U	<0.3	5.6	7.0	>45	LPF	Harmonic Radio Amateur 80 Meters	24.95
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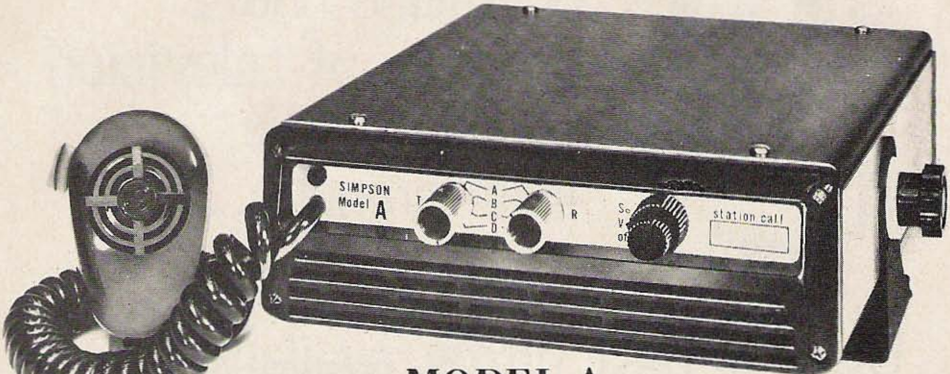

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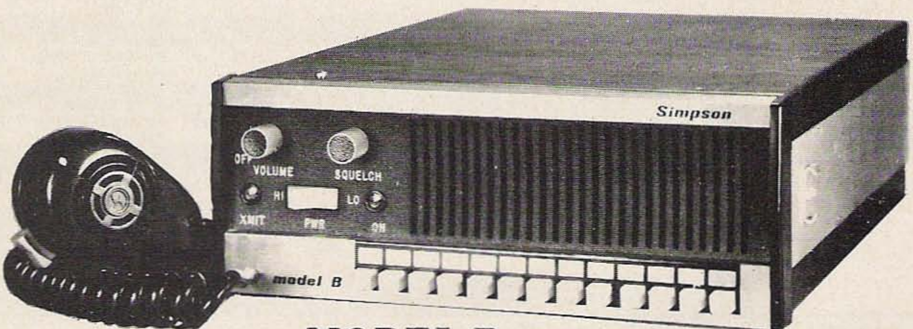

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10 AMP VARIABLE POWER SUPPLY

This power supply grew out of the "Versatile Variable Power Supply" described by W6SLP in the June 1968 issue of *73*. That circuit used a capacitive multiplier feeding two germanium type 2N1970 power transistors wired to adjust the output voltage to any desired level. I found several difficulties in his circuit. First there was no way that his capacitive multiplier could supply power to the output transistors when the pulsating dc from the bridge was at an instantaneously low potential. Also that extra filter circuit in series with the high current dc path caused an undesirable extra voltage drop. The 2N1970's in the dropping circuit had a tendency to leak badly under heavy loads. When they leaked too much the output voltage would rise – and the output current would rise – and the temperature would rise – and the leakage would rise – and so on to terminate in a well known result. After two of the 2N1970's rediffused themselves all over the inside of their cases, I decided that this supply just wasn't going to hack more than just a small load.

The supply that I built is a legitimately regulated dc supply that is capable of up to 10 amps at any voltage between 2 and 36 volts, and still remain in one piece. Ripple and noise is less than 10 mV at full load and the output voltage drops off less than ½ volt from no load to full load. It is built of the least expensive and therefore least exotic parts that I could dig up. Many of the components can be found in surplus stores at much less than their catalog prices.

Theory of Operation

This supply uses two silicon power transistors, Q3 and Q4, in a series regulator circuit. They are fed by a full wave bridge and a large filter capacitor. Q3, Q4, Q2, and Q1 form a triple Darlington with a gain of about 400,000 at 10 amps.

Q5 and Q6, along with a few other components, form the error amplifier circuit. These two transistors sense the output voltage and adjust the bias on the regulators so that the output voltage maintains a preset level. Any change in loading on the supply is fed back out-of-phase so that the regulators will compensate for it. Also any input change, including hum, is virtually eliminated by the regulators.

C2 provides a nearly pure dc voltage for the error amplifier. D5 allows C2 to charge from the power path but does not allow it to discharge back. In this way only the small load of the error amplifier is placed on this capacitor. R2 prevents D2 from blowing up when the supply is turned on. R3 provides the collector load for Q5 and will dissipate a little over two watts when the supply is set to a high output voltage.

R4 and R5 balance the current between the two regulator transistors so that one of them will not hog all the current and run too hot. The 10 amp fuse, F2, is there to protect the regulators against a not-too-drastic overload. It probably won't help if the supply is shorted good and proper. One of the regulators will probably succeed in protecting the fuse.

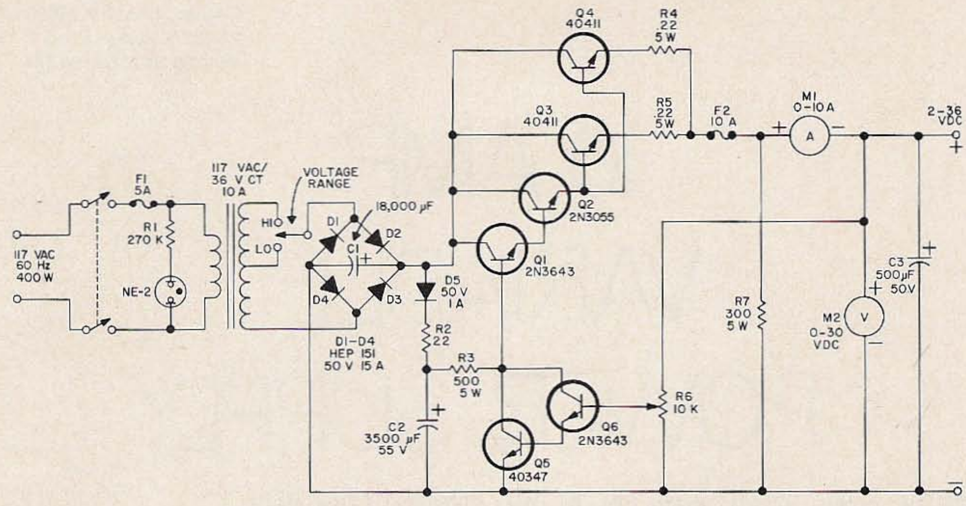

Fig. 1. Circuit of the 2-36V, 0-10A variable power supply.

R7 is a bleeder to keep the output voltage down to about 2 or 3 volts when the voltage control is set to minimum. Any residual output above 2 volts is caused by leakage in the regulators or their drivers.

The voltage control pot is connected to the output connector so that any voltage drop caused by R4, R5, F2, or M1 is compensated for by the regulator.

C3 is to help drop the output impedance of the supply and to provide some transient protection for the supply.

The Design

I have found that a regulated supply can provide about the same dc output voltage as the rms voltage rating of the transformer at full load. The transformer can have the same current rating as the supply is supposed to have and it will behave just fine. With a 35 volt surplus transformer wound with #12 wire, a full-wave bridge, and an 18,000 µF capacitor bank, I could get 47 volts no load and 38 volts minimum at a 10 amp load. This meant that at full load and a 35 volt output, my regulators, Q3 and Q4, could drop no more than 2 volts. I found that the RCA 40411 or the type 2N3772 were two of the few silicon power transistors that would do the job and still not cost too much. These types are rated at 150 watts and 30 amps and cost about $4.25 each. Two in parallel provide all the power dissipation that is required. A type 2N3055 would work for the regulators, but I don't recommend this. They are rated at 115 volts and 15 amps but their $V_{ce(sat)}$ is too high at high currents. $V_{ce(sat)}$ at 5 amps is about 6 volts minimum. This limits the maximum output voltage of the supply to about 30 volts. The 2N3055 has one big redeeming characteristic, however, its cost is half that of the others.

The regulator driver, Q2, should have a low saturation voltage at about 300 mA. A 2N3055 will work here as it behaves better at lower currents. You can use a lower power device than the 2N3055 here as it is never called upon to dissipate more than 15 watts. Just be sure that it has a high collector current rating so that the regulators will not starve for base current.

The regular pre-driver, Q1, can be almost any signal type as long as it has *low leakage.* I_{ceo} should be less than 1 µA, and it would help if the transistor has high gain. A 2N3643, available from Fairchild at about $.50, or a 2N1613, available from just about anybody at $.75, will work well.

The error amplifier, Q6, can be the same as Q1. It should also have low leakage.

I had surplus rectifiers in the bridge, but a funny thing happened when I tried to discharge the filter capacitors with a screwdriver with the power still on. Where I had had four rectifiers, I then had three bolts. One rectifier managed to survive. I replaced the surplus jobs with HEP 151's. These work very well although they are running right at their voltage rating. They cost \$.79 each. A HEP 152 might be a better idea because it is rated at 200 volts, but they cost about \$1.25.

When the supply is used at high currents and low voltages, the regulators have to dissipate the most power. At a current of 10 amps and an output of 10 volts or less, the regulators have to dissipate 300 watts or more. This is very rough on the supply but it can handle it. When low output voltages are desired, it is better to use a lower transformer voltage and keep your electric bill down. By hooking the supply to a lower tap on the transformer, such as a center tap, the supply will still work just the same up to 15 volts or so and it will remove 200 watts of dissipation from the regulators. The supply should be turned off and the filter capacitors discharged *before* the voltage range is changed. If you don't do this, you may be buying some more rectifiers. The switch should be capable of handling 10 amps.

Construction of the power supply isn't critical except for a couple of things that are quite important. Any wires that carry the heavy output currents should be at *least* #16 and should be as short as possible. This especially applies to the ground wire. Also Q3 and Q4 should be mounted on *large* heat sinks and the heat sinks should be mounted on the *outside* of the cabinet in a location where they can have excellent ventilation. If possible the fins on the heat sinks should be vertical so the heated air can flow up past the heat sinks with little difficulty. Q3 and Q4 must be mounted with good silicon grease, and, if possible, the heat sinks should be electrically floating and the mica washers eliminated.

The voltage control pot I used has a linear taper, but a reverse audio taper would work better if you can find one. The value is not critical, any value between 5K and 50K will work fine.

This supply is highly useful to power small projects as well as big ones. It will handle 6 and 12 volt FM two-way radios or 24 or 28 volt surplus gear as well as charge batteries. With a 4Ω limiting resistor it even pulls a nice little arc.

. . .WB6TOX

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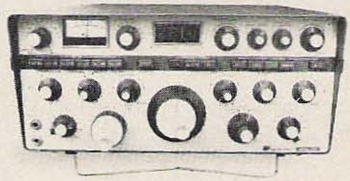

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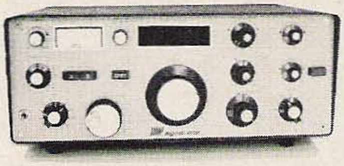

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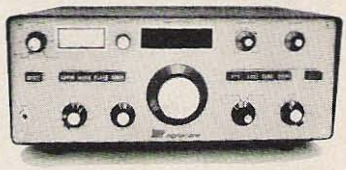

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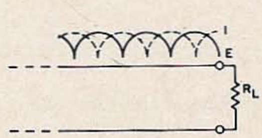
TRANSMISSION LINE SECTIONS

In modern amateur practice the transmission line is usually of the concentric or coaxial type, although it could also be of the parallel conductor type (i.e., shielded or unshielded twinlead and open-wire lead). Most amateurs, if shown a length of coaxial line, could readily suggest the obvious use; namely, interconnecting the antenna and the station equipment. But it would be safe to wager that only a few would be aware that a carefully selected length of transmission line terminated properly can be made to act as a capacitor, an inductor, or even a resonant circuit.

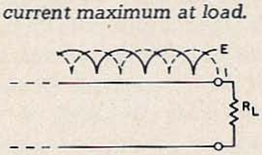
TYPE	DIELECTRIC	VELOCITY FACTOR
COAXIAL	POLYSTYRENE	0.66
COAXIAL	FOAM POLYSTYRENE	0.78–0.80
300 OHM TWIN-LEAD		APPROX. 0.70
75 OHMS TWIN-LEAD		APPROX. 0.80

A transmission line has a characteristic impedance (Z_O) determined chiefly by condutor size and spacing and by the dielectric constant of the insulating material between the conductors. If a transmission line is terminated in a load whose impedance is equal to the Z_O of the transmission line, it is said to be flat, or nonresonant. This is the desired condition when using it as a feedline.

However, if the line is terminated in something other than its Z_O, strange things begin to happen. Such mismatch results in reflection of energy from the terminating load and creates standing waves on the line, the interaction of the outgoing and the reflected energy being the cause of the waves. Extreme mismatches occur when the line is terminated in a short circuit or if left open-circuited. Referring to Fig. 1 will give some idea of what occurs. If R_L is much greater than Z_O a voltage maximum results and vice versa. A voltage minimum along the line would mean that the generator would "see" a low impedance if attached at that point. Note that peaks and valleys of either the voltage or current curves are electrically separated by a quarter wavelength.



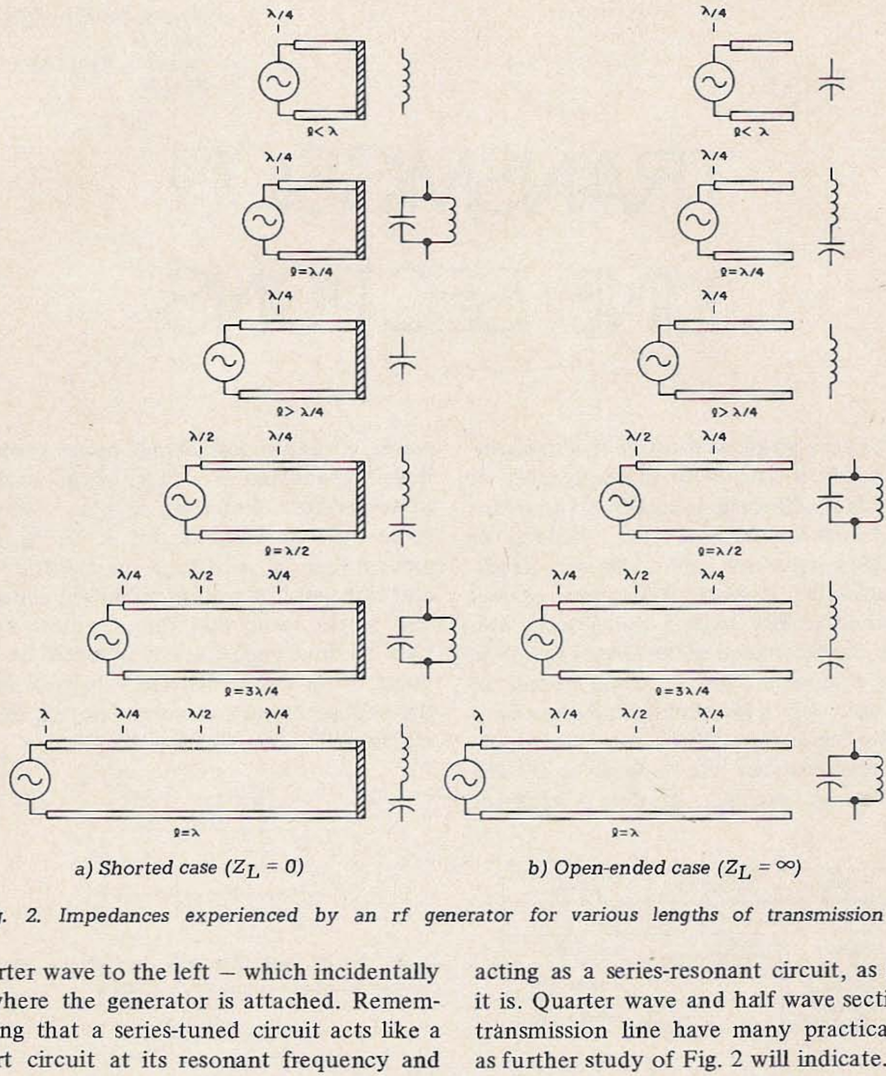
a) R_L much less than line impedance. Voltage minimum, current maximum at load.



b) R_L much greater than line impedance, voltage maximum, current minimum at load.

Fig. 1. Current and voltage standing waves on a transmission line terminated in a resistive load.

Going on to Fig. 2, consider an open-ended transmission line whose length is an electrical quarter wave. The terminated end is "shorted" by a load whose impedance is infinite and therefore a voltage maximum will exist. A voltage minimum will exist a



a) Shorted case ($Z_L = 0$)

b) Open-ended case ($Z_L = \infty$)

Fig. 2. Impedances experienced by an rf generator for various lengths of transmission line.

quarter wave to the left – which incidentally is where the generator is attached. Remembering that a series-tuned circuit acts like a short circuit at its resonant frequency and that the generator is seeing a very low impedance beause a voltage minimum exists there, it seems logical that the line could be acting as a series-resonant circuit, as indeed it is. Quarter wave and half wave sections of transmission line have many practical uses, as further study of Fig. 2 will indicate.

These sections will be frequency sensitive and will have high Q. When designing transmission line sections, the physical length of

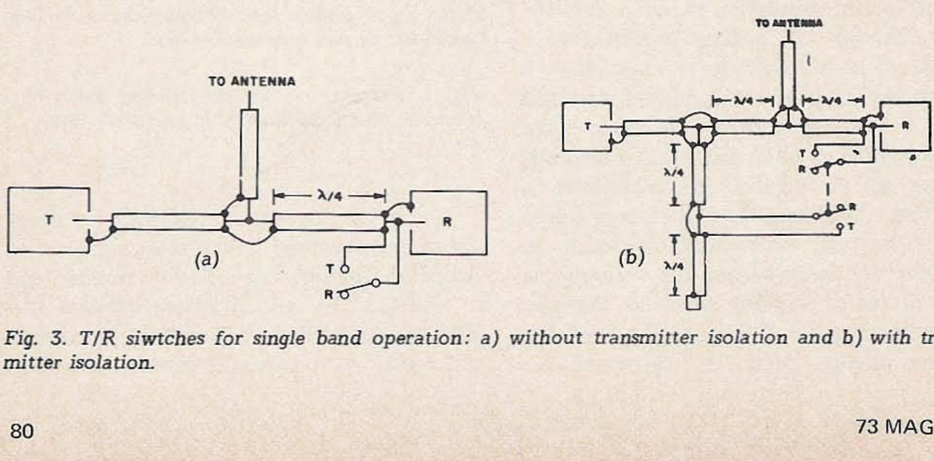


Fig. 3. T/R siwtches for single band operation: a) without transmitter isolation and b) with transmitter isolation.

the section will be found to be less than the free-space wavelength, and is calculated by multiplying the velocity factor times the free-space wavelength. Jim Fisk's Coaxial Transmission Line Handbook[1] contains several tables pertaining to the physical length of coaxial line sections. Some of the standard and not-so-standard tricks with transmission line are touched on in the remainder of this article.

Coax Tr Switch

The switches shown in Fig. 3 utilize quarter wave and half wave sections in the shorted condition to provide receiver isolation during transmit. Dual-band operation is possible on certain harmonically related bands such as the 40 and 15 meter bands if frequency excursions are not too far from the design center frequencies. Such operation is possible because odd multiples of

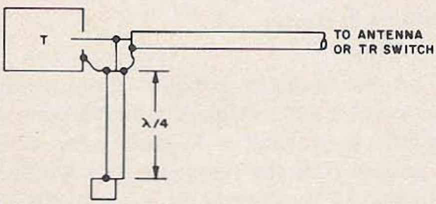


Fig. 4. Harmonic interference trap for transmitter use.

quarter wave sections repeat their characteristics (see Fig. 2). A mechanical switch of some type must be used to short the sections; however, the voltage and current ratings are not too stringent.

I have constructed 50 MHz versions of both Tr switches and found them to work quite well, but no absolute measurements of isolation were made. An attempt to use back-to-back diodes to give automatic shorting of the quarter wave sections on transmit did not give the required isolation – this was to be expected.

Transmitter Harmonic Trap

This type of trap is very effective over a limited frequency range and may be very helpful in eliminating channel 2 TV interference caused by 10m transmitters. Receiver harmonic traps may be constructed from

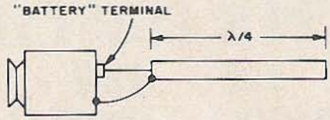


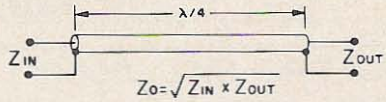
Fig. 5. Alternator filter using open quarter wave coax section.

open-ended quarter wave sections and are placed in parallel with the antenna terminals of the receiver[2]. If the transmitter is at 28 MHz, even harmonics (54 MHz, 112 MHz, etc.) are attenuated.

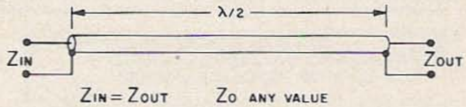
Alternator or Generator Hash Filter

More than one trap may be paralleled to get two- or three-band operation.

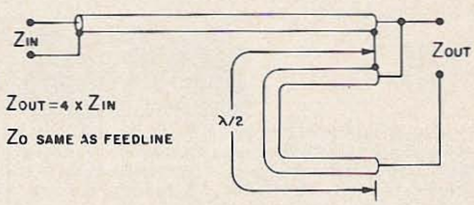
Referring to Fig. 6a, the quarter wave transformer can operate both as a stepup and stepdown rf transformer. For example, if Z_{in} is less than Z_o, then Z_{out} will be greater than Z_o. Of course the reverse also holds true. A common application of this



a) Quarter wave matching transformer for balanced or unbalanced transmission lines (unbalanced shown).



b) Half wave matching transformer (1:1 ratio). Applicable to balanced or unbalanced line.



c) Trombone matching transformer (4:1 ratio). Unbalanced to balanced (in direction of impedance stepup) shown.

Fig. 6. Transmission line sections as matching devices.

device is to match the 70Ω impedance of a transmitter to a quarter wave mobile whip whose impedance is about 20Ω. Using the formula given, the Z_0 of the line would be about 50Ω, so a section of 52Ω coax works fine. Although it would not be feasible to delve into the theory of operation of this transformer, its operation is related to what you have seen in Fig. 2 for the open and shorted quarter wave line sections.

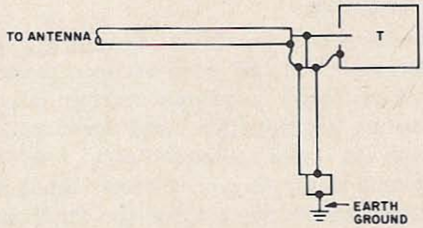


Fig. 7. Lightning protector and static drain.

Lightning Protector and Static Drain

This device can be placed at the transmitter or even at the antenna if a good ground is available. It provides a dc ground but does not ground rf at the frequency it is cut for. Naturally it is inherently a narrowband device, but it does have application with single-band antennas.

In summary, then, these sections are very selective and can provide accurately tuned resonant circuits with only a tape measure and a pair of sidecutters. They make excellent single-band rf transformers. They can be used to construct low-loss rf switches Although nothing was mentioned on the subject of matching stubs, it is possible to use lengths of transmission line to supply capacitive or inductive reactance for the purpose of matching an antenna to a feedline. This review of transmission line sections could at best only hope to skim the surface, since the theory behind these devices would fill a book. It is hoped the reader will pursue this subject further and in greater depth.

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2. Rand, *Television Interference Handbook*, The Nelson Publishing Company.

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RADIO ASTRONOMY for RADIO AMATEURS

The thought of optical astronomy conjures images not only of Mount Wilson and Palomar but also of the many thousands of amateur observers throughout the country. On the other hand, radio astronomy brings to mind visions solely of huge installations such as Arecibo and Jodrell Bank; this is in large part due to the availability of small visual instruments, which makes amateur participation possible, and popular. Such optical observers send in hundreds of reports each month to national societies such as the American Association of Variable Star Observers, and their data prove invaluable to astronomical research.

Predictably, radio astronomy currently has no similar "sky patrol." However, it is possible for hams to initiate such a watch on their own with a reasonable initial outlay using essentially what equipment they presently possess. I intend to show in this brief article what kind of set-up is necessary and what data can be obtained from radio astronomical observation.

One of the primary factors influencing the quality of HF and VHF radio transmissions is the emission of the sun in the region of the electromagnetic spectrum from the ultra-violet through the x-ray domain. Some correlation exists between visually observable sunspots on the one hand, electronically detectable solar radiation in the HF and VHF range, and short-term behavior of the ionosphere on the other. Analysis of either or both of these phenomena can have substantial predictive value for skip conditions. The ham is in an ideal position to gather, analyze, and make use of such data. This is still a wide open field where original research with simple equipment can potentially be of significant scientific value.

A brief word on the history of radio astronomy may suffice. Forty years ago, January of 1923, Karl G. Jansky, a Bell Telephone engineer, detected "a steady hiss type of static of unknown origin." He had discovered the radio emission from the center of our galaxy at a frequency of 20.5 MHz. Five years later Grote Reber, working with a homemade parabolic dish antenna in his backyard started exploring the sky in the VHF region. In 1944 he published the first maps of the radio sky and in the same year detected solar radiation at 10 MHz. G. C. Southworth and J. S. Hey subsequently found solar thermal emission at centimeter and meter wavelengths, respectively. The developments in radio astronomy since the war (the prediction and detection of the interstellar hydrogen line at 1420 MHz, to name one) have been too numerous to recount here; the interested reader is referred to the works listed in the bibliography.

How difficult is it to get started in radio astronomy? Not at all, really. This author has successfully supervised a group of high school students using little more than unsophisticated FM receivers and TV antennas to observe both solar and extra-solar radiation. The advanced amateur radio astrono-

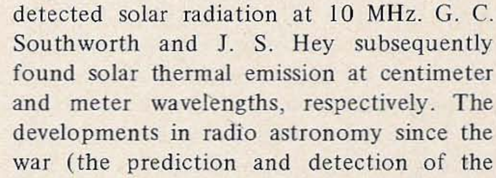

Fig. 1. Block diagram of a radio telescope.

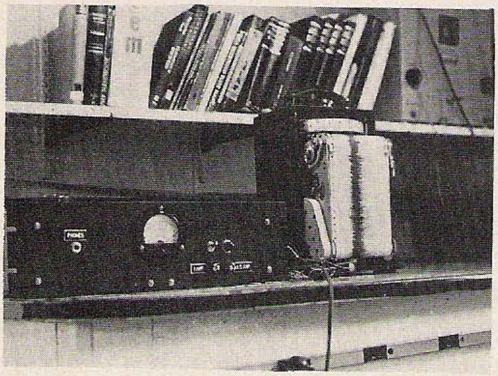

Fig. 2. The 22.2 MHz receiver and Esterline Angus recorder at the Kalbfleisch Field Research Station.

mer may eventually wish to expand his observations to extra-galactic sources which provide a greater challenge due to the generally weaker signals involved. But the sun makes an ideal first target because of its relative strength and discernible effect on radio communication.

A radio telescope consists basically of the items shown in Fig. 1. Initially, the calibrated source can be omitted since measurements will be taken relative to an arbitrary baseline. A desirable receiver will have a very low noise figure and extremely high gain stability (for every gain variation is seen as a change in the recorded noise level). Typically, regulation to 1 part in 40,000 for high voltage and 1 in 3,000 for filament voltage are employed. The recording device for our purposes could be no more than a glorified S meter, but preferably a strip line recorder.

In 1968 I first experimented with the feasibility of a small scale radio observatory at the Kalbfleisch Field Research Station (Huntington NY) of the American Museum of Natural History. Our "shack" consisted of a single channel receiver operating at around 22.2 MHz, an Esterline Angus model AW recorder, and an eight element Yagi (see Figs. 2 and 3). We naturally directed our attention to the sun, being the strongest source of extraterrestrial radio waves with the qualified exception of Jupiter, but that's another story entirely. Using the armstrong method we were able to point the beam at the sun throughout the greater part of the day. (By the way, it gave excellent results on 15 meters.) After a while we were able to identify the various types of solar bursts we had recorded, and recognize their characteristic sound when we heard them again. A detailed description of these emissions can be found in Steinberg and Lequeux. (See bibliography.)

Although virtually any type of antenna may be used initially, the ordinary three element beam (or, of course, larger) is preferred because of its directivity and subsequent gain. The feed line should be adequately shielded and unbroken from antenna to receiver. Any possible sources of attenuation, such as T-R relays and lightning arrestors, should be removed from the line (unless one is monitoring a local lightning storm, in which case an arrestor is a necessity!).

The receiver should be ideally a single conversion superheterodyne with a high S+N/N ratio. A rough way of ascertaining the noisiness of your receiver is first to listen on a clear frequency at midday, using the widest selectivity available, with the antenna first connected, and then with a 50Ω resistor across the receiver input terminals. The drop in noise level should be significant. Repeating the test at three in the morning should yield an almost imperceptible change. This is

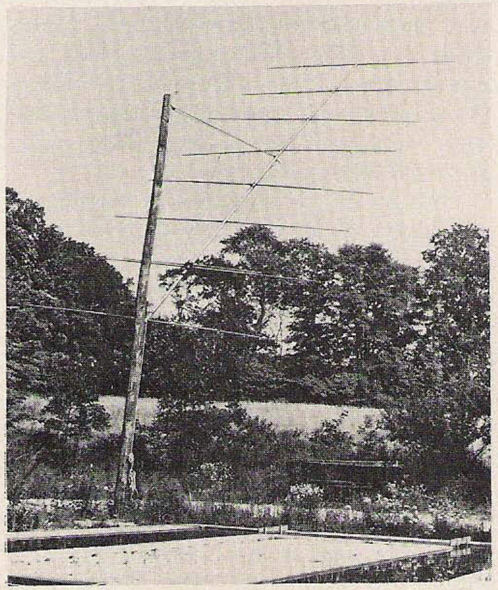

Fig. 3. View of the eight element beam used in the Kalbfleisch system (photographs courtesy the American Museum of Natural History).

a good sign that the system is both quiet and sensitive enough to make detection of solar emission possible.

Up to this point I have not mentioned what frequencies should be used for observations. The three major considerations here are transparency of the ionosphere to incoming signals of that frequency, freedom from terrestrial interference (both communications and noise), and performance of your system (receiver plus antenna) at that frequency. As a rule the 15 meter band is a good place to start. The Kalbfleisch station has for several years monitored extraterrestrial sources at 21 MHz using only a commercial three element monobander for an antenna.

Choose what appears to be a clear frequency either below or above the ham band. International fixed stations above and aeronautical stations below will make frequency selection a difficult matter. After you have found an open spot, stay tuned to it for several days using the broadest selectivity to ascertain its freedom from potentially interfering stations. Listen carefully and after a while you should begin to recognize noise that sounds not like ordinary QRN. If you are fortunate enough to have once heard an audio recording of a solar flare, you might identify what you are receiving as such. Remember to use broad selectivity – the purpose of this is to allow as much as possible of the signal (which is essentially broad banded) to go through, since power output will be directly proportional to bandwidth. The Kalbfleisch unit uses in its i-f amplifier a crystal filter with a width of 13 kHz.

Now that you are reasonably certain the sun is coming through well, you can consider the matter of recording the output. There are several choices available as to from what stage the signal should be taken. At Kalbfleisch we rectified the audio output of the receiver, and having imparted a characteristic time constant to it (R x C), fed it into the 0–1 mA graphic recorder (Fig. 4). The purpose of the back biasing arrangement is to allow the recorder pen to be positioned so that the full scale of the instrument can be used. The 47,000Ω resistor simply isolates the dc power source from the recorder.

Clearly, the higher the value of R, the lower the current the recorder will see. We were hard put to find individual paper capacitors to provide the necessary time constant of about five seconds. Electrolytics were avoided since experience has shown that their capacitance varies too much with time and temperature to be useful in serious work, though they are perfectly satisfactory for initial observations.

An alternative to rectifying the audio output is taking the filtered detector voltage from the receiver, which will be in the order of 1/2 volt, pass it through an RC circuit similar to that in Fig. 4 and then feed it directly to a recorder with the requisite sensitivity. During period of observation the receiver avc should be turned off or grounded at the appropriate place, since the R-C combination provides the time constant regulation necessary; the anl, noise blanker and such should also be off.

A graphic recorder is the one piece of equipment needed to complete your observatory. Unfortunately for the prospective radio observer the prices of new units tend to be rather high. A survey of Philadelphia and Washington, D.C. surplus shops reveal a preponderance of recorders designed for 220 volts ac at 50 Hz, which can be bought for less than $80. The effect of running such an instrument on a 60 rather than 50 Hz line is that the chart speed will be slightly higher than normal, just enough as to make time readouts on standard paper difficult. If you are inclined to experiment a little with clockwork, it is possible to build into an ordinary wall clock a device which will send out pulses every so often, say at hour or half hour intervals. This way the time of a

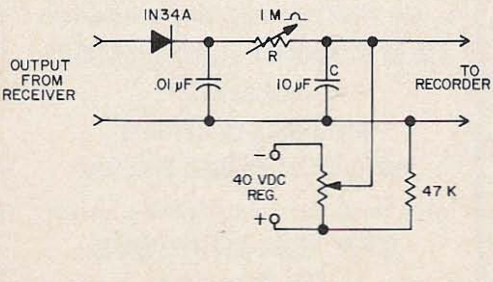

Fig. 4. Detector and back biasing circuit used between the receiver and recroder. The variable resistor R and the capacitor C determine the time constant.

particular event can be readily determined. As an alternative to purchasing a recorder, the physics department of a local university can be checked out as a source of a loan of one.

Just to become acquainted with the noise strength profile at the frequency you have chosen, let the recorder run at five to six inches an hour for several days. Because of ionospheric absorption and divergence (see Hanbury Brown and Lovell, p. 16), signal strengths will be greater towards midday. Studying the profile of bursts requires a speed of twelve to twenty inches per hour, but this must not be done indiscriminately, lest you find your paper consumption getting out of hand.

The information you should seek as a result of your observations is what correlation exists between type and intensity of solar outburst and propagation on the amateur bands. Data such as what frequencies, areas and paths are affected are of great interest. I would be pleased to hear personally of the problems and progress the amateur radio astronomer encounters.

I have concentrated here only on the sun, being the most readily observable radio source. If you are so inclined you can find a list of celestial radio emitters in the several books on radio astronomy listed in the bibliography. It will hopefully not be long before optical astronomy associations have their counterparts in radio astronomy. Hams could potentially provide a vast amount of valuable data to the scientific community, and themselves gain an understanding of the still obscure workings of the universe.

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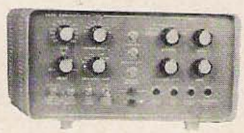

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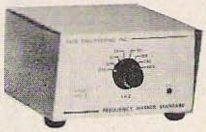

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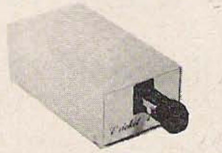

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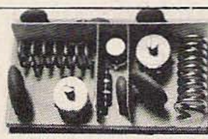

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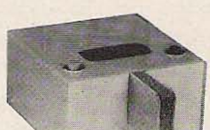

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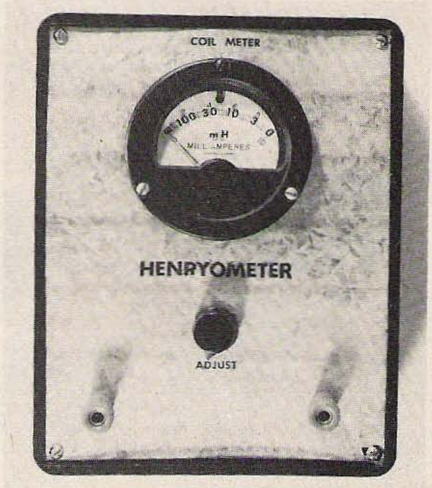


I know for a fact that many of my friends, as well as myself, have boxes of chokes and coils which are of no use without known values. Most of these inductors, it will be found, are still good and may have applications in projects. Even though the chokes may be aged and dusty, underneath may be a coil that could save you a bit of money on that receiver or linear you are about to build. All you need to save yourself this time and money is a "Henryometer." Unlike bridges, which are slow, and many times inaccurate, or the capacitance method of resonating with a grid-dip meter, the Henryometer reads directly, like an ohmmeter. All it should cost you is a few parts from the junkbox and a little time.

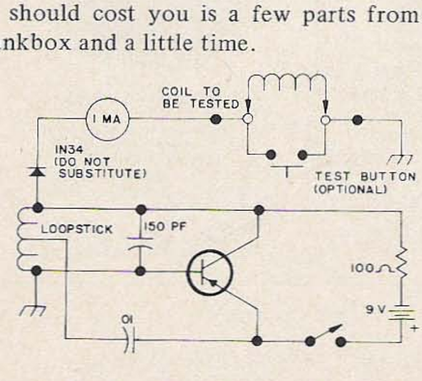


Fig. 1. Circuit of the direct reading inductance meter.

The Henryometer is based on the formula for inductive reactance. This states that the two variables which control reactance are frequency and inductance. Since the Henryometer supplies the frequency, inductance will control reactance. Thus, this is a reactance, or ac ohmmeter. It operates in the same way as a dc ohmmeter except that an oscillator replaces the battery, for an ac current; and a diode on the meter changes it back to dc to register on the direct current milliammeter.

You will find this meter very easy to build and simple to operate. Most any PNP transistor will work in it, but the diode *must* be a 1N34. The case can be made very small, for all that need be contained is a battery, meter, potentiometer, and small circuit board. To test a coil, connect it across the terminals, push the test button (or connect the leads as with an ohmmeter), adjust the control for zero, or one mA, let up on the test button, and read the value indicated. You may calibrate it with known values. It should read accurately from .25 to 10 millihenries. You might wish to add ranges by adding a selector for meter shunts. One important precaution is to use leads as short as possible to keep added inductance as low as possible.

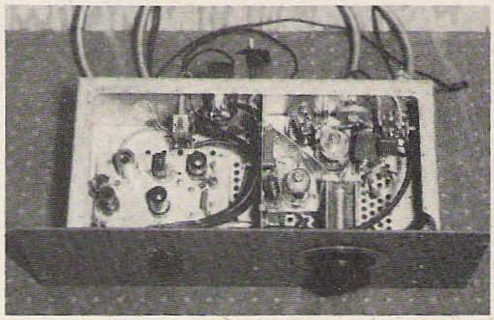
...WA8MLP

Paul L. Schmidt W9IDP
214 North Washington
Bloomfield IN 47424

TRANSVERTER FOR 20 METERS

Expand the coverage of your single or dual band transceiver with a unit that features convenient high-level mixing.

This is primarily for those having single-band or two-band transceivers having 75 or 80 meter capabilities but with no provision for 20 meter operation. This describes an outboard 20m transverter which is hooked into the transceiver antenna line like a linear amplifier with its receiving and transmitting functions controlled by the transceiver working on 75m.



The transverter uses the same crystal for both receiving and transmitting conversion. This way the transceiver you are using "thinks" it's on 75 while it is actually on 20m. Aside from the added 20m coverage, no modification of your present transceiver is made; thus, the resale price is unaffected.

Whenever I am exposed to a "how to" article, there is always something not just exactly right about the other author's design. Therefore, the reader is here encouraged to receive my ideas in the same light, to make his own improvements or modifications to what is described.

Figure 1 gives the functions of the transverter stages. I use a 6.025 MHz

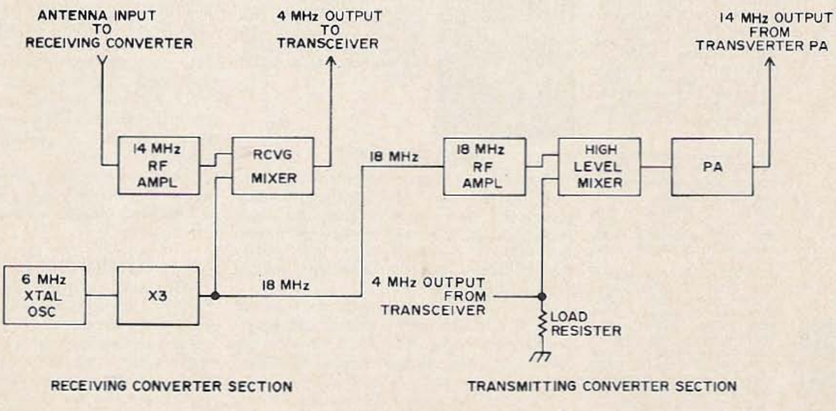


Fig. 1. Functions of transverter stages.

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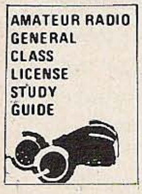

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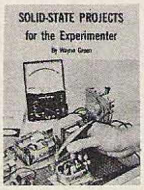

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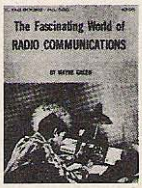

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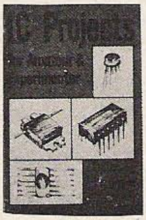

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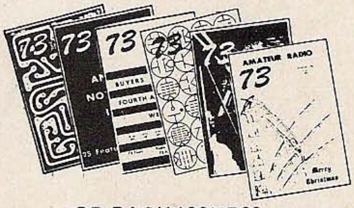

OR BACK ISSUES?

Where can you buy a one year subscription to a magazine and get a set of twelve back issues as a bonus? That sounds like a pretty good deal doesn't it? Well, unless you have a complete set of back issues of 73 that is a fabulous deal. It is such a good deal that it has a string attached – the twelve back issues are a free bonus for a subscription, but there is one more problem that has to be faced. This is the postage involved. Twelve back issues are darned heavy and the postage cannot be dismissed lightly. If you want one of the three different back issue packages you will have to send along an extra $2 to cover the cost of postage and handling. It's still a great deal. The problem is that books can be mailed at the library book rate, while magazines have to go parcel post, which costs an arm and a leg.

Over 3000 great articles have appeared in our back issues and most of them are just as good today as the day they were printed. You will have the time of your life reading all those wonderful issues you missed. We have separated the back issues into three packages. issues from 1960 – 1964 (I), 1965 – 1967 (II), and 1968 – 1970 (III). These back issue bundles are put together by illiterate apple pickers borrowed from other ham magazine staffs and thus there is no possibility of our guaranteeing any particular issue in your bundles . . . you take pot luck.

A DX FRIEND?

Foreign subscriptions to 73 are a bit more expensive than local ones, naturally – however we will be happy to enter a gift subscription for a DX op at the same low U.S. rate as part of this book offer. Here is your chance to spread a lot of happiness around the world. One of the most appreciated gifts any DX ham can get is a subscription to 73. Indeed, we suspect that 73 is read in more countries around the world than any other ham magazine – in well over 200 countries at last count!

If you work DX you must have a couple good friends who will practically fall out of their tree over a subscription to 73. Try them.

Have you ever been shown a kindness by a DX op? Maybe you visited him? Remember his kindness with a 73 subscription.

WHY THIS OFFER?

The whole purpose of this offer is to bring 73 to the attention of more active amateurs – to get more subscriptions. Obviously we are paying dearly for the initial subscription – but we frankly intend to make it up next year when the renewal comes due. In the long run all of us will benefit from this.

It is obvious that it is not possible to send two books with a two year subscription. This offer is valid for one year subscriptions only.

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Where else can you get an amateur radio handbook for free? That's right, you get about 1200 pages of articles in 73 every year and the magazine is designed so that each and every article is on separate pages – and 73 is the only magazine that does this – with no flipping to the back of the magazine for a parts list or anything. Every page of the magazine is numbered with the regular numbers plus special yearly handbook page numbers – all so you can, if you like, take apart your issues of 73 and put them together by subject into a giant handbook at the end of the year. No other magazine has anything like this available.

ACTIVE EDITORS

Only one ham magazine of the four has editors that are active and on the air – and have been for years. 73 has its own repeater going – the only ham magazine staff that has done this. 73 has its own mountain top laboratory for VHF – the only ham magazine with one. 73 is active on slow scan television – the only magazine to do this. 73 goes on DXpeditions – the only ham magazine to do this. 73 runs DX tours – the only ham mag to do this. And so it goes.

And what difference does all this make? Perhaps you've noticed that 73 is more involved with the hobby – 73 not only reports the most interesting news, sometimes it helps to make the news. It helps 73 to be more fun to read, to attract better authors for articles, to bring you more valuable information on the newest of ham products.

Which ham magazine was the first to report on the first commercially made two meter synthesizer? 73 of course. And which got the first new units made by Genave? And which got the first Clegg units? The first International Signal units? The first Drake FM units? The first Tempo units? And so on – being active and on the air helps make 73 more interesting and valuable, doesn't it?

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If you prefer not to shred your copy of 73 there is no real reason why you should not put the subscription information on a separate piece of paper, on the margin of a hundred dollar bill, or whatever turns you on.

Regular subscriptions ordinarily start with the next published issue of 73 – the November issue, in this case. Gift subscriptions marked for Christmas will start with the Giant January issue since that is the one that should arrive right around Christmastime. If you want otherwise just indicate same on the order.

The regular subscription rate for 73 is $6 for one year $11 for two years, $15 for three years in North America and $1 extra per year for foreign subscriptions. This special book premium offer is valid world wide at $6 for one year until December 31, 1972.

The recent serious rise in postal rates will be forcing 73 to increase the subscription rate soon – don't say you weren't warned.

Did you enjoy the article in August on the DXpedition to Navassa? This is one of the reasons that 73 is different – it is involved. The editors get out there and operate, go on DXpeditions, organize them even – organize ham tours – set up repeaters – work in the contests – work lots of DX – are actually on slow scan – on RTTY – it makes the magazine come alive. When the editors write about something you know that they have the background to bring you the inside scoop. If you are the type of person who fights progress – opposes change, you are going to find 73 getting your back up, for 73 is in there first with the new things.

Amateur Radio
is more fun
When you read 73

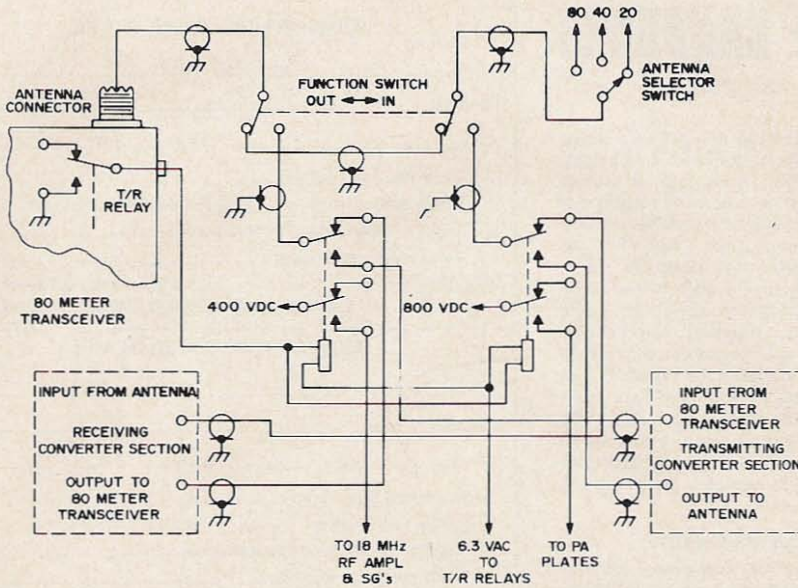


Fig. 2. Transverter control circuitry.

crystal oscillator and triple to 18.075 MHz. Then the amplified incoming 14 MHz signal heterodynes in the mixer with this to produce the 4 MHz output for the transceiver's receiver. The receiving converter and crystal oscillator–tripler remain on during the transmit mode, but during transmit, an additional 18 MHz rf amplifier turns on to provide more 18 MHz power for a high-level transmitting mixer.

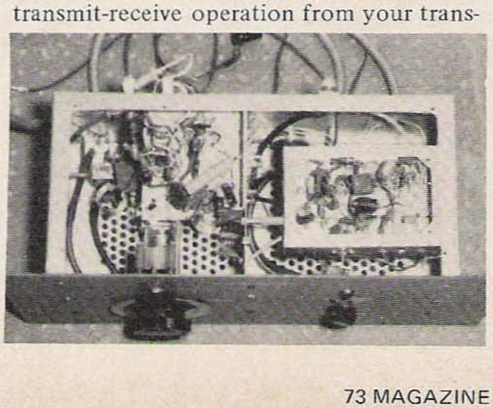
And in the transmit mode, your transceiver's 4 MHz output goes into a 50Ω load in parallel with the input of the high-level mixer, the output of which drives the 14 MHz power amplifier.

My crystal oscillator frequency of 6.025 MHz was chosen because the crystal happened to be on hand. Its third harmonic, 18.075 MHz, mixes with 4.000 MHz to give 14.075 MHz for CW operation, and 3.800 MHz lower sideband (the low end of the dial of my WRL Duo-Bander 84) produces 14.275 MHz upper sideband. Note that the required sideband inversion is accomplished in the conversion process

A happier choice of crystal frequency might have been 6.067 MHz, whose third harmonic, 18.200, would give full phone band coverage and a little bit more, going from 14.200 to 14.400 MHz.

Because your transceiver dial isn't calibrated for the 20m band, and since the aim of this exercise is to keep your transceiver unmodified, it becomes necessary to make a conversion chart in order to know your operating frequency. A suggested design is shown in Fig. 6.

To have the transverter in the transceiver antenna circuit at all times, like a linear amplifier, it must be switched from "out" (straight through) to "in" (transverting to 20 meters) by means of a substantial double-pole-double-throw wafer switch. Two DPDT relays perform the transmit-receive operation from your trans-



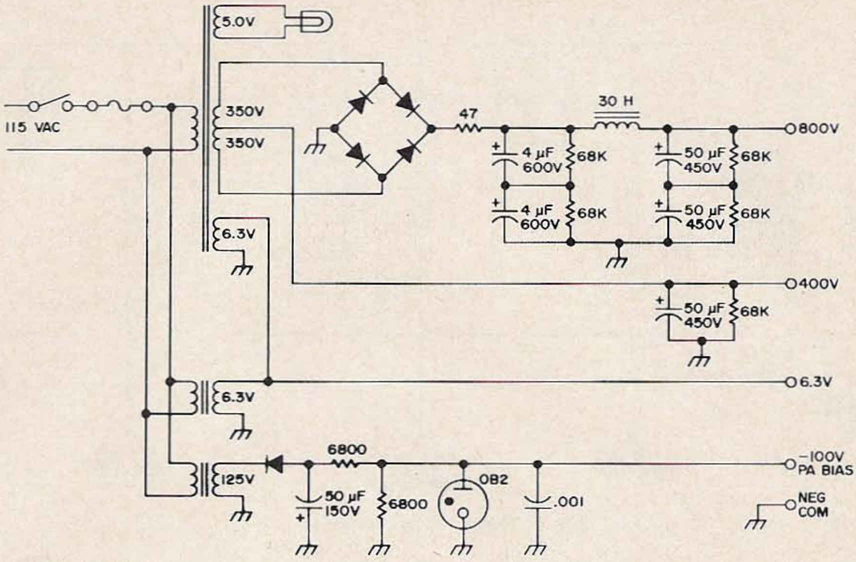


Fig. 3. Transverter power supply.

ceiver's TR relay. Control circuitry for all this is shown in Fig. 2.

Now that the functions have been roughed in, the construction steps should follow in some logical order. Plan your layout for ease of maintenance and repair if possible. The one I built requires removal and replacement of nine screws just to change a pilot bulb.

You might like to complete the receiving converter and power supply first. Then you can listen to 20m while completing the transverter. Don't forget to unplug the microphone from your transceiver during the construction phase while listening to 20m; otherwise, you might forget and transmit through the receiving converter (not recommended). A grid dipper is a must for pruning and tuning. If you don't own one, better borrow one.

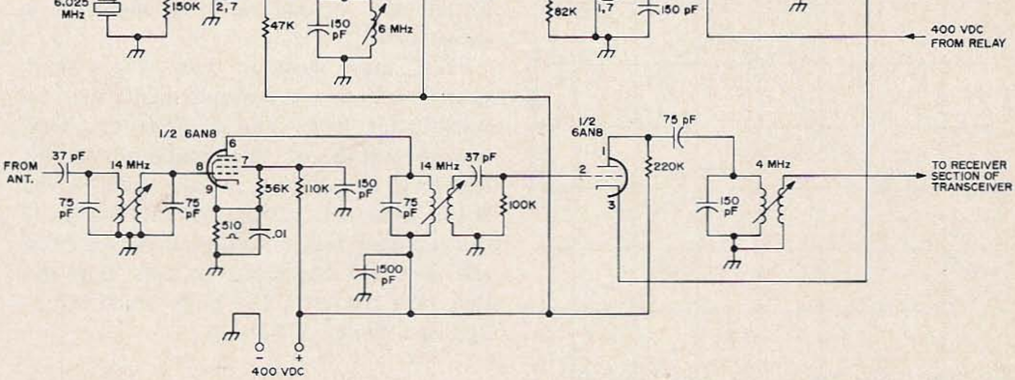


Fig. 4. Receiving converter.

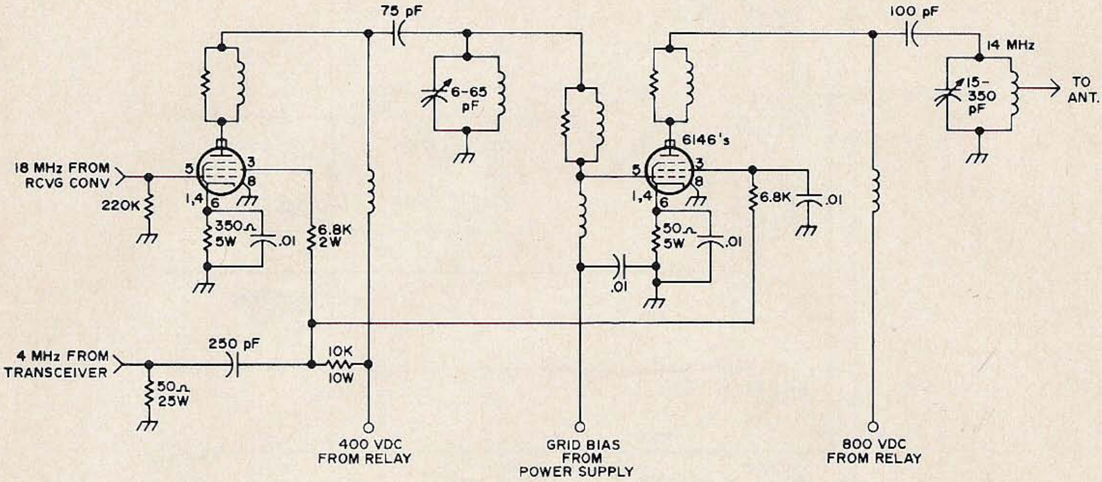


Fig. 5. Transmitting converter.

Figure 3 shows the power supply. Because my available control relays were 6V ac types, I decided to run a 6V line between power supply and transverter (as opposed to the usual 12V line). This practice can spell trouble unless the filament cable and the common return bus are of generous wire size. With relays energized and filaments lighted, the current averages 5A. Just half an ohm of interconnecting cable resistance can drop the filament voltage from 6.3 down to 4.6V, with resulting marginal operation.

Figures 4 and 5 complete the whole

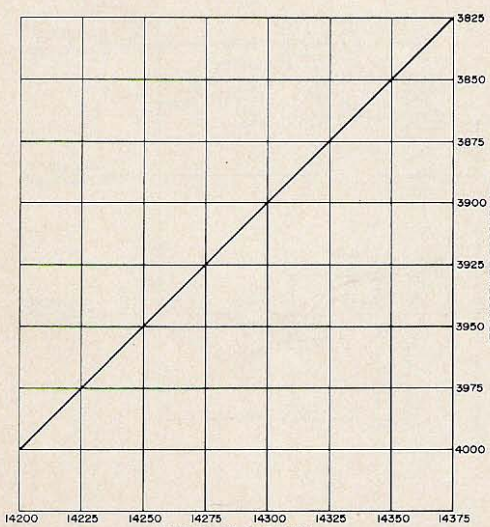


Fig. 6. Frequency conversion chart.

nine yards. Construction details are left to the builder's good judgment. From the experience gained in constructing this little gem, I would say that the most vulnerable part is the rf power amplifier following the high-level mixer. The 6146s are prone to parasitic oscillations. With 800V on the plates these tubes can disintegrate in short order. If my good friend Lew (W9YEA) had not sustained my needs by furnishing extra 6146s, I never would have been able to complete the project.

On December 23 my transverter was completed. On Christmas morning I worked VK3VG. On the 28th I contacted KZ5AB, and on the 29th, KH6AX. This is quite good considering the antenna, a dipole 25 ft up at its highest point – a dipole installed with the assistance of a loving and patient wife at night in a snowstorm.

You may wish to vary the circuit elements to suit the requirement, such as transverting from 20m to 75m, etc. One unique feature of this transverter is the high-level transmitting mixer, which works better than anticipated. Another bonus is the complete lack of birdies or images from the receiving converter. In fact, it is the first such converter I've built which exhibited such purity of output.

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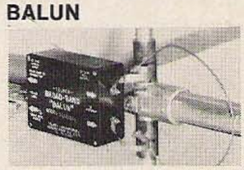

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A PRIMER ON LEDS

The surplus market is flooded with light emitting diodes (LEDs). They have some great characteristics and are easy to use.

What are they? They are diodes, they rectify just like any other diode but their atomic structure is such that when the electrons jump from one energy band to another they give off light. This is cold light and is intended to be seen only at the source, it is not for reading.

What good are they? Well, they withstand 1500gs vibration, they will last over a million hours without loss of intensity, they operate on low voltage dc, they come on in 35 nanoseconds, they can interface with any logic circuitry and be pulsed or driven steady state.

How do you use them? They operate on as little as two volts. The critical factor is the forward current. You must limit this forward current. This is done by putting a resistor in series with the diode. This resistor is calculated using Ohm's law:

$$R = E/I = \frac{\text{Voltage you want to use}}{\text{Current limit of the diode}}$$

A typical LED burns at about 15 mA; the more current the brighter it burns; this is a straight linear relationship. Some LEDs take 1 Ampere – if you use a heat sink.

The LED like any diode has a cathode (where you connect the positive lead) and an anode, the negative side. You take your ohmmeter and measure the forward and reverse resistance of the LED. When you find the connection with the lowest resistance that is the way you want to connect the LED in your circuit – in the forward direction. You can't hurt it with an ohmmeter.

There are many sizes and shaped of LED but they resolve into two distinct types: those with plastic lenses; and those with a flat face. The lens type is for viewing at a distance and directly in front of the display; and the flat face can be seen at the side more easily but not as brightly.

The first outgrowth of the LED was the opto-isolator. This is a LED and a light sensitive diode in combination. There are also LED-transistor and LED-SCRs. All of these come in a little 1/2 inch long package and they are used for isolating one circuit from another. This eliminates ground loops, transient spikes, and random noise. The difference in these three packages is the transfer ratio. The LED-silicon diode pair has a transfer ratio of 0.15%, for instance, if you put a 16 mA pulse to the LED you get a 24 mA pulse out. If you shunt the output with 42K ohms you have 1 volt to play with. The LED-transistor isolators have a transfer ratio that varies depending on the connection and biasing of the transistor but to get in the ballpark figure one to one transfer

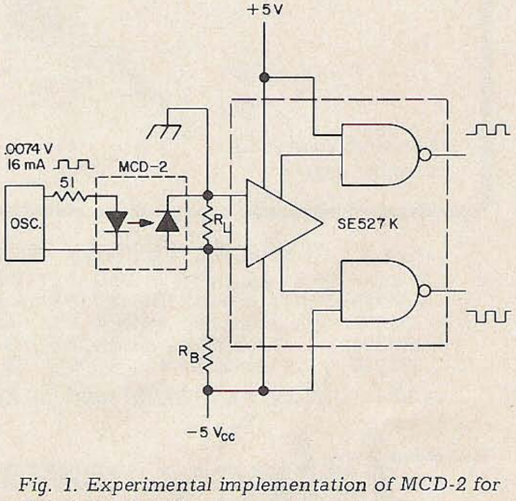

Fig. 1. Experimental implementation of MCD-2 for digital data transfer.

ratio. For instance 15 mA in gives 15 mA out. Why use diodes when transistors are so much better? The diodes are faster and they can transfer logic information.

The LED-SCR is a typical SCR and does anything another SCR can do like acting as a relay or switch except that it is triggered on by the light from the LED. This isolates it electrically from the input circuit.

The diagram shown in Fig. 1 shows a diode opto-isolator transferring a 1 MHz square wave from one circuit to another. In computer circuitry which is very sensitive to transients, this is a great thing. The load resistor RL was one K ohms and RB was the pull-down bias resistor necessary to operate away from the click point of the IC.

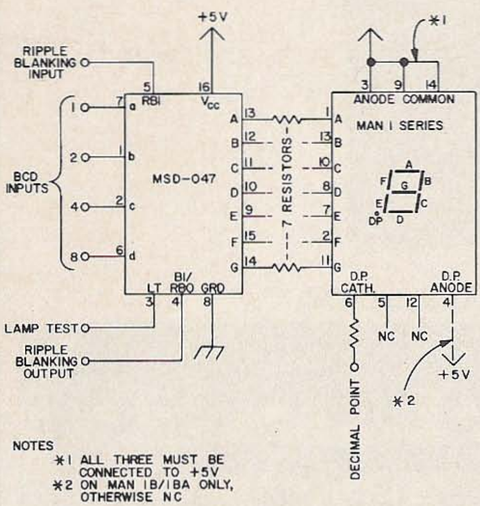

Fig. 2. TTL decoder driver to MAN 1 series.

The next big step in LED complexity is the seven segment numerical display. I only mention this because so many are advertised in the surplus market. If you have one of these you need a decoder-driver that converts BDC information to the proper logic to activate the segments. They usually run on 5 volts and like the single LEDs, the segments must be current limited. Figure 2 shows a typical circuit. If this interests you, write to: *Monsanto, 10131 Bubb Road, Cupertino CA 95014* for their Product Directory and the proper application memos.

. . .WB6JNI

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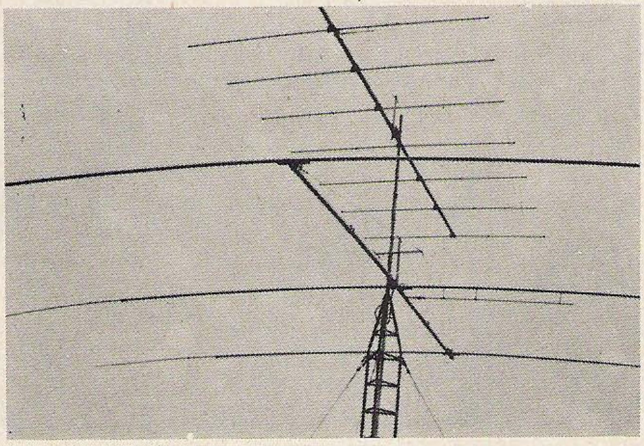

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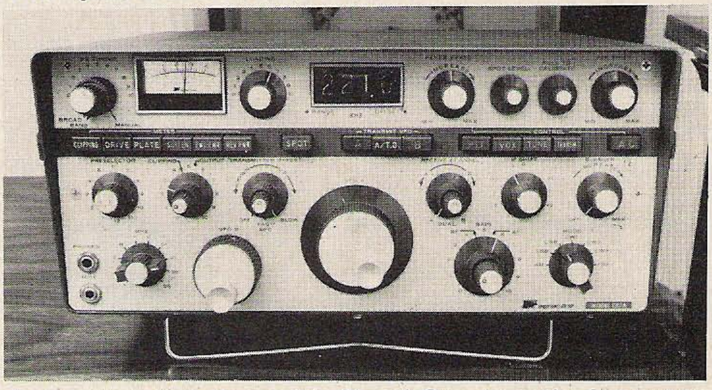

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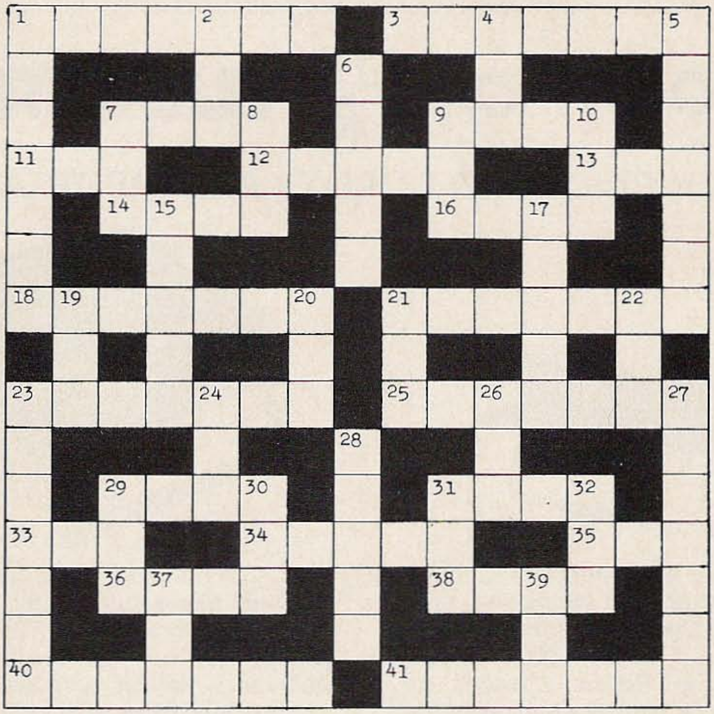

ACROSS

1. A pulse that starts an action.
3. The core of an atom.
7. Any range of frequencies which lie between two defined limits.
9. The smallest portion of an element which exhibits all properties of the element.
11. A small low-voltage type incandescent lamp.
12. The element which receives the highest DC voltage in a cathode-ray rube.
13. An electrically-charged atom.
14. Also called derivative action.
16. A single unit capable of serving as a DC voltage source.
18. An expression of relations in an equation or formula.
21. A housing for a radar antenna.
23. A device having a scale calibrated to read directly in decibel values at a reference level.
25. A four-electrode electron tube.
29. A clue.
31. Short for synchronous.
33. A unit of conductance, which is the reciprocal of resistance.
34. A type of meter for measuring hearing ability.
35. The pickup device on a record player.
36. A connecting device.
38. A facsimile transmitter in which the copy is mounted on a rotating cylinder.
40. A plan or layout for a receiver.
41. The time taken by an electron to pass through a specified area.

DOWN

1. Three radionavigational stations operated as a group.
2. A firing weapon.
4. Sever.
5. In a facsimile transmitter, that which translates the densities of the subject copy into signal waveform.
6. The deadening of sound.
7. Special test pattern for adjusting color TV receivers.
8. Payable.
9. A luminous discharge of electricity through a gas.
10. A unit of measurement.
15. Identified on diagrams by the letter P.
17. A type of beam.
19. The center of activity.
20. To impair, spoil or blemish.
21. A small quantity.
22. Terminate.
23. Also called a rhombic antenna.
24. Metallic chemical element, At. No. 50.
26. Attempt.
27. Any component part of a vacuum tube.
28. Acronym for Carrier-Operated Device Anti-Noise.
29. An excursion of a radio wave from the earth to the ionosphere and back.
30. Also called a sentinel.
31. A surface layer of earth containing grass plants.
32. A sliding part used to convert rotary motion to linear motion, or vice versa.
37. A section or branch of a component or system.
39. A metal container with a faucet.

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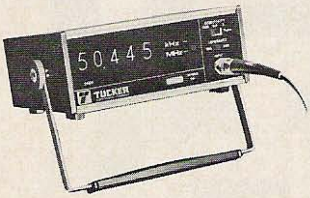

The Model 60 Frequency Counter (shown with 160 Hetrodyne unit) measures frequency from 1 KHz to 60 MHz with a full 5 digit readout (overranging feature provides an equivalent 8 digit display). With the optional 160 Converter, this tiny (less than 4 pounds) counter will also read 130 to 160 MHz with a sensitivity of 50 MV. With inputs of up to 100 MV, the unit will cover the full range of 110 MHz to 170 MHz. Only three switch controls provide complete operation—just plug in your signal and read the answer. Not a kit and no adjustments to be made!

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Ed Marriner W6BLZ
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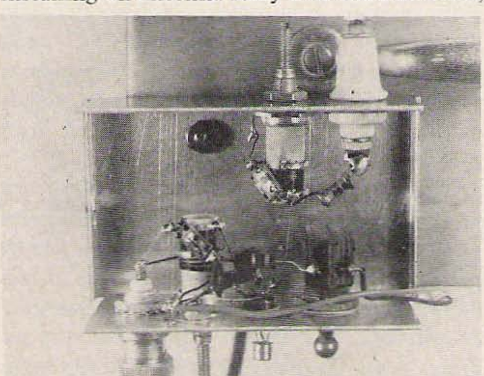
FORTY METER FET PREAMPLIFIER

Here is a simple experiment used to familiarize yourself with FET circuitry. Described is a simple forty meter pre-amp which can be used to soup up a transistor shortwave receiver or add sensitivity to an inexpensive 80 or 40 meter receiver.

On several vacation trips I used 60 feet of wire wound on a dowel 3/8 in. in diameter, and then clamped to the car window. Without the pre-amp no signals could be heard even though a loading coil was tried, and several antenna tuning coils. Running coax back to the transmitter in the trunk and installing an antenna relay and control wires, converted me to this simple separate antenna installation with the pre-amp. No measurements were made on the gain, but it makes the difference between no signals and S9 results.



Bottom view of Pre-amp showing input and output coils and FET socket on the back.

Theory

Since this circuit was used just for the forty meter amateur bands, no attempt was made to use variable tuning condensers. The unit was peaked up by adjusting the slug tuning and left untouched.

The RCA FET used in this circuit is the 3N128. It is a high impedance device and is much like a vacuum tube in that it does not load down the coils like a transistor. In this circuit the antenna was attached to the top of the input coil through a 10 pF condenser because a random hunk of antenna wire was used. If the antenna had been a coax fed arrangement, several turns of wire could have been wrapped on the bottom of the coil for coupling. The output of the pre-amp is taken from five turns of number 23 wire into RG174 small coax to get the amplified signal over to the receiver.

The unit was built in an LMB box type 000, 3¼ x 2 1/8 x 1 5/8 in. The slug coils were 24 turns of number 28 wound on J.W. Miller ceramic 3/8 diameter forms, type

PROPAGATION CHART

J. H. Nelson

Good (Open), Fair (□), Poor (O)

DECEMBER • 1972

S	M	T	W	T	F	S
					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	14	7	7	3A	3A	7	3A	3A	7	14	14A	14A
ARGENTINA	14	7	7	7	7	7	14A	21	21	21	21	14A
AUSTRALIA	14	7A	7B	7B	7B	7B	7B	14	14	14	14	21
CANAL ZONE	14	7	7	7	7	7	14	21	21A	21A	21A	21
ENGLAND	7	7	7	3A	7	7	14	21	21	14	7B	7
HAWAII	14	7A	7	7	7	7	7	7B	7B	21	21A	21
INDIA	7	7	7B	7B	7B	7B	7A	14	7B	7B	7B	7
JAPAN	14	7B	7B	7B	7	7	3A	7	7B	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	21	21	21	14A
PHILIPPINES	14	7B	7B	7B	7B	7	7	7	7B	7B	7B	7B
PUERTO RICO	7	7	7	7	7	7	14	14A	14A	14A	14	14
SOUTH AFRICA	7B	7	7	7	7B	7B	14A	21A	21A	21	14A	14
U.S.S.R.	7	7	3A	3A	7	7B	14	14A	14	7B	7B	7
WEST COAST	14	7	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
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ARGENTINA	14	14	7	7	7	7	7A	21	21	21	21	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	14	14	14	21
CANAL ZONE	14	7A	7	7	7	7	7A	21	21A	21A	21A	21
ENGLAND	7	7	7	3A	7	7	7B	14	21	14	7B	7B
HAWAII	21	14	7	7	7	7	7	7	7A	21	21A	21
INDIA	7	7	7B	7B	7B	7B	7B	7A	7A	7B	7B	7B
JAPAN	14	7B	7B	3B	3B	3A	3A	3A	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	7B	7B	3B	3B	3A	3A	3A	7	7B	7B	14
PUERTO RICO	14	7	7	7	7	7	7A	14A	21A	21	21	21
SOUTH AFRICA	14	7	7	7	7B	7B	14	21	21	21	21	14
U.S.S.R.	7	7	3A	3A	3A	7B	7B	14	7A	7B	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	3	3	3	3	3	7	14	14A	21
ARGENTINA	21	14	7A	7	7	7	7B	14	21	21	21	21
AUSTRALIA	21	21	14	7B	7B	7B	7B	7B	14	14	14	21
CANAL ZONE	14	7A	7	7	7	7	7	14	21A	21A	21A	21A
ENGLAND	7B	7	7	3A	7	7	7B	7B	14	14	7B	7B
HAWAII	21	14A	14	7	7	7	7	7	7	14A	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7	7	7	7B	7B
JAPAN	21	14	7B	7B	3A	3A	3A	3A	7	7	7B	14
MEXICO	14	7A	7	7	7	7	7	7	14A	21	21	14A
PHILIPPINES	21	14	7B	7B	3B	3B	3A	3A	7	7	7B	14
PUERTO RICO	14	7A	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	14	7B	7	7	7B	7B	7B	14	21	21	21	14
U.S.S.R.	7	7	3A	3A	7	7B	7B	7A	7A	7B	7B	7B
EAST COAST	14	7	7	7	7	7	7	14	21	21A	21A	21

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

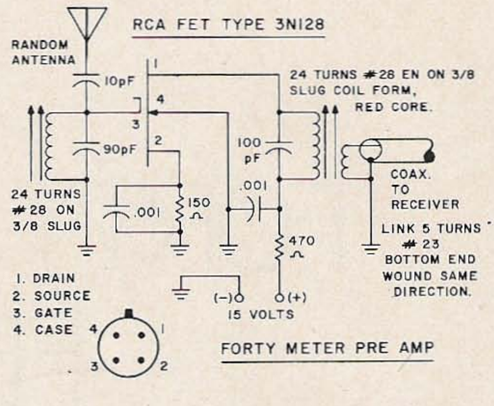

Fig. 1. Forty meter Pre-amp.

4400 or equivalent. These slugs are painted red and cover the 1.0 to 20 MHz range. The coils were mounted in the box as far from each other as possible. Normally there should be a shield between the coils to prevent oscillation, but the circuit was stable and no shield was necessary. If variable tuning condensers were used, the extra mass might suggest a shield because of more radiation in the area between the coils.

There are many stories about being careful when handling FET's, and I do not doubt them. No trouble was had with this unit. The case was held with the left hand, and the snippers held with the other, while cutting off the leads just below the shunt on the leads. Grabbing the shunt while still holding the case, it was slipped off and the leads formed to go into a transistor socket. The book says to use plastic tweezers and not to touch the FET because static charges from snippers might cause damage. Needless to say, you should remove the FET while soldering on the chassis. Wire it all up before putting the FET into place, and then push it in the socket with the power off, and I am sure you will have no trouble.

When the unit is finished, hook up everything and peak the slugs for maximum gain into the receiver. Generally the CW or phone portion of the band can be tuned without readjusting the slugs for any particular antenna. No attempt was made to try other bands. If you wind coils and dip them with a grid-dipper, there should be no problem.

. . .W6BLZ

Warren MacDowell W2AOO
11080 Transmit Road
East Amherst NY 14051

LIQUID PLASTIC WATERPROOFING

Strange as it may seem, the weatherproofing of a coaxial cable splice becomes a difficult problem especially when the splice is to be buried underground. Ordinary plastic electrical tape, over a length of time underground, will allow seepage of water between the layers.

We recently came across a system that has worked very well and that is the use of "Clear Cast" to encapsulate splices. "Clear Cast" is the trade name for a liquid plastic that turns very hard when a proper catalyst is added and allowed to "cure." In its original application, Clear Cast is used for hobby projects such as molding, etc.

In using Clear Cast for sealing coax splices, a cardboard tube ½ in. larger than the coax is placed over the splice. The end of a small balloon is placed over the coax and stretched over the end of the cardboard tube. Of course the splice is opened to put these items in place. The coax is then suspended in a vertical position with the balloon "seal" downward. Clear Cast is then poured in the cardboard tube so as to surround the splice. The hardening catalyst must be added to the Clear Cast before pouring. Correct amounts of hardener or

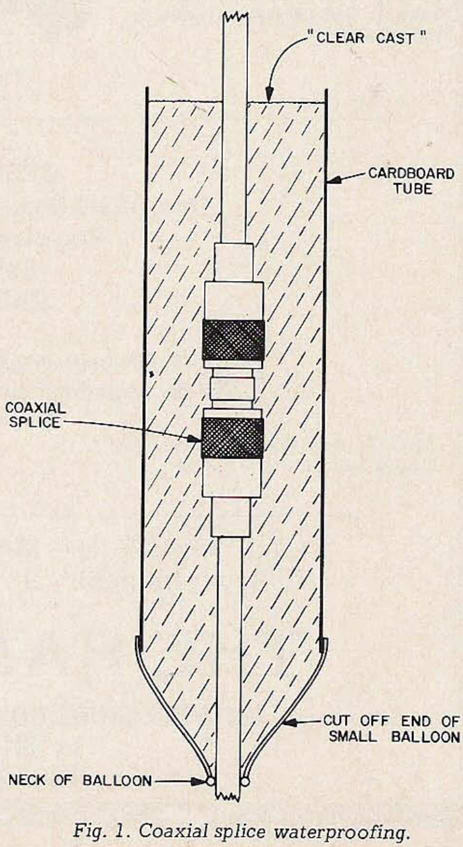

Fig. 1. Coaxial splice waterproofing.

catalyst is prescribed on the container that the Clear Cast comes in. During the hardening process, a fair amount of heat is generated due to the chemical reaction. Approximately six to seven hours are required for complete hardening. Strange as it may seem, the smaller amounts of Clear Cast require longer times to "cure." The larger casts generate more heat and apparently cure faster. Once hardened, the cardboard tube and balloon can be removed leaving the sealed coaxial splice (see Fig. 1).

Clear Cast also works well as a mechanical stabilizer for vfo and other oscillator coil assemblies. A small plastic box, just larger than the coil to be encapsulated, is used as a mold. The coil can be suspended by strings (or whatever means you desire) to a central position in the plastic box. The Clear Cast is poured and allowed to harden. The Clear Cast holds the coil extremely rigid eliminating much mechanical vibration and partially insulates the coil from temperature change. The Clear Cast form can be drilled and tapped to securely mount the coil to a chassis (see Fig. 2).

A third application for this liquid plastic is to encapsulate, insulate and support the vertical element of a ground plane antenna. Again the balloon technique is used to seal in the plastic while in a liquid state. Prior to encapsulating, the coax center conductor is attached to the vertical element and the shield braid is soldered to the copper tubing (see Fig. 3). At this point also, the ground radials should be soldered to the copper tube. The balloon seal is stretched into place and the Clear Cast poured in the top. The plastic hardens and seals the coax and vertical element in place (weatherproof) and insulates it from the copper radial support. The entire assembly is mounted by the use of stainless steel straps to the mast.

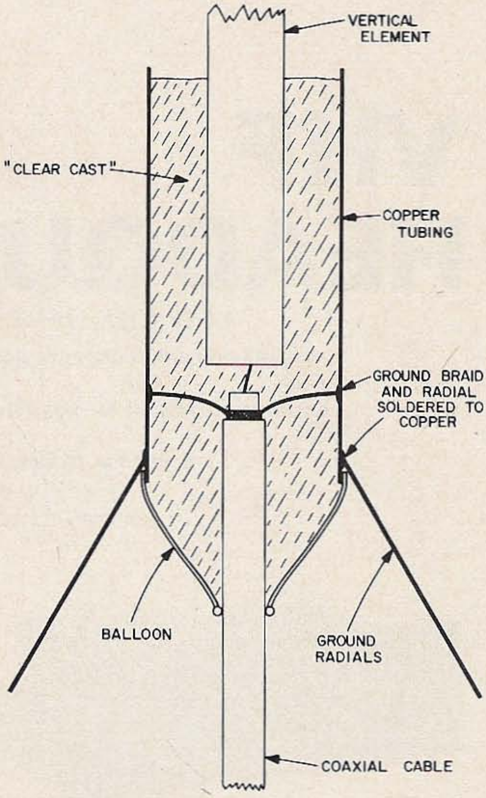

Fig. 3. Ground plane vertical insulation.

If you are using a gamma match type of beam, it might be possible to encapsulate the gamma capacitor to protect it from weather. Of course if you encapsulate the entire capacitor, plates and all, you would have to experiment with the dielectric effect of the Clear Cast when poured between the capacitor plates. Another possibility is to form a "cavity" in the Clear Cast so the capacitor would be variable yet protected.

No doubt once you have experimented with this liquid plastic you will come up with many more applications.

. . .W2AOO

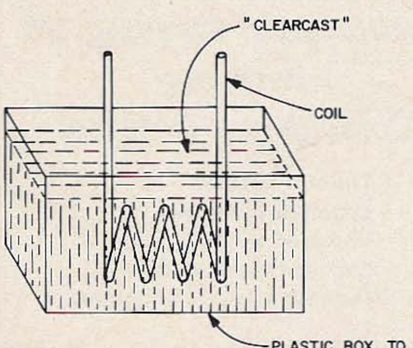

Fig. 2. VFO coil stabilization.

Note: "Clear Cast" and hardener may be obtained from: *American Handicrafts Company, 680 Main St., Buffalo, New York.*

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IMPROVED CIRCUITRY FOR KTI CW FILTER

A recent article (*Ham Radio*, August, 1970), described the use of the KTI – Kinetic Technology Inc., 3393 De La Cruz Boulevard, Santa Clara, California 95051 – integrated circuit active filter as a selective audio filter for CW reception. The suggested circuit diagram is shown in Fig. 1. The author constructed this circuit and found it to be a very selective filter, but with certain reservations. At high Q or narrow bandwidth the received signal was difficult to control; the gain of the filter varied inversely with bandwidth, requiring constant readjustment of the receiver gain control.

I discussed this problem with Mr. Fred Glynn, Western Regional Sales Manager for KTI, and he suggested the circuit shown in Fig. 2. He also suggested that I use their Model FX-60 active filter (Amateur class FS-60, $4.95). This circuit works fine and is a pleasure to use. Now the filter has unity gain regardless of bandwidth, i.e., once a

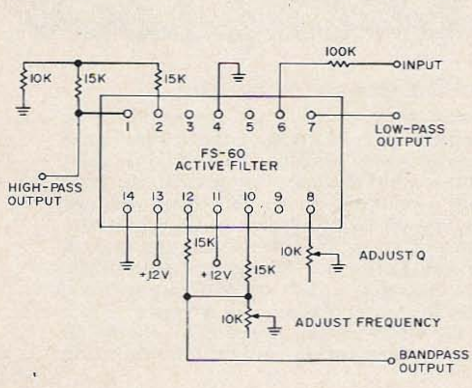
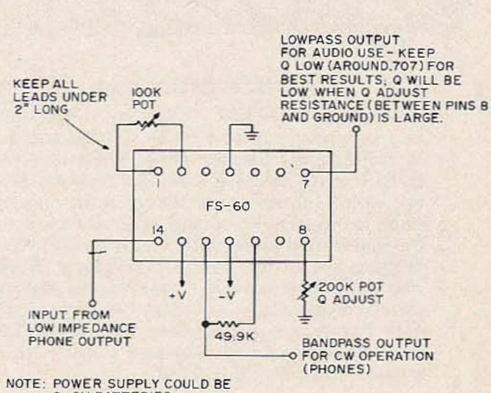


Fig. 1. Original active filter circuit using the FS-60 as it appeared in Ham Radio Magazine.



NOTE: POWER SUPPLY COULD BE 2 9V BATTERIES.

Fig. 2. Modified active filter circuit.

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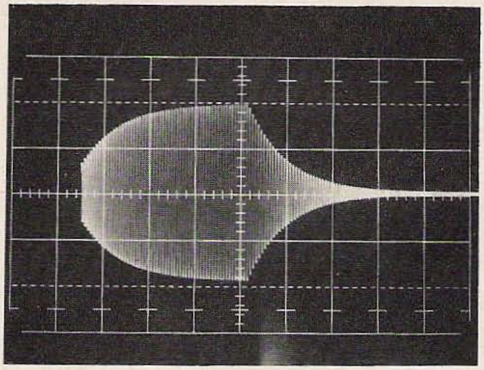
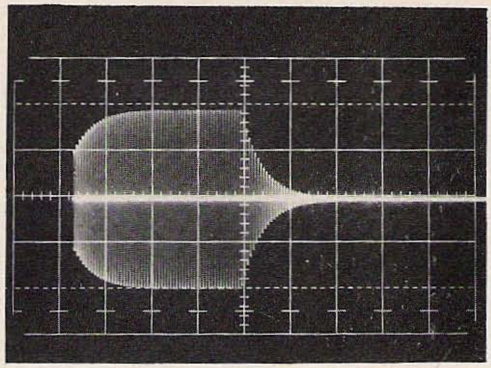
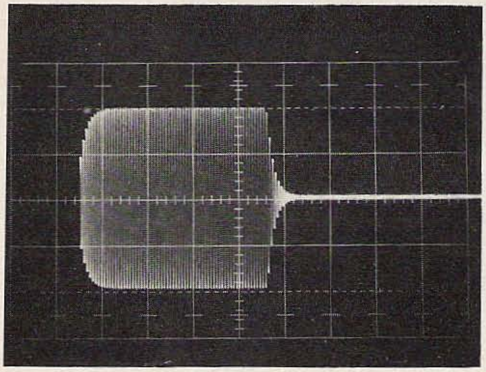


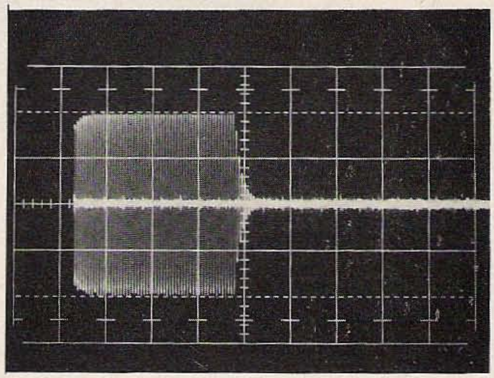
3 dB bandwidth 30 Hz. fo = 800 Hz



3 dB bandwidth 60 Hz. fo = 800 Hz



3 dB bandwidth 100 Hz. fo = 800 Hz



3 dB bandwidth 200 Hz. fo = 800 Hz

Keyed signal characteristics as function of filter bandwidth, horizontal scale 20 msec/cm.

signal is peaked, QRM can be eliminated by means of the Q control. On 80 meters, increasing the Q eliminates most of the background QRN.

One of the inherent problems associated with a selective filter used with a keyed signal is the effect of filter bandwidth on the "sound" or "crispness" of this signal. As the bandwidth becomes very narrow, the filter requires more time to reach equilibrium. As a result, at narrow bandwidths the received CW signal will become distorted as shown in the photographs.

It can be seen that at 30 Hz bandwidth a 70 msec keyed signal takes nearly 70 msec to reach full amplitude and to decay to zero. This signal would not sound too good at a high CW word rate. As the bandwidth increases, the filter output waveform closely approximates the input wave form.

I have used this filter in conjunction with a Hammarlund SP-600 receiver. I can obtain as good or better selectivity and intelligibility with this audio filter and an i-f bandwidth of 13 kHz as I can without the filter and an i-f bandwidth of 200 Hz (excluding single signal effects).

In addition to selectivity, this filter provides the operator with a separate tuning control within the audio bandwidth. Signals can be selected, peaked and interference eliminated without adjustment of the receiver frequency control or bfo. I believe that the CW operator will find this filter a useful adjunct to his receiving equipment.

. . .W6AGX

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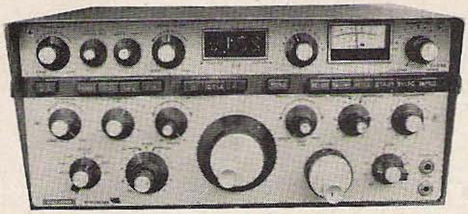

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- optional: CW-300 and 400 HZ. FSK-1200 HZ.
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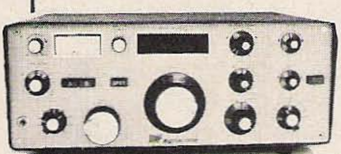

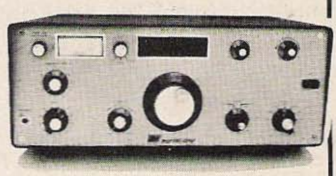

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The problems encountered in the design of a variable oscillator for use in amateur transmitter frequency control are manifold. The circuit must be stable electrically and the mechanical design must be such that the oscillator frequency-determining components are mounted in a rigid fashion. The design to be presented satisfies both requirements and utilizes a rather simple but effective mechanical layout.

In addition to electrical and mechanical considerations, thermal transients are responsible for much of the short term frequency variation encountered in normal operation. The use of transistors and a well mounted toroidal inductor in the tuned circuit does much to eliminate these short term frequency changes.

Circuit Description

The oscillator is the familiar Clapp circuit so often used in amateur vfo applications. It is different from most in that the oscillator is amplitude limited resulting in a low and constant level of oscillation. Q2 is an emitter follower and isolates the oscillator stage from Q3 and the output amplifiers. Q3 is a dc amplifier that supplies bias to the oscillator transistor; an increase in the level of oscillation drives Q3 further into conduction which in turn lowers the base bias on Q1 stabilizing the level of oscillation at a constant value. This results in true class A operation for Q1, a condition which is seldom met in a fixed bias oscillator. It will be noted that the output of the oscillator stage is further isolated from the rest of the circuitry by coupling off the collector of Q1 rather than from the tuned circuit as is usually done. This results in extremely good isolation between the frequency determining elements and the rest of the vfo.

Q4 and Q5 are straightforward amplifiers to raise the output of the oscillator to a usable level. With a nine volt battery the output at the collector of Q5 was more than adequate to drive my home built vacuum tube transmitter which contains an untuned buffer amplifier between the vfo and frequency multiplier chain.

The oscillator coil, L1, is wound on a 1/2" toroid core and the rest of the tuned circuit consists of a variable tuning capacitor shunted by a silver mica padder and two silver mica capacitors in the feedback loop.

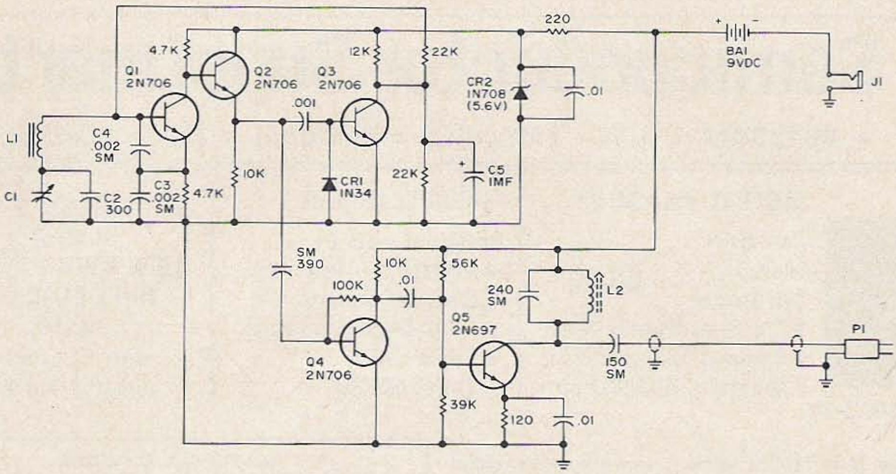

Fig. 1. Schematic diagram of the transistorized vfo.

Schematic Diagram Notes

L1 – toroid coil 1/2" od 'E" material core. Amidon associated core T-50-2. Winding 45 turns number 28 enamel wire spaced over entire core.

C1 – 100 pF maximum variable capacitor. Johnson type S 148-6 or equivalent. Remove plates as required to provide desired bandspread.

C2 – Silver mica – approximately 300 pF. Adjust exact value to set lower tuning range to 3.5 MHz.

C3, C4 – Silver mica 2000 pF.

C5 – Miniature electrolytic 1 μF at 10 VDDW.

L2 – 40 turns number 28 enamel wire on 3/8 diameter slug tuned form.

CR2 Zener diode, 1N708 – 5.6 volts. (Motorola HEP-103 useable)

BA1 9 volt transistor battery

J1 Miniature jack

P1 Two prong plug with standard .486 pin spacing for crystal sockets or other to match companion transmitter.

Q1, Q2, Q3, Q4 2N706

Q5 2N697

These were .002 μF in the unit built, but their value could probably be increased to result in even more decoupling of the tuned circuit from the oscillator transistor.

Coupling off the collector of Q5 requires that the load for the vfo be a high impedance such as the grid of a vacuum tube amplifier or frequency multiplier. For low impedance output a link wound over the B+ end of the L2 should do the job if it is necessary to drive a coax line.

The supply voltage for the first three stages is regulated by a zener diode. With a battery power supply in fixed station service this is probably not absolutely necessary, but the zener does provide a convenient means of supplying the first stages with a constant supply.

Mechanical Design

The mechanical layout of a vfo is extremely important if variations in frequency due to shock and thermal changes are to be avoided. Many methods have been used and some have gone to rather elaborate lengths to achieve mechanical stability. With transistors and a printed circuit board for the layout the mechanical design is simplified. The circuit board ties down the wiring and all the components except the coil and tuning capacitor. It then remains to devise suitable mounting arrangements for these two.

The toroidal coil is handled by connecting it to the circuit board and then encapsulating it and its leads to the board with epoxy cement. This provides a very rigid mount mechanically and is quite simple to use. In addition to the coil, the three silver mica capacitors in the tuned circuit are spoxied to the circuit board to enhance their machanical rigidty. This expedient is probably not absolutely necessary, but the excess epoxy from the coil fastening operation can be well used here.

The mechanical mount for the tuning capacitor is often the shortcoming of an otherwise good vfo. Since the epoxy used to hold down the coil and capacitors on the

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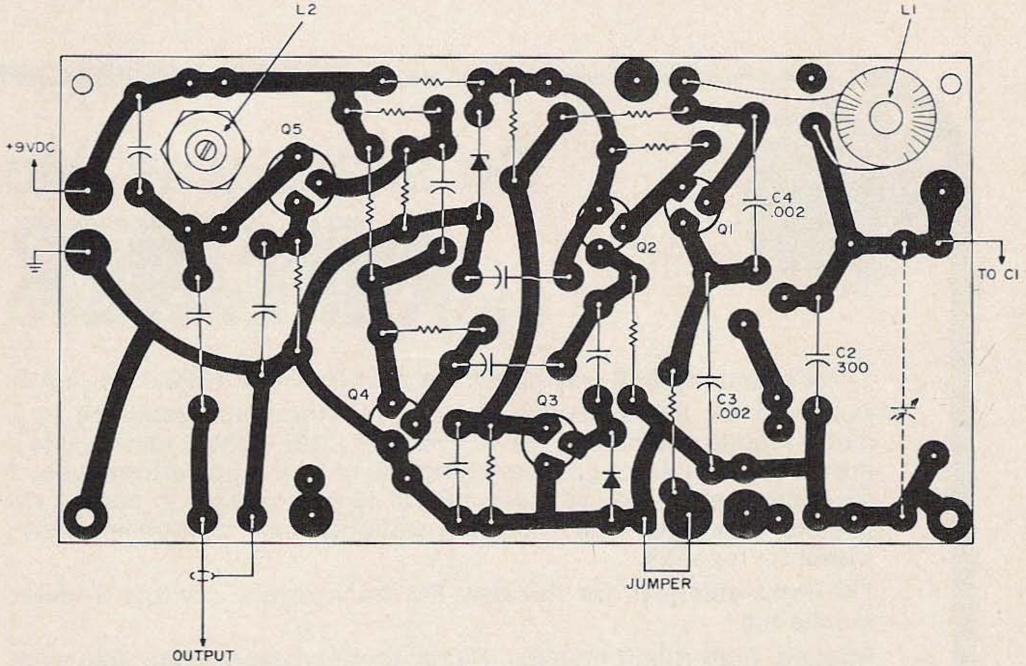

Fig. 2. Circuit board and parts placement for the vfo. Major values are noted to serve as a key.

circuit board proved to be so sturdy, I reasoned that it might also be used to mount the variable capacitor. The shaft of the capacitor is mounted to the vernier dial coupling and its ceramic body fastened to the chassis by a liberal application of epoxy through a hole approximately 1/2" in diameter immediately above the capacitor. A sketch of the mounting arrangement is shown. A mounting bracket would probably work, but the direct chassis mounting eliminates the mechanical variations which might be present in a secondary connecting member.

I obtained the epoxy used throughout at the local hardward store; it's sold under the trade name "E-POX-E STEEL."[1] Preliminary tests on a sample showed that it did not cure very well when allowed to dry overnight as suggested in the directions, but a test cure in the kitchen oven at 200F proved to be quite good, and the drying time at the elevated temperature was under a half hour. Some capacitance is added to the toroid coil by the encapsulant so final padding adjustment on the tuning must be done after the coil is epoxied in place.

[1] Woodhill Chemical Corporation, Cleveland, Ohio 44128.

I suggest that the printed circuit board layout be used as shown. The wiring can get quite complicated without a circuit board, and point to point wiring can be unstable for vfo use. I made no attempt at miniaturization in laying out the board and it could have been smaller. The size was chosen to be compatible with the remainder of the station gear and the dial on the vfo itself.

Once the board has been assembled, the remainder of the wiring is minimal with the only connections being to the variable capacitor, the battery and the output cable. It will be noted that some unused holes are shown on the board. These are a result of some ideas which did not work out in the final circuit design. One of these necessitates jumpering the emitter resistor of Q1 to ground (see reference to oscillator keying below).

The assembled circuit board is mounted on top of a standard minibox which is 3 X 5¼ X 2" high. A hole must be drilled in one corner of the top of the box to clear the output slug tuned coil. Mounting the board on top leaves the inside open for the tuning

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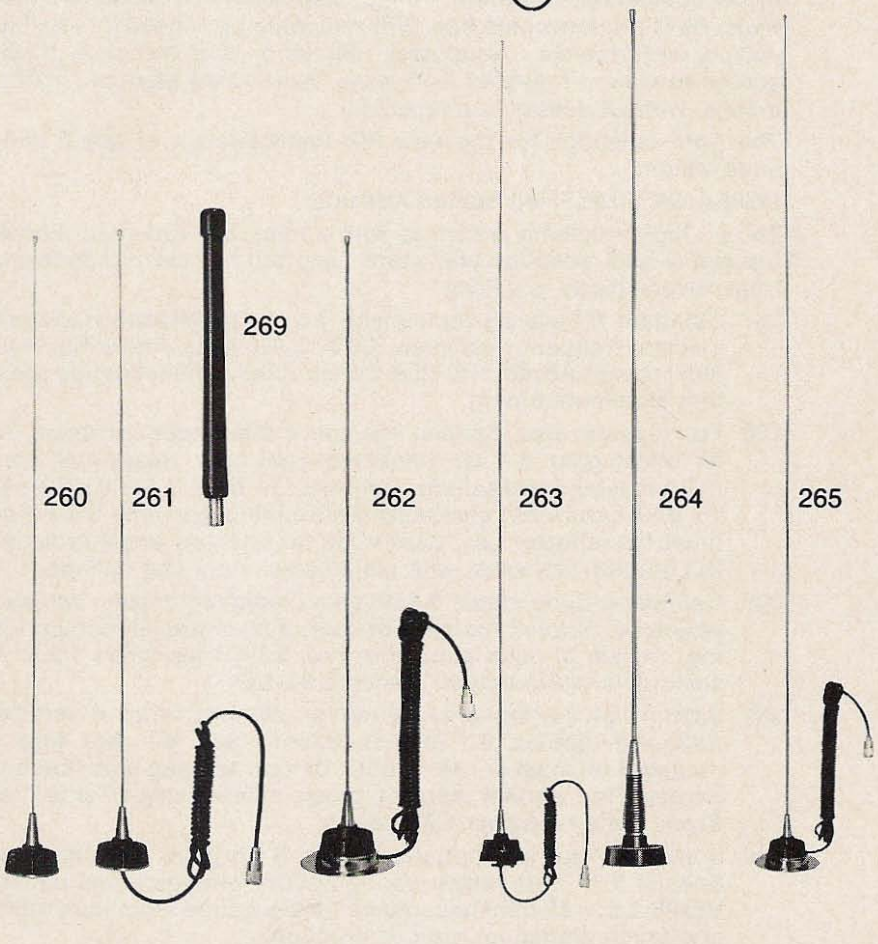

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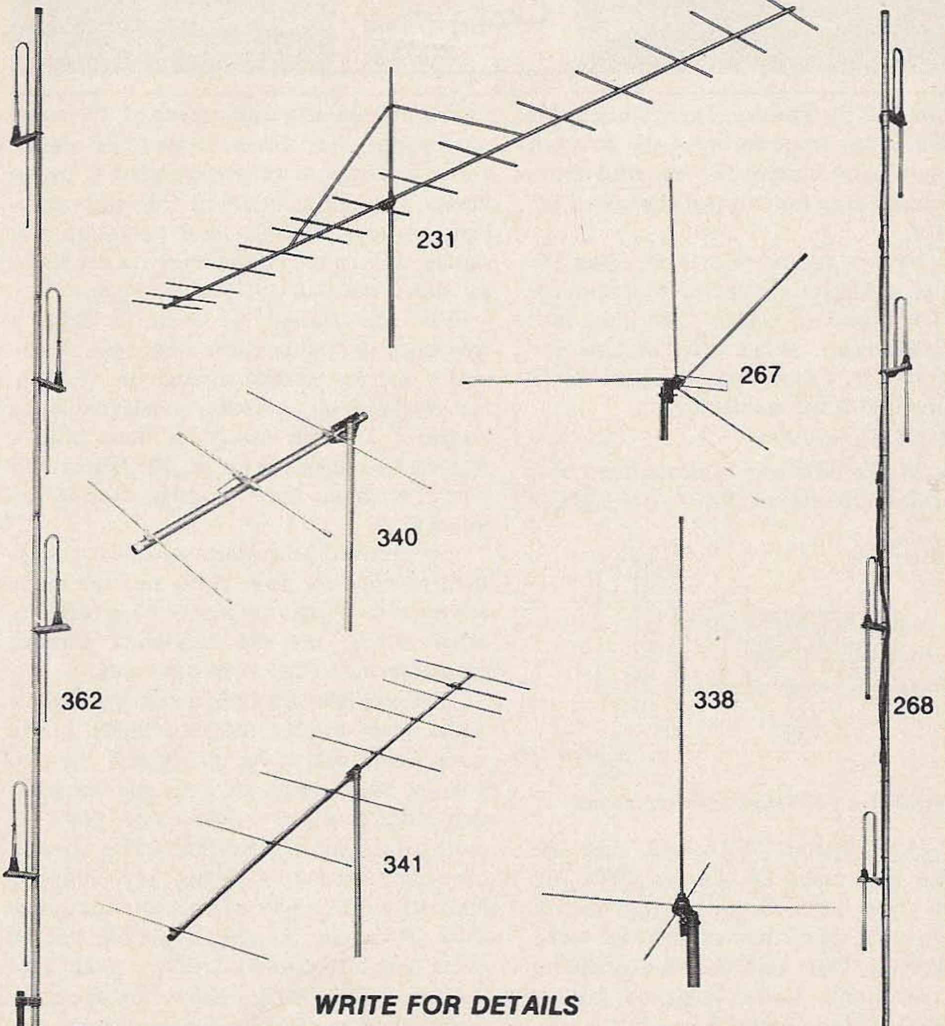

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capacitor and the battery. The vernier dial is mounted to the front apron of the box and the output cable exits at the rear with a jack on the rear apron for external control of the oscillator.

The battery mount was made using the top of an old battery soldered to a terminal strip. The nine volt battery then plugs into this arrangement. While this mounts the battery simply, a more rugged mount would be more suitable for mobile use.

Results and Conclusions

One of the problems I encountered with the vacuum tube circuit this vfo has replaced

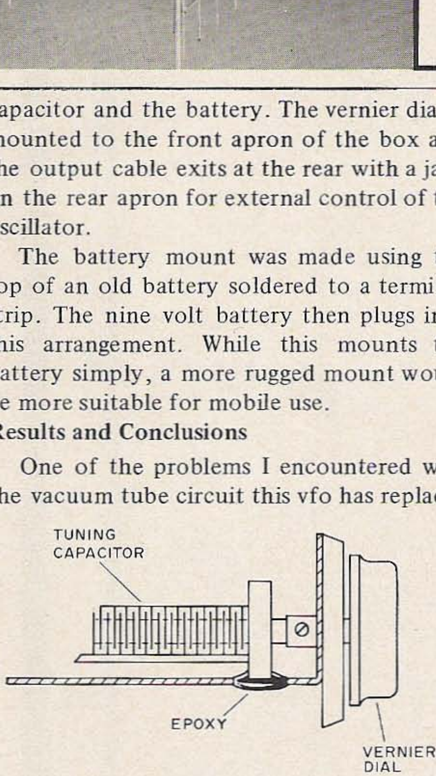

Fig. 3. Details of rigid capacitor mount.

was a slow thermal drift each time the oscillator was turned on during a QSO. This sort of short term frequency variation is common with tube circuitry and high levels of oscillation. Drift with the semiconductor vfo is practically non-existent on both a short and long term basis.

In normal operation the vfo is allowed to run continuously and a subsequent stage in the transmitter is keyed. This does not allow break-in operation although the vfo has been keyed and only a very slight chirp can be detected. The chirp is dependent on the load presented by different settings of exciter tuning and suitable adjustment of the multiplier stages does eliminate the chirp almost entirely. This sort of arrangement is by no means a sound solution to the chirp problem, however, and for best operation you should run the vfo continuously or provide a suitable method of differential keying.

This vfo should be used to drive a frequency multiplier in the companion transmitter and not straight through on 3.5 MHz. For eighty meter operation, a half frequency design of 1.8 MHz should be built. Since I wanted operation only on 40 meters and above I chose the 3.5 MHz output frequency.

The above precautions are almost standard practice for ham vfo's, and the many attempts to bypass them have been futile. In other words, the old handbook warning against trying to key a vfo still holds.

This oscillator has been a very worthwhile replacement for the old tube model in the station transmitter. As mentioned, the output was adequate to drive my rig, but some transmitters in the Novice class might require a little more drive. The output level is dependent on supply voltage; increasing the battery to 12 or 18V will provide additional drive. However, the supply should not be much over 20V unless a 2N697 is used at Q4 in place of the 2N706 shown on the schematic diagram. Different bias resistors for Q5 as well as a larger dropping resistor for the zener diode would be required if the supply is increased. An untuned vacuum tube buffer amplifier might be more effective to couple into an existing transmitter if the output of Q5 is not enough alone. . . .W9ZTK

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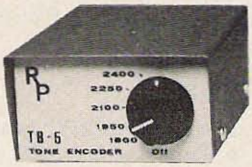

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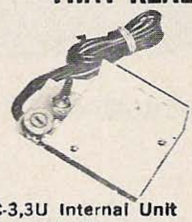

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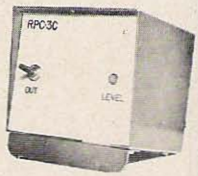

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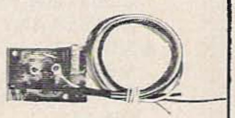

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RULES FOR PARTICIPATION ON PAGE 128

RIG OF THE MONTH

RIG OF THE MONTH RULES

1. All entries in the contest must be sent to *73 Magazine, Peterborough NH 03458* on official entry blanks, unofficial entry blanks, imitation entry blanks, or reasonable facsimilies thereof. A sample entry blank, which is not official, nor unofficial, but is closely related to an unreasonable facsimile is illustrated below. The very best source of entry blanks is your friendly neighborhood RIG OF THE MONTH participating radio distributor. This is the only source of really FB true-blue entry blanks for this contest.

2. The drawing for the RIG OF THE MONTH will be held each 15th of the month and all entries received after that date will go into the pot for the next drawing. If you really are hot for a Memory-Matic 8000 you would be shrewd if you would make sure that your entry blank is received at 73 Magazine between December 15th and January 15th.

3. To be valid, an entry blank should be signed or initialed by your local friendly (or, in some cases, unfriendly) radio distributor – the place where you spend your money for ham gear. Participating dealers will have a good supply of blanks – non-participating dealers will, after your bugging them, see the light and start to participate. The more participating dealers there are the better the contest will be, obviously.

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Enclose self-addressed stamped envelope with request for additional entry blanks from 73.

MORE LETTERS

It was very gratifying to see my latest article on SSTV equipment in print in the September issue of 73 Magazine. I am already receiving many compliments on it and that 73 is publishing timely articles on SSTV. From the correspondence and conversations with chaps who are building this camera I have been getting several questions in regard to the Plumbicon deflection coils.

In the diagram the horizontal sync pulse drawn near Q4 is 5 *milli*seconds, not 5 microseconds. The vertical sync pulse drawn near the diode of Q6 is 45 *milli*seconds, not 45 microseconds. In the upper right hand paragraph above the schematic Fig. 4, the third sentence should read as follows: *Each horizontal coil has approximately 620 turns of #36 wire.* The fourth sentence should read: *Each vertical coil has approximately 800 turns of #36 wire.*

I would also like to add that the .050 inch thick deflection coil form is used for the vertical coils during winding. A form of the same dimensions but only .030 inches thick is used as the window opening form for the horizontal coils. This second window form was omitted from the article.

That is about all the comments from K7YZZ for now, Wayne. See you on 20 SSTV sometime soon, I hope.

Louis I. Hutton K7YZZ
Bellevue WA

We have some very, very dishonest fellow amateurs on our airwaves. I happened to be working a very chirpy Novice lately and I reported to him what I was hearing. We spent about 30 minutes discussing his chirp problem and the possible causes of it. He reported that I was the first one to tell him that he had chirp and thanked me for telling him. I heard the same guy a few nights later, and his beautiful ac chirp was still there. I called him and he did everything but call me a liar, saying he had asked almost everyone whom he had worked since our first QSO and was told his signal was very clean, with no trace of chirp. Now the guys that he had worked were either lying to him or very ignorant, not to know a very noticeable chirp when they hear one.

I just cannot believe these guys would lie to him. If my signal sounds lousy, I want you to tell me and I'm sure going to tell you if yours sounds lousy, hopefully before the FCC does, because that's the worst way to find out. So come on, guys, let's help each other out and most of all let's help out the beginners, because they need the help the most, especially now that they will be using VFO's at least 50% of which will probably be ancient drifters that are cheap and easy to come by. Spend a little time working the Novice bands and let's get them started out on the right foot.

Steve Morgan WA8QNR

Nothing special (i.e., no axe to grind) but thought I would mention that I feel the Sept. 72 73 just received is one of the best balanced (opinion, articles, scope, etc.) to date – and real pro. appearance.

Will Rassbach WA7GRN
Seattle WA

I just thought I would include a little note to let you know that my selection of your magazine was not just chance. I have seen and read all the leading ham publications. I've even been given a free 6 month subscription to C.Q. As far as I am concerned they just don't match up to yours, for good, overall total information on the "state of the art." I enjoy the columns on most all subjects, but I would like to see more in the way of operating hints for Novices. Like tips on DXing, antenna systems, and just overall coverage for the newcomer.

William Armstrong WN8NKT/4
Shaw AFB SC

With reference to the October issue, I read with interest W2GOM's explanation of how a Clapp oscillator works. It is amusing to note that the model he develops couldn't possibly oscillate without a 180 degree phase shift, a point he was trying to refute! Although a crystal, by itself, can't develop a 180 degree shift, in combination with the other capacitors in the circuit it can and does.

That tutorial article should be interesting.

Gilbert L. Boelke W3EUP
West Seneca NY

I'm with you on the Amateur Extra Class license. While in high school in 1925 I got a 1st Class Telegraph, followed by a 1st Class Fone. Worked at them both, even after I went back to school for an engineering degree several years later. Present call acquired in 1932, Class A, then Advanced. Have worked over 45 years in amateur radio, AM, SSB, CW. Kept current in all. Why should you, I, or any serious, knowledgeable amateur, be penalized? I believe the FCC action, sponsored by ARRL, is discriminatory. While I would have no trouble with the exam, including code, I refuse to take it.

J. Alan O'Neil W6GIX
San Francisco CA

I am a collector . . . I collect magazines devoted to amateur radio. Mine is not a large or particularly exotic collection, but I think you might be interested in a portion of its contents. The most expensive single copy I have is an Aug. 72 issue of "rpt." I paid $6 for it. I didn't intend to pay that much for the issue, as I was led to believe there would be 23 subsequent issues included in the price.

I also have a similar issue of "FM" which also seemed to cost a larger amount than I intended to pay.

As of this date, I am not a regular subscriber to 73. I found that several years ago I received several free issues of 73 after paying so much for my "FM" issue; and, it is said that history has a way of "rpt"ing itself.

I doubt very much that I will continue to collect limited editions . . . they are getting too expensive.

Dave WB9DNI/WA7GSG
Aurora IL

P.S. Have you heard about the new publication devoted to Citizens Band Repeaters? I believe it will be published in Michigan, by a former amateur.

No, no free issues of 73 this time. And, if you'd read 73 or the Repeater Bulletin you would have been warned that special interest magazines are a big gamble as far as subscriptions go. Many thousands of amateurs have been taken in the past short-lived publications. If you watch 73 carefully, you will find that we do not recommend publications that look like they are not going to be able to make it.

DXer Magazine will make it. We run ads for Gus and his nice little publication because we know that he is going to be there and that readers who depend on 73 will not be disappointed. World Radio looks good – and is fun to read. I don't know how Armand gets all those interesting DX stories, but he does. . . .wayne.

The FM bug is following quite closely. I recently acquired an RCA Carfone CMV-4F xmtr-rcvr single frequency, presently on 154 MC and modified for 12V. I plan to remove the dynamotor and vibrator. I have a power supply which is adequate for base station use. I also have a manual. I would appreciate any info concerning conversion to 2 meters.

Although I am only a Novice I hope someone can give me a little help. I am working for my General license now.

Also I was considering using the Carfone on 2 meter CW by grid block keying a couple of xmtr stages. Comments on this by anyone would be appreciated.

Richard L. Gagnon WN3RUB
903 Cedar St.
Pocomoke City MD 21851

Continued on page 146 . . .

YOUR CALL

Please check your address label and make sure that it is correct. In cases where no call letters has been furnished we have had to make one up. If you find that your label has an EE3*&* on it that means we don't know your call and would appreciate having it.

ANSWER TO CROSSWORD PUZZLE

on page 99 of this issue

1 T	R	I	G	2 G	E	R	■	3 N	U	4 C	L	E	U	5 S
R	■	■	■	U	■	■	6 M	■	■	U	■	■	■	C
I	■	7 B	A	N	8 D	■	U	■	9 A	T	O	10 M	■	A
11 P	E	A	■	■	12 U	L	T	O	R	■	■	13 I	O	N
L	■	14 R	15 A	T	E	■	E	■	16 C	E	17 L	L	■	N
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18 T	19 H	E	O	R	E	20 M	■	21 B	L	I	S	T	22 E	R
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23 D	B	M	E	24 T	E	R	■	25 T	E	26 T	R	O	D	27 E
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33 M	H	O	■	■	34 A	U	D	I	O	■	■	35 A	R	M
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40 D	I	A	G	R	A	M	■	41 T	R	A	N	S	I	T

SOLUTION TO CRYPTOGRAM

on page 117 of the November issue, a quote from W2NSD's editorial in that issue:

> The heavy hand of an insensitive government has just dealt a cruel blow to the most exciting and fun aspect of amateur radio in many, many years.
>
> Wayne Green

NEW NOVICE REGS

In the Matter of Amendment of Part 97 of the Commission's Rules to provide for expansion of the telephony segments of the high frequency amateur bands.

Adopted: September 27, 1972;
Released: October 2, 1972
By the Commission: Commissioner Johnson concurring in the result.

1. The Commission adopted a Notice of Proposed Rule Making in the above entitled matter on February 24, 1971, which was published in the Federal Register on March 6, 1971 (36 FR 4511). Interested persons were invited to file comments on or before June 1, 1971, and reply comments on or before June 18, 1971, respectively. The Notice proposed to expand the General-Conditional Class sub-band operator privileges in four amateur radio high frequency bands, to provide additional Amateur Extra and Advanced Class sub-bands in those high frequency bands where they do not exist, and to make other adjustments to the allocations of high frequency bands to facilitate the accomplishment of these proposals and additionally to expand the telephony sub-allocations in the five amateur radio high frequency bands from 3.5 to 29.7 MHz.

2. Formal comments were received from persons and amateur radio organizations within the United States and foreign countries. Many comments simply urge the adoption, or the rejection, of the proposals. Others endorse certain proposals and request that others not be adopted. Many propose alternate frequency band allocation plans. Since the comments received were so numerous, it is not practicable to discuss each herein. However, every comment filed has been given careful consideration.

3. Reactions to the proposals expressed in the comments, were highly mixed. Some, identifying themselves as telegraphy enthusiastis, opposed the proposal, usually citing the resulting reduction in the effective use of the telegraphy bands as the reason. Others, identifying themselves as telephony enthusiasts, supported the proposal, usually giving the crowded telephony bands as the reason. Proponents of both sides of the issue agreed that telephony expansion would be at the expense of telegraphy operation, with the telegraphers aruging that their preferred mode of radiocommunication would be impaired and the telephony advocates aruging that telegraphy is outmoded and unnecessary.

4. All of the HF bands from 3–30 MHz have predictable propagation characteristics depending on the period of the sunspot cycle, season, time of day, and the order of the frequency band itself. At times, some bands are primarily useful for short-distance radiocommunication, even though under those circumstances signals cross national boundaries. At other times, even the two main lower frequency amateur bands (3.5, 7.0 MHz) become international in character through long distance ionospheric propagation of signals. During the low period of the sunspot cycle, congestion in the lower frequency bands becomes more critical as the maximum usable frequency (MUF) decreases. Bands above 14 MHz, are generally considered international in nature by reason of long distance propagation of signals in these bands for a large percentage of the time.

5. A considerable number of comments were received from organizations located in other countries, and a delegation from one country paid an official visit to the Commission to discuss the ramifications of the Notice. The comments and information of other countries are worthwhile, and provide an added insight to what is normally considered a domestic matter. It is recognized that there are no formal internationally agreeed sub-allocation plans which reserve certain portions of any of these bands for one type of emission or the other. There are, however, "gentlemen's agreements" among amateurs in various parts of the world (Region 1 in particular) which have worked out well in practice in maintaining order and providing efficient utilization of the various amateur bands. Only a few countries, having large numbers of amateurs, provide sub-allocations in domestic regulations. The International Radio Regulations, to which the United States is a signatory administration, provides only band allocations to the Amateur Radio Service for the three Regions. In reaching a judgment on a matter with implications which could result in a lessening of international good will among amateurs, as well as a reduction of efficiency of utilization of the spectrum, we would be doing amateurs generally a disservice were we to disregard physical phenomena. Certainly we would be short-sighted if we totally disregarded opinions such as that of the International Amateur Radio Union, Region 1 Division, which pointed out,

> "The downward shift to 14,150 kHz will cause severe interference to operation in Region 1. With the high power and large number of US stations it will not be possible for foreign stations to operate above 14,150 kHz when propagation conditions enable USA stations to be heard. The consequent move downward in frequency by Region 1 Telephony stations will undoubtedly cause breaches of the voluntary IARU Region 1 band plans which have been in satisfactory operation for a number of years."

A similar opinion was expressed by the Radio Society of Great Britain and others.

6. Therefore, we conclude that a significant expansion of the telephony segments within the high frequency amateur bands would be at the expense of the telegraphy segments. Furthermore, we are of the opinion that the traditional amateur telegraphy radiocommunication mode must not be compromised. The rationale for this conclusion is well summarized in a quotation from a letter to the Chairman of the Commission from the Director of the Office of Telecommunications Policy:

> "While the use of CW radio telegraph communications has been replaced in most radiocommunications services with more sophisticated techniques over the years, this is not considered sufficient reason to justify the curtailment of such operations among U.S. amateurs. Knowledgeable communicators agree that when other types of high frequency radiocommunications fail CW transmissions are likely to get through. Thus, even though other techniques might be relied on first, it still would be wise to retain a pool of U.S. citizens skilled in CW operations as a resource in reserve. Amateur operators, with their past superb record of serving the public interest when needed, are considered the best means for preserving this skill."

7. We find that amateurs have been resourceful in effectively operating in the overcrowded high frequency bands. The vast majority have adopted spectrum conservation receiving and transmitting techniques. The nearly

universal incorporation of suppressed or reduced carrier types of SSB emission and other frequency conserving capabilites, such as highly selective receivers and directional antennas, has permitted more operators to conduct reliable radiocommunication over greater distances. Nevertheless, the question of how the existing high frequency amateur bands can accommodate even a relatively modest increase in the number of stations is now clearly in view. As evidenced by the petitions and comments, even the present number of amateurs authorized for telephony emissions on the high frequency bands at times far exceeds the capacity of the allocated A3 and F3 emission segments. We see no technological developments on the horizon to enable more simultaneous telephony amateur radiocommunication within the present sub-allocations, although this is in itself a challenge to amateurs. Any proposed amendment to Article 5 (spectrum allocation) of the International Radio Regulations to allocate additional portions of the high frequency spectrum to the Amateur Radio Service, are at best some years in the future and only speculative. The only practical solution appears to be one of limiting access to the more crowded bands only to higher class licensees. Until such time as this becomes necessary, amateurs are encouraged to utilize other emissions and frequency bands during times of severe overcrowding of the telephony segments. Furthermore, we strongly urge that the VHF and UHF bands be utilized for all local radiocommunication; that the minimum power rules be strictly observed to minimize interference; that full carrier double sideband emission not be used in the lower four HF bands except in an emergency; and that all amateurs exercise good judgment and restraint when selecting a frequency and emission for their operation.

8. Accordingly, we conclude that the high frequency spectrum available to the Amateur Radio Service does not allow treatment which would significantly alleviate the problem of overcrowding in telephony radiocommunication through expansion of sub-band allocations. We are of the opinion that a small increase for telephony operation in the 3.5 and 7.0 MHz bands can be accommodated without causing a serious deterioration in telegraphy operation. We believe any telephony expansion of the 14.0 MHz band would result in a serious degradation to non-voice radiocommunication, and no expansion is adopted. Numerous comments from amateurs outside the United States express opposition to any telephony expansion by the United States, particularly in the 14.0 MHz band. Should U.S. licensees be permitted to operate in the unofficial, but widely observed, non-US telephony sub-band between 14.1 and 14.2 MHz, they predict a movement by non-US telephony stations into the 14.0 to 14.1 MHz segment, causing a deterioration in telegraphy radiocommunication and a general breakdown in inter-Region cooperation. This must not take place. We also find the 21.0 and 28.0 MHz frequency bands not to be sufficiently crowded to warrant an expansion of the telephony segments.

9. Comments from Canadian amateurs express concern for the resulting impact of expansion of the telephony segments available to US amateur below 3.8 MHz. In addition to the 2.8 to 4.0 MHz telephony sub-band authorized for both US and Canadian amateurs, they are also permitted 3725 to 3800 kHz. This concern is expressed in the comments from the Director of the Canadian Division of the American Radio Relay League. Although we do not agree entirely with the implied necessity for Canadian amateurs to operate in different subbands, their comments are taken into account.

> "Canadian amateur operators have always made extensive use of the 3.5 MHz band. The size of the country and the low density of population have precluded the use of other frequencies, such as 144 MHz, since they did not provide adequate coverage. It is perhaps the most widely used amateur band in Canada for internal communication, in spite of the fact that 25 kHz, (3725–3750 kHz) are shared with American Novice operators. While Canadian voice operation could and undoubtedly would be moved to some lower portion of the band such as 3650–3700 kHz, in order to avoid Novice interference, there would be less space available for other modes as a result . . ."

10. The Notice proposed 3750 to 3775 kHz for Amateur Extra Class and 3775 to 3875 kHz for Amateur Extra and Advanced Classes, an expansion of 50 kHz for telephony privileges. The American Radio Relay League, and others, recommend an expansion of only 25 kHz, limited to Amateur Extra Class operators only. This would authorize some 12 thousand higher class licensees to operate within the 3775–3800 kHz sub-band. In recognition of the Canadian operators' comments, we are of the opinion that the American Radio Relay League recommendation is a workable compromise, and we are therefore adopting it.

11. We conclude that the 7.0 MHz telephony sub-band can be expanded as proposed to the extent of permitting A3 operation between 7150 and 7200 kHz. While the comments heavily favor the adoption of this proposal, objections were also made, although to a lesser extent, by Canadian amateurs, because telephony operation is authorized in Canada by the Department of Communication for the same segment. Since the expanded telephony segment of 7150 to 7200 kHz have been heavily utilized for Novice Class A1 operation, and since only a limited number of higher class licensees will be permitted to operate within the new telephony segment, the expansion is acceptable. As a result of this action, the Novice band is relocated to 7100 to 7150 kHz.

12. The proposal to provide a telephony sub-band below 7100 kHz for contacts with stations in Region 1 and 3, is not being adopted. Numerous comments pointed out that the proposal, if adopted, would make inter-regional radiocommunication with foreign stations occupying these frequencies more difficult since Region 2 stations would overload the segment. The proposal to permit telephony operation between 7075 and 7100 kHz for American stations located outside of Region 2 is adopted, however.

13. In the interest of encouraging beginning amateur operators to gain experience in telegraphy radiocommunications, a new Novice privilege segment is adopted for 28.100 to 28.200 kHz. Observations indicate that the segments 21.200 to 21.250 MHz and 145–147 MHz are lightly occupied for Novice operation and are therefore deleted. In light of these changes, and because of the relocation of the Novice 7.0 MHz sub-band, the requirement that the transmitter be crystal controlled is removed. We are of the opinion that the technical state of the art for calibrated variable frequency generating devices in the Amateur Service permits this change and re-crystalling of the many thousands of Novice Class transmitters is unwarranted. Additionally, this will enhance the operating effectiveness of Novice operation through reduction of interference and increased operating flexibility. Since the distinctive "N" designator in a Novice Class call sign prefix is easily recognized in the Service, Novice operators are cautioned to observe strictly the authorized frequency sub-allocations for Novice Class licensees. While amending paragraph 97.7(d), we revise the wording for the 75 watt power limitation to generalize its application to other am-

plifying devices in addition to vacuum tubes.

14. As pointed out by a number of respondents, the 28 MHz frequency band does not offer itself to providing meaningful exclusive operating segments for upgrading incentives since the frequency availability problem is not of comparable magnitude as that encountered on the other high frequency bands. For this reason, the proposed establishment of exclusive operating frequency privileges for Amateur Extra Class and Advanced Class licensees is not adopted. With thousands of amateur radio operators upgrading to Amateur Extra Class and tens-of-thousands upgrading to Advanced Class, while the number of General and Conditional Class licensees is decreasing, adjustments to the sub-band allocations must be made in order to retain the incentive principle. Additional adjustments will be made periodically in the future as the upgrading movement continues. Allocations follow a pattern of apportionment of the telephony segments into three sub-bands in the case of 3.5 MHz and 21.0 MHz; one restricted to Amateur Extra exclusively; one restricted to Amateur Extra and Advanced; and one available to General/Conditional and Extra/Advanced. These-sub-band apportionments are determined by considering the number of individual licensees in each group having privileges to each subband weighted in favor of the higher classes. Proposed telephony sub-bands restricted to the Amateur Extra Class in the 7.0 MHz and 14.0 MHz bands are not adopted because the application of the apportionment pattern to these smaller telephony segments would result in Amateur Extra Class sub-bands so small as to be practically useless.

15. Comments received in response to the proposed reduction in the Amateur Extra-restricted telegraphy sub-band were almost entirely opposed. Reasons cited included observations to the effect that the proposed 10 kHz sub-band was too small to be meaningful, and that the restricted telegraphy sub-band was their primary incentive for upgrading. We find these comments persuasive and in agreement with our own observations. The proposal is not adopted herein, and the sub-band remains at 25 kHz.

16. We find the attached amendments to the rules are necessary and desirable and in the public interest. Authority for adoption of these amendments is contained in Sections 4(i) and 303 of the Communications Act of 1934 as amended.

17. Accordingly, IT IS ORDERED, that effective November 22, 1972, Part 97 of the Commission's Rules is AMENDED as set forth in the attached Appendix.

18. IT IS FURTHER ORDERED, that in addition to the fifteen petitions set forth in the heading to the proceeding, the pending petition of Mr. Frederick J. Hagen, filed February 1, 1971, RM-1748; and the pending petition of Mr. George W. Flyer, filed November 1, 1971, RM-1873; and the pending petition of Mr. William G. Welsh, filed November 8, 1971, RM-1880, have been fully considered and, to the extent that they are at variance with the rule changes adopted, they are DENIED.

19. IT IS FURTHER ORDERED, that this proceeding IS TERMINATED.

Federal Communications Commission
Ben F. Waple
Secretary

Attachment

NOTE: Rule changes herein will be covered by T.S.VI(72)-1.

APPENDIX

Part 97 of the Commission's Rules is amended as follows:

1. Section 97.7(a) and table, subparagraphs (d)(1) and (d)(2) are revised to read as follows:

§97.7 *Privileges of operator license*

(a) *Amateur Extra Class and Advanced Class.* All authorized amateur privileges including exclusive frequency operating authority in accordance with the following table:

FREQUENCIES	CLASS OF LICENSE AUTHORIZED
3500–3525 kHz	Amateur Extra Only
3775–3800 kHz	
7000–7025 kHz	
14000–14025 kHz	
21000–21025 kHz	
21250–21270 kHz	
3800–3890 kHz	Amateur Extra and Advanced
7150–7225 kHz	
14200–14275 kHz	
21270–21350 kHz	
50–50.1 MHz	

(d) *Novice class.* Those amateur privileges designated and limited as follows:

(1) The power input to the transmitter final amplifying stage supplying radio frequency energy to the antenna shall not exceed 75 watts, exclusive of power for heating the cathode of a vacuum tube(s).

(2) Radio telegraphy is authorized in the frequency bands 3700–3750 kHz, 7100–7150 kHz (7050–7075 kHz when the terrestrial location of the station is not within Region 2), 21,100–21,200 kHz, and 28,100–28,200 kHz, using only type A1 emission.

2. In Section 97.61, the table in paragraph (a) is amended and (b)(10) is added to read as follows:

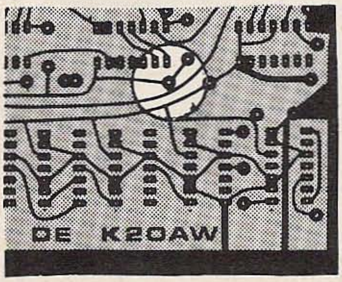
§97.61. *Authorized frequencies and emissions*

(a)

Frequency band	Emissions	Limitations(see paragraph (b))
kHz		
1800–2000	A1,A3	1,2
3500–4000	A1	
3500–3775	F1	
3775–3890	A5,F5	
3775–4000	A3,F3	4
7000–7300	A1	3,4
7000–7150	F1	3,4
7075-7100	A3,F3	10
7150–7225	A5,F5	3,4
7150–7300	A3,F3	3,4
14000–14350	A1	
14000–14200	F1	
14200–14275	A5,F5	
14200–14350	A3,F3	
MHz		
21.000–21.450	A1	
21.000–21.250	F1	
21.250–21.350	A5,F5	
21.250–21.450	A3,F3	
28.000–29.700	A1	
28.000–28.500	F1	
28.500–29.700	A3,F3,A5,F5	

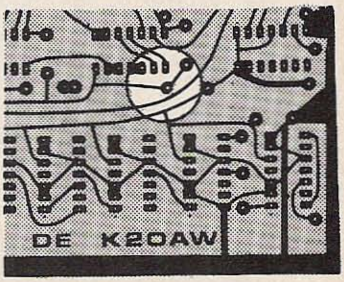
(b)

(10) The use of A3 and F3 in this band is limited to amateur radio stations located outside Region 2.



AUTHOR'S CORRECTION

On page 82 of the November 73, in the article "Frequency Synthesizer III," Fig. 13 contains an error. One solder pad was shown merging with a wire (see detail at left). There should be no connection between them, as at the right.
. . .K2OAW



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 . . .

"SUPER COUNTER" . . . . to 160 MHz, five digit, AC/DC, 4.5 lbs., a professional grade counter by MIIDA, "The H.P. of Japan." $349 with 1 year warrantee. SASE for more info. NHE Communications, Bob Brunkow, (206-747-8421), 15112 S.E. 44th, Bellevue, WA. 98006.

YOUR CALL LETTERS. Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

WANTED: Old Radio Transcription Discs. Any size or speed. Send list and details to Larry Kiner, W7FIZ, 7554 132nd Ave N.E.. Kirkland, Wash. 98033.

MERRY XMAS and HAPPY NEW YEAR from WØCVU. Heard around the world since 1913.

N.Y.C. HAMS NEEDED: Volunteers to operate new modern KW amateur station part time during Tue–Sat 10–4, Sunday 1–5 demonstrating to public. Have time – want to help young people? Here's your thing – Call Bob Reiley, Hall of Science of the City of New York, Box 1032, Flushing, N.Y. 11352. Phone 212-699-9400.

FOR SALE: JOHNSON 6N2 Thunderbolt, excellent – $475.00. Prefer pick up. Want Gonset 903A or 903A MK II. Jim W1VYB (617) 922–3850.

22nd ANNUAL DAYTON HAMVENTION will be held on April 28, 1973 at Wampler's Dayton Hara Arena. Technical sessions, exhibits, hidden transmitter hunt, flea market, and special program for the XYL. For info write Dayton Hamvention, Dept. 7, Box 44, Dayton, Ohio 45401.

HAVE I GOT A DEAL FOR YOU! Unusual values full reconditioned guaranteed equipment. Listed alphabetically by manufacturer. Drake 2B $169, 2NT $109, RV4 $79, TR4 $429, TR6 $395. Galaxy 300 with supply $149, GT550 both supplies $395, RF 550 $49. Gonset Communicator IV (six) $99. Hallicrafters HT 37 $149, SX101A $149. Hammarlund HQ170C $149, HQ170A/VHF $199. Heath SB301 CW Filter $199. Military R 39CA/URR $495. National NCX5 Both supplies $349, NC173 $69. Swan 260 $295. Tempo DC1A $69, Tempo 2000 Linear $339. Lots more. Get complete listing. New Drake, Galaxy, Hallicrafters, HyGain, Kenwood, Newtronics, Regency, Tempo. Stan Burghardt, Box 73, Watertown, S.D. Phone 605-886-3767.

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TECH MANUALS for Govt surplus gear only $6.50 each: R-388/URR, R-389/URR, R-390/URR, R-220/URR, R-274/FRR, CV-591A/URR, ALR-5, URM-25D, TT-63A/FGC. W3IHD, 4905 Roanne Drive, Washington DC 20021.

BRAND-NEW 4 channel Hi-Band G.E. Master Royal-Pro transceiver 35 Watts Solid-State trunk mount low split 132–151 mhz. 4-TX Icom and 6-RX crystals for 2mfm. $800.00. J.A. Smith, P.O. Box 2065, Newburgh N.Y. 12550. Tel 914-562-4300 or 914-562-2285.

STANDARD 826m 2 meter FM 12 channels 6 with xtals plus sub-audible tone encoder and reed and base station power supply. All A-1 condition. $250.00. J.A. Smith, P.O. Box 2065, Newburgh N.Y. Tel. 914-562-4300 or 914-562-2285.

REPEATER IDENTIFIER: 110 V.A.C.; I.D.'s each transmission; with auto-hold; programmed with your call in matrix: $60; W9BLR, 9434 W. Mitchell, West Allis, Wisconsin 53214.

CLEANING HOUSE: Digitec digital voltmeter model 201 $40; TS268 $5; Many other items; J. Buckler, 29 Parkview Drive, Plains PA 18705.

HOOSIER ELECTRONICS – Your ham headquarters in the heart of the Midwest where only the finest amateur equipment is sold. Individual, personal service by experienced and active hams. Factory-authorized dealers for Drake, Regency, Standard, Ten-Tec, Hy-Gain, CushCraft, Ham-M, plus many more. Orders for in-stock merchandise shipped the same day. Write today for our quote and try our personal, friendly Hoosier service. Hoosier Electronics, R.R.25, Box 403, Terre Haute, Indiana 47802.

SAROC Eighth National Convention – the PRESTIGE convention at the Flamingo Hotel Convention Center, Las Vegas, Nevada 89109, January 4 through 7, 1973. SAROC special room rate $15.00 plus tax, per night, single or double occupancy, only 500 rooms, so get your accommodations request in early. Advance Registration $10.00 per person. Registration and eyeball session on Thursday. Seminars, Meetings, Exhibits, open Friday and Saturday. SAROC-SWAN Electronics Social Hour, Friday. Ladies Program, Saturday. SAROC Sixth National FM Conference, Friday and Saturday. SAROC-HY-GAIN/GALAXY Cocktail Party, with Leo WØGFQ, at the Organ, Saturday. SAROC Buffet Hunt Breakfast, with Champagne, Sunday. Advance Registration with Sergio Franchi Flamingo Midnight Show, two drinks $17.00 per person. Advance Registration with Sergio Franchi Flamingo Dinner Show, no drinks, $21.00 per person. SAROC Jet Roundtrip Vacation Package Plan includes airfare, deluxe Flamingo Hotel Room for three nights, SAROC Advance Registration with Flamingo Hotel Dinner Show: via United Airlines departure cities; Baltimore/Washington, $287.00; Boston, $316.00; Chicago, $228.00; Cleveland, $256.00; Columbus, $251.00; Detroit, $249.00; Hartford, $310.00; Milwaukee, $233.00; New York/Newark, $303.00; Philadelphia, $296.00; Pittsburg, $268.00; via Frontier Airlines departure cities: St. Louis, $214.00; Kansas City, $192.00; Denver, $137.00; Omaha, $186.00; Lincoln, $180.00. The price quoted is per person, double occupancy in hotel room. If single occupancy in hotel room is desired add $25.00 additional per person to each amount quoted. All fares and schedules are subject to CAB rules and regulations – send for additional details. Remember to send accommodations request to Flamingo Hotel. Send Advance Registration and information request to, SAROC, P.O. Box 73, Boulder City, Nevada 89005."

ARRL REPORT WANTED. A $5 reward is offered for a readable copy of the 1971 ARRL yearly report. The League claims they sent them all out and have none available for members, even Lifetime members. Please send report to Box 2864, 73 Magazine, Peterborough NH 03458.

KLEINSCHMIDT MANUALS, Mite KSR, teletypewriter supplies, gears, parts, covers. Send SASE for list. Buy, too Teletype manuals wanted. Typetronics, Box 8873, Ft. Lauderdale, Fla. 33310, W4NYF.

SELL: E.E. and other technical books. SASE for list. Roger A. Baim, WB9BDP 2753 W. Coyle, Chicago, Ill. 60645.

Continued on page 146...

James D. Pryor, Jr. WØIPB
626 North Erie
Wichita KS 67214

NON-SQUIRRELY TWO METER PREAMP

During my years of experimenting with 2 and 6 meters, I have built a number of things such as preamps and converters using tubes, nuvistors, transistors and FET's, including the well-known 3N128 Mosfet. I recently tried a circuit using an MPF-107 FET in a common source configuration. The circuit herein described, if followed closely, will produce a non-critical two meter preamp second to none. Nor is there any neutralization required.

This preamp can be built on a home brew printed circuit board with ease. The board need be only about 2½ in. square. All leads should of course be kept as short as possible. The coil forms should be quarter inch with white powdered iron cores. The preamp should draw about 15 mils. Tuneup is accomplished by tuning for maximum first limiter current, or maximum S meter reading. This circuit is basically for 146.94 MHz, but should be adaptable for any two meter frequency.

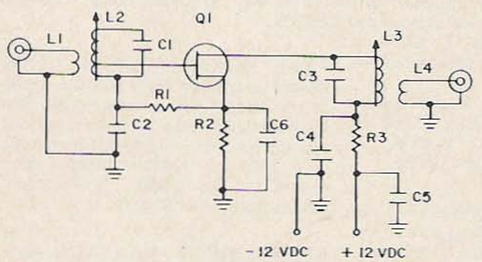


Fig. 1. 2m FM preamp. L1 & L4, 2T No. 22 hookup on cold end of L3; L2 & L3, 3½T No. 16 spaced the dia. L2 & L3 must be wound opposite directions; C-1, 10 pF; C-2, 470 pF; C-3, 10 pF; C-4, 470 pF; C-5, .01; C-6, 470 pF; R-1, 220 ohm ½W; R-2, 370 ohm ½W; R-3, 22 ohm ½W; Q-1, Motorola MPF-107 or HEP 802.

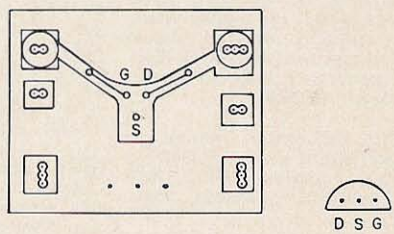


Fig. 2. Printed circuit layout. Drain and source interchangeable.

I have been unsuccessful in all attempts to make the preamps break into oscillation while properly connected. This unit will bring a one microvolt sensitivity to less than four-tenths microvolts for copyable signal.

This article is intended basically for the FMer but should not be overlooked by the SSB and AM boys either. There are several of these preamps in use today here in Wichita by very satisfied base stations and mobiles.

I would like to express my appreciation to Wayne McVay (WAØPLY) for his part in the discovery of this very successful circuit. Apply your 12V dc and hear signals that you never knew were there.

. . .WØIPB

3rd PARTY REGULATIONS

In the matter of inquiry into the extent to which amateur stations should be used on behalf of non-amateur organizations.

Docket No. 19245, RM-1687

Released October 11, 1972

By the Commission: Commissioner Johnson dissenting; Commissioner Reid absent.

1. On April 28, 1971, the Commission issued a Notice of Inquiry in the above-entitled matter. The Notice which was published in the Federal Register on May 8, 1971 (36 F. R. 8611) requested that comments be filed by interested parties by July 1, 1971. Subsequently, the time for filing comments was extended to August 31, 1971. Seventy-five comments were filed by both individuals, amateur organizations, and other organizations which have in the past used the facilities of amateur radio stations.

2. The Notice of Inquiry was the proximate result of §97.39 which prohibits certain organizations from both obtaining an amateur station license or having an amateur operator use his station on behalf of those organizations. One of the effects of this Rule is to prohibit amateur operators from using their stations on behalf of such parties as the Eye Bank, American Red Cross and the March of Dimes as well as commercial businesses.

3. Our Notice requested comments regarding whether any restriction on the use of amateur radio stations by non-amateur organizations is needed. We also requested comments on what those restrictions should be. The Notice further related to the fact that unlimited operation on behalf of organizations (third party communications) could lead to the creation of large numbers of new networks which would create additional unwarranted interference on the amateur bands.

4. The comments received in the Docket suggested many solutions to the problem of which organizations, if any, should be allowed to use amateur radio facilities. The comments covered the full range from no third party communications to any communications that individual amateurs wish to carry. Most of the comments advocated a position between those two positions. Three comments suggested that amateur radio be used on behalf of non-amateur organizations but only when normal communications are unavailable. Many other comments suggested that third party communications be allowed for charitable nonprofit organizations but only during emergencies. A majority of the comments agreed that it is not a sound practice to allow commercial organizations to use amateur radio stations, but there was no consensus as to what other organization should have use of amateur stations.

5. The Commission believes that the best solution lies between the extremes of prohibiting entirely third party communication and permitting unlimited third party operations. To prohibit entirely third party traffic would tend to stifle one of the basic purposes of the Amateur Radio Service which is to provide a voluntary non-commercial radio service. But to allow all third party communications would tend to cause increased congestion in the Amateur bands.A basic principle permeating our rules and the international radio regulations is that amateur radio shall not be used for any pecuniary interest to any party or for commercial communications. The international rules specifically provide that amateur radiocommunications must be of a technical nature or remarks of a personal character for which, by reason of their unimportance, recourse to a public telecommunications service is not justified. There can be no legitimate reason for an amateur station to carry message traffic of a commercial nature. Radiocommunications, the sole purpose of which is to facilitate regular business or commercial activities, do not enhance the intended purpose of the Amateur Service and should not be allowed except for an emergency communication as defined in our rules

6. Several comments were received which suggested that the thrust of the Commission's Notice of Inquiry was to censor the Amateur Radio Service. These comments suggested that any categorization of groups, some of which could use amateur radio facilities and others who could not, would be in violation of §326 of the Communications Act of 1934 which prohibits censorship of radio communications. It has been established, however, that eligibility restrictions and reasonable rules limiting communications to those consistent with the purpose of the radio service involved are within the scope of the Commission's authority. See, *Lafayette Radio Electronics Corp. v. United States,* 345 F2d 278 (2nd Circ. 1965). Moreover, it is not only permissible but an affirmative duty of this Commission to classify radio stations and to regulate the nature of the radiocommunication service that is to be rendered by stations in that class. See §303(a) and (b). Our rules adopted today regarding commercial third party traffic merely regulate generally the nature of the radio communication service which may be rendered by amateur stations.

7. The Rules adopted today will delete the phrase "nor for its use" which is contained in §97.39. The result of this action will make §97.39 a rule concerned only with who or what organizations may obtain a license. The amended §97.39 will not be directed to permissable communication nor to the use of an amateur station.

8. We are adding a new section, §97.114, which will both prohibit commercial third party traffic and clarify the permissible international third party traffic. As to the provisions of subparagraph (a) concerning international third party traffic, these rules simply incorporate the already existing international rules. As such they make no change in permissible communications and they are therefore considered to be of an editorial nature. Subsection (c) of §97.114 prohibits corporations, companies, associations and other organizations engaged in commercial activities from using amateur radio facilities. It will not prohibit the use of the Amateur Radio Service on behalf of organizations such as the Eye Bank and the American Red Cross except for traffic which relates to the regular business affairs of those organizations. Subparagraph (b) will prohibit amateur control operators or station licensees from receiving any compensation including a salary or reimbursement for non-collect telephone calls for operating an amateur station for transmitting or delivering third party traffic. This provision explicitly sets forth the fact that both domestic and international amateur traffic must not be handled with a pecuniary interest in mind.

9. To prevent unnecessary confusion as to what is meant by third party traffic, we are adopting a definition of that term and are making editorial changes in §97.79(d).

10. The provisions of §97.114(b) and 97.112 will clearly prohibit the American Radio Relay League's long

standing practice of providing compensation to the control operators of station W1AW. As a consequence, we are today issuing a Notice of Proposed Rule Making in a separate proceeding which would allow in certain instances involving club stations the compensation of control operators. We are also herein granting a waiver of the necessary rules to the licensee of station W1AW to allow the station to continue to operate pending the final action on our Notice of Proposed Rule Making. Any other club station providing similar services as W1AW may apply for a similar waiver. Such requests will be handled on a case by case basis.

11. The American Radio Relay League and several other individuals filed comments which suggested that the Commission adopt a rule specifically prohibiting communications for any purpose or activity which is contrary to federal, state, or local law. We find that this suggestion as it applies to any radio communications including third party traffic, has substantial merit. Therefore, with certain editorial changes, we are adopting their proposal as § 97.116.

12. Authority for the rule changes adopted herein is contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended.

13. The Commission finds that further Public Notice in regard to the subject matter of this Report and Order is unnecessary. Notice of the general subject matter and of the issues involved was previously given and extensive comments from interested parties have been received and given careful consideration. No public interest would be served by further notice and public participation in this matter.

14. IT IS ORDERED, effective December 1, 1972, that Part 97 of the Commission's Rules is amended as set forth in the attached Appendix.

15. IT IS FURTHER ORDERED, that a waiver of §§97.112 and 97.114(b) is GRANTED to the licensee of amateur station W1AW.

16. IT IS FURTHER ORDERED, that RM-1687 is denied to the extent that it is inconsistent with the rules adopted in this Report and Order and that this proceeding is TERMINATED

Federal Communications Commission
Ben F. Waple
Secretary

NOTE: Rules changes herein will be covered by T.S. VI(72)-1.

APPENDIX

Part 97 of the Commission's Rules is amended as follows:

1. Section 97.3(w) and (x) is added as follows:

§ 97.3 *Definitions*

(w) *Third party traffic.* Amateur radiocommunication by or under the supervision of the control operator at an amateur radio station to another amatuer radio station on behalf of any one other than the control operator.

(x) *Emergency communication.* Any amateur radio communication directly relating to the immediate safety of life of individuals or the immediate protection of property.

2. Section 97.39 is amended to read as follows:

§ 97.39 *Eligibility of corporations or organizations to hold station license.* An amateur station license will not be issued to a school, company, corporation, association, or other organization, except that in the case of a bona fide amateur radio organization or society, a station license may be issued to a licensed amateur operator, other than the holder of a Novice Class license, as trustee for such society.

3. Section 97.79(d) is amended to read as follows:

§ *97.79 Control operator requirements*

(d) The licensee of an amateur radio station may permit any third party to participate in amateur radio communications from his station, provided that a control operator is present and continuously monitors and supervises the radiocommunication to insure compliance with the rules.

4. Section 97.114 is added to read as follows:

§ 97.114 *Third party traffic.*
The transmission or delivery of the following amateur radiocommunication is prohibited:

(a) International third party traffic except with countries which have assented thereto;

(b) Third party traffic involving material compensation, either tangible or intangible, direct or indirect, to a third party, a station licensee, a control operator, or any other person.

(c) Except for an emergency communication as defined in this Part, third party traffic consisting of business communications on behalf of any party. For the purpose of this section business communication shall mean any transmission or communication the purpose of which is to facilitate the regular business or commercial affairs of any party.

4. Section 97.116 is added as follows:

§ 97.116 *Amateur radiocommunication for unlawful purposes prohibited.* The transmission of radiocommunication or messages by an amateur radio station for any purpose, or in connection with any activity, which is contrary to Federal, State, or local law is prohibited.

Notice of Proposed Rule Making Docket 19605

In the matter of Amendment of Part 97 to allow the compensation in certain instances of control operators of stations operating in the Amateur Radio Service and modification of the logging requirements regarding third party communications.

Adopted: October 5, 1972
Released: October 11, 1972

By the Commission: Commissioner Johnson dissenting; Commissioner Reid absent.

1. In our Report and Order adopted today in Docket 19245 we established rules regarding the type of third party traffic that amateur licensees may properly handle including the compensation of control operators for transmitting such messages. The Commission hereby gives Notice of Proposed Rule Makin concerning the collateral issues of compensation of amateur club station control operators and possible relaxation of the logging requirement for third party communications.

2. The American Radio Relay League operates an amateur station that is engaged in multiple address point to point communications. They broadcast bulletins, informational matter, and code practice of particular significance to amateur licensees. This type of communication is highly beneficial to both amateur operators and the Amateur Radio Service and should be encouraged.

3. The equipment used by these stations is in many instances as complex as a standard or FM broadcast station. As a result, it is impractical to operate these stations with volunteers, especially if the station operates for a substantial period each week.

4. The Commission is considering two different solutions. First, we are proposing specific rules which are designed to allow any bona fide amateur organization to operate a station and provide reasonable compensation to the control operator when the station transmits material solely related to the Amateur Radio Service. The rules, which will be designated as § 97.112(b) set forth specific criteria which a club station must meet in order to provide compensation to their operators. These criteria are designed to insure that stations compensating their operators are in fact en-

Continued on page 146.

FM 2 Meter UHF 6 Meter USED

GENERAL ELECTRIC . . . RCA . . . MOTOROLA

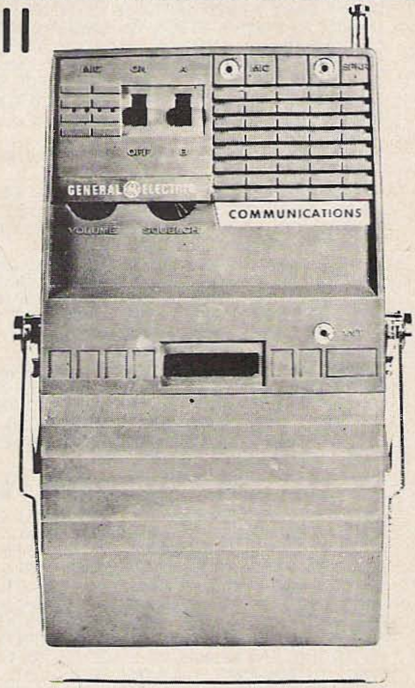
VOICE COMMANDER III

GENERAL ELECTRIC
FULLY SOLID STATE FM

Transmitter - Receiver

132 to 174 MHz
1 WATT OUTPUT
1/2 MICRO-VOLT SENSITIVITY
Size: 9.5" x 5.3" x 1.7"

High Performance, completely self-contained two-way FM radio. Compact, lightweight, easily operated and hand-carried. Housed in high-impact 2-section case. All external hardware polished stainless steel.



Proper charger available separately. $15. each.

$148

Lots of 5 ea. $133.20
Lots of 10 ea. $125.80

Includes rechargeable nickel cadmium battery pack and charger. . . . .

(Crystals & tuning, add $50)

PROGRESS LINE STRIPS physically complete, but are sold on an as-is basis only.

	LOW BAND		VHF		UHF
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Power supply, 30W, less vibrator	$20	—	$20	—	$20
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14" Progress Line Case, consisting of front basket and front plate with lock . . . . . . $10.
Low band dual front end, 2 freq. strip . . . . $20.
Hi-Band TPL RX with TX exciter strips less speaker, as is, missing parts . . . . $25.

15,000 2-way FM mobile units in stock! Send for new 1973 catalog.

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ELECTRONIC SURPLUS BARGAINS

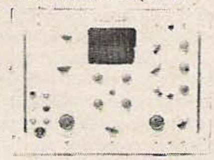
KLEINSCHMIDT TELETYPEWRITERS

Model TT-100/FG

Capable of sending 60-100 WPM, 115v., 60 cyc. Self contained power supply, Shipping weight - 70 lbs . . . . **$59.50 ea.**

Model TT-117/FG same as above except no power supply. This unit used with Model TT179/FG Reperforator-Transmitter which contains the power supply for both units $59.50

OSCILLOSCOPE



A widerange, high gain, portable test unit for observation of pulses, short-period electrical disturbances, sine waves, Band width 3 cyc.-15 mc. 105/125 VAC, 50-1000 cyc.
AN/USM50 . . . $79.00

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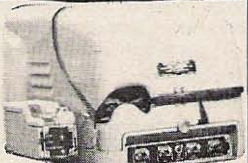
Heavy duty construction, shpg. wt. 20 lbs. for page printer, 22" x 18" x 27" ht. . . . $15.95

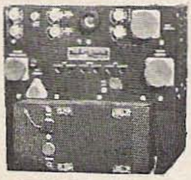
REPERFORATOR-TRANSMITTER

Model TT-179/FG Mfg by Kleinschmidt

Tape printing & punching, also transmitter-distributor, 115 volts, 60 cyc. shpg. wt. 90 lbs. Used, excellent cond., (gov't cost $2,000) $59.50

TT-117 & TT-179 as a set $100





AN/APN-12 RADAR SET

Consists of rec.-trans. RT11-A and ID-169 indicator. The transmitter interrogates a remote radar beacon by pulse type RF signal, pulse reply from beacon is received and displayed on the indicator to show distance and left or right heading for homing to location of remote beacon. The rec.-trans. contains 1-24 V.D.C. gear-head motor, 1-blower and tubes: 2 x 2, 2C26A, 9002, 5R4GY, 6SN7GT, 6V6, 6E5, 2-6SL7GT, 2-6AK5, 6-6AC7. Indicator contains motorized coaxial switch and tubes: 3BPL-C.R.T., 6AS6, 6AQ5, 6 x 4, 2-5726, 5-12AU7. Power reqmt. 115 V.A.C. 400 cy. and 24 V.D.C. freq. range 160-240 MHz.
Rec.-trans. shpg. wt. 50# $14.00
Indicator shpg. wt. 35# $10.00

VERTICAL ANTENNA INSULATOR

TOP - 1 3/8" o.d. - bottom 1 3/8" i.d. 16½" long - Shpg. wt. 8#$2.50 ea.

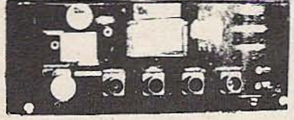
Volt and ammeters
Many types and styles

T-142/ART-13 Transmitter

This unit is ideal for HAM use on 80, 40, 20 and 10 meters. It has a power output of 100 Watts, AM, CW and MCW in a freq. range of 2-18 MHz and can be preset to the desired frequencies on any of 10 preselected channels. Complete with oscillator, 12" x 16' x 24", shpg. wt. 75# . . . . . . **SPECIAL $20.00**

USM-79/FR4 Frequency Meter

This unit has a frequency range of 100 kHz to 20 MHz in seven bands and is used to calibrate transmitters and receivers. Uses a blinking light for accurate zero beat settings. Has a built in scope for interpolation. Complete with calibration book. 115 volt 50-1000 Hz. Shipped in own transit case. Wt. 100# $45.00



RT7/APN-1 TRANSCEIVER

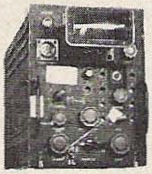
This FM rig can be tuned to 432 MHz. Has wobulator type transmission — requires 27 v.d.c. Shpg. wt. — 30# $6.50

RECEIVERS

SRR-13 — 2—30 MHz
This fine receiver is tunable in 4 bands and is modular in construction, very stable $250

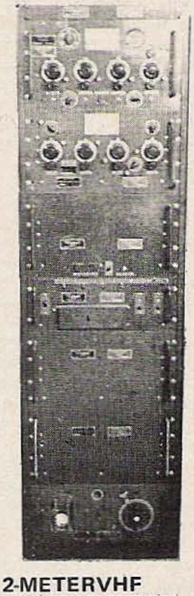
HAMMARLUND SP-600
A great general coverage receiver, tunable in 6 bands, 540 kHz to 54 MHz. 115 volt, 60 Hz $400

CRV-46147
Freq. range 500 kHz to 4 MHz. 115 volt, 60 Hz $100



APN-9 LORAN

A receiver operating in the marine band to provide boats and aircraft with their exact position. Shpg. wt. 45# used. $49.50



2-METERVHF BC-640 X'MITTER

50 watt - CW and AM. Freq. range 100-156 MC crystal controlled Pwr. rqmt. 100/125 60 cyc. Crated wt. 600 lbs. 6' x 22" wide. $49.50

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713-645-7057 R.E. Bradley — WA5MLX
(DIV. OF ANDY INTERNATIONAL, INC.) F.O.B. Houston, Tex. — Payment with order

FCC continued from p. 140.

gaged in providing a service to a significantly large sement of amateur licensees. Another solution would be to create a new class of amateur station which will be required, before they will be licensed, to make a showing similar to our proposed rules contained in the attached appendix. Comments are invited regarding these two possible solutions and any other proposals regarding this type of operation.

5. Section 97.103(b)(3) requires that an amateur radio station log include a notation of third party messages sent or received, including names of all participants and a brief description of the message content. The Commission invites comments regarding the usefulness of this requirement and whether it should be modified or deleted.

6. Authority for the proposed rule changes contained herein is contained in §§4(i) and 303 of the Communications Act of 1934, as amended.

7. Pursuant to applicable procedures set forth in Section 1.419 of the Commission's Rules, an original and 14 copies of all material requested by this proceeding should be submitted on or before December 20, 1972, and reply comments on or before January 3, 1973. All relevant material will be considered by the Commission. In reaching its decision in this proceeding, the Commission may also take into account other relevant data before it in addition to the specific data 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, 1919 M Street, N.W., Washington, D.C.

Federal Communications Commission
Ben F. Waple
Secretary

APPENDIX

In Section 97.112, the present text is designated as paragraph (a) and a new paragraph (b) is added to read as follows:

§97.112 *No remuneration for use of station*

(b) Control operators of a Club Station may be compensated when the club station is operated primarily for the purpose of conducting amateur radiocommunication to provide code practice transmissions intended for persons learning or improving proficiency in the International Morse Code, or to disseminate information bulletins consisting solely of subject matter having direct interest to the Amateur Radio Service provided:

(1) The station is operated weekly for a period of at least 40 hours;

(2) The station schedules operations on all allocated high frequency amateur bands using reasonable measures to maximize coverage;

(3) The schedule of normal operating times and frequencies is published at least 30 days in advance of the actual transmissions;

FCC

....LETTERS continued

I am in search of information concerning a surplus U.S. Navy receiver. Type CAY 46077 2–20 MCS in 4 Bands. A unit of RBM-4 Radio Equipment manufactured for the Navy Department – Bureau of Ships. I am primarily concerned in obtaining a circuit diagram of this rcvr. and also a circuit diagram of the proper power supply for this unit. Possibly one of your readers could help me with this.

S.E. Williams VE3AZD
14 Cheshire Dr.
Islington Ontario
Canada

Re your comments on Sept 72 editorial page titled "Incentives." Ever since the "spokesman for U.S. amateurs' started promoting incentive licensing, the prime question goes begging, namely, WHAT incentive? A follow-on question is: What benefits? If new frequencies or other rewards were given to those attaining advanced licenses, the term incentive would have been valid. If the majority of amateurs ever bother to earn their extra, those narrow segments will be just as crowded as the segments allowed general and advanced. This would reduce the extra license to a mere status symbol.

I am also in favor of the amateur updating his technical knowledge (I recently did when I had to repair my transceiver – the company went out of business.) I question how much knowledge is gained and retained by marking a series of multiple choice questions. From my listening, I fail to detect any improvements attributable to incentive licensing. And like you, Wayne, I also have trouble equating higher code speed to operate on extra phone frequencies.

In sum, I hold the FCC equally culpable for buying the gold brick as peddled by that group in Hartford. Unfortunately for all of us (who were not even consulted) the ill conceived laws stay on the books as long as the good laws.

Amateur radio needs stalwarts like you, Wayne, so please don't give up the ship (73). And when you run for Director – I will move back to the first district just to vote for you.

F. E. McAllen W2SPB
Asbury Park NJ

The 5/8 wavelength vertical using a weather balloon (Oct. '72 73, p. 60) looks like a great idea for field-day expeditions, but, knowing how the high impedance end of a whip can produce lightning displays, especially when driven by a gallon at low frequencies, I wonder about the safety of persons and facilities on the ground as the then-flaming hydrogen-recommended sphere descends. Remember the Hindenburg?

Bob Hirschfeld W6DNS
Cupertino CA

We're still running . . .

I am presently studying amateur radio at night school. VE3GCP is our teacher. He is the president of the Hamilton Radio Club and delegate to the Ontario Radio Society for the Niagara region.

I built the pre-Novice xmtr of WA8OIK in the January 73 issue. It works fine and is a real help.

Charles McBride

TECHNICAL AID GROUP

The Technical Aid Group is a group of hams who have indicated a willingness to share their knowledge and skills with others. They have volunteered to be of service to fellow hams and do so without compensation. If you have a technical question, look over the list to see who has competency in the area of your question. For many of the TAG members, descriptions of all areas of expertise would be lengthy, so an abbreviated description is given. When stating your problem, give as much information as possible and clearly state the difficulty. Enclose a SASE for reply.

For those hams who have a desire to share, the TAG is the thing for you. Send a brief note requesting the membership form, fill it in and send it back. It asks a few questions about your qualifications, and there is a check-list to indicate your fields of competence. These cover all modes currently used by hams, antenna design and theory, transmitter and receiver design for HF, VHF, and UHF, logic, ICs, general help, and other areas. As more members are added, their names and addresses will be published.

This list is not complete, but represents those former TAG members who have responded to a recent mailing and have expressed a desire to continue in the program. Comments from them indicate that they have enjoyed helping and all have been contacted frequently for advice.

Robert Perlman WB2VRW, 3 Josten Place, Hudson NY 12534. Electrical engineering student. Will help with Novice transmitters and receivers, and any help for beginning hams.

Thomas Laffin W1FJE, Box 133, Hillsboro NH 03244. Radio communications technician. Special aid to ex-CBers and those who need terms in easily understood terms; aid to Novices and Techs interested in MARS, RACES, CD, and CAP; how to build and scrounge parts; assistance on ham history, ATV, microwave, and general help.

Theodore Cohen W4UMF, 8603 Conover Pl., Alexandria VA 22308. Geophysicist. Specially prepared to answer questions about SSTV and ATV.

J. Bradley Flippin K6HPR, 116 Montecito Ave., Apt. M., Monterey CA 93940. Electronic engineer. Help with RTTY, data processing and programming, general.

Ira Kavaler WA2ZIR, P.O. Box 54, Flatbush Sta., Brooklyn NY 11226. Electrical engineer. Assistance offered in theoretical aspects of electricity and electronics from dc to UHF, design of equipment, computer programming, and signal circuit (failsafe) design.

Jon Teich WB2JAE, 22 Olden Rd., Edison NJ 08817. High school student. Novice and others, transmitter and receiver problems, logic, and general.

David Felt WB6ALF, P.O. Box 261, Sierra Madre CA 91024. Electronics engineer. Qualified help in logic, digital and analog design, solid state, AM and TV.

Robert Groh WA2CKY, 65 Roxborough Rd., Rochester NY 14619. Communications engineer. Bob can lend a hand in HF and VHF transmitter and receiver design as well as solid-state logic and digital techniques.

Carl Miller WA6ZHT, 334 Paragon Ave., Stockton CA 95207. Computer technician. Carl's specialty area is solid-state QRP.

George Daughters WB6AIG, 1560 Klamath Dr., Sunnyvale CA 94087. Research associate. HF transmitter and receiver, SSB, and solid state, are George's fields.

D. Hausman VE3BUE, 267 Northcrest Pl , Waterloo, Ontario, Canada. Student. Novice transmitter and receiver problems as well as logic, digital techniques and ICs.

Hugh Wells W6WTU, 1411 18th St., Manhattan Beach CA 90226. Electronics instructor. Hugh can help with AM, Novice problems, VHF-UHF receivers and converters, solid state, test equipment, FM and repeaters, and general help.

Charles Hill WA7LQO, 4005 Campbell St., Baker OR 97814. Student. TV, Novice transmitter problems, and logic.

John Perhay WAØDGW, Route 4, Owatonna MN 55060. EE technician. John will help with RTTY, AM, SSB, Novice gear, HF transmitters and receivers, solid state, ICs, and test equipment.

Jim Jindrick WA9QYC, 801 Florence Ave., Racine WI 53402. Consulting engineer. General help as well as HF, VHF, and UHF antennas, transmitters, and receivers.

William Welsh W6DDB, 2814 Empire Ave., Burbank CA 91504. Electronic engineer. Beginner's problems, code instruction, theory and regulations.

Ken Knecht K8VNT, Box 39, Clintondale NY 12515. Television engineer. TV, logic, and digital techniques.

Tom O'Hara W6ORG, 10253 E. Nadine St., Temple City CA 91780. Communications engineer. RTTY, TV, AM, SSB, VHF antennas, transmitters and receivers for HF through UHF, solid state, and general help.

Bruce Creighton WA5JVL, 2517 Metairie Ct., Metairie LA 70002. Electrical engineer. Antennas, Novice problems, solid state, logic, digital techniques, test equipment, and general help.

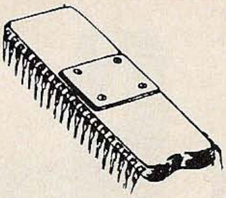
Tom Borok WB2PFY 215-33 23 Rd., Bayside NY 11360. Student. Tom is especially qualified to help Novices with their problems with transmitters and receivers, HF and VHF antennas, HF receivers, test equipment, and surplus, Morse code instruction.

Roger Taylor K9ALD, 2811 William St., Champaign IL 61820. Engineer. Roger is adept with AM, SSB, antennas, solid state, logic and digital techniques, ICs, test equipment, and other general help.

Orris Grefsheim WA6UYD, 1427 W. Park St., Lodi CA 95240. TV technician. Orris is capable of assisting in all fields of amateur work, DC through UHF, logic as well as Novice help.

John Allen K1FWF, 112 Edgemoor Lane, Ithaca NY 14850. Technical director. John's areas of assistance are VHF and UHF antennas, receivers, and transmitters, solid state and digital techniques, ICs, and SSB.

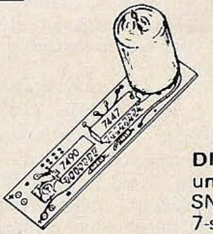
CALCULATOR ON A CHIP
40 pin DIP package –



Add, subtract, multiply, and divide
12 digit display and calculate
Chain calculations
True credit balance sign output
Automatic overflow indication
Fixed decimal point at 0, 2, 3, or 4
Leading zero suppression
Complete data supplied with chip

Only $12.95

CD-3 Universal Counter Module



Can be programmed to count to any modulus 2–9 for one kit, 2–99 for two kits, etc. Includes board, 7490, 7447, RCA DR2010 Numitron display tube and five programming components. Full instructions included – perfect for displaying second, minutes and hours, etc.

Complete $9.25

DIGITAL SPECIAL

Ten brand new (on carriers) dual-in-line JK flip-flops–LU321 with data sheet and two pages of application notes describing hookups for–divide by three through ten, and twelve. Also self correcting ring counter hookups, etc.

10 LU321 W/data $4.00

TTL dual-in-line

7400, 7401, 7402, 7404, 7405, 7410, 7420, 7430, 7440, 7450, 7451, 7453 .. 100 for $20.00	ea.$ .22
7441 BCD decoder driver	1.00
7442 BCD decoder	.90
7473 dual JK flip-flop	.55
7474 dual type D FF	.40
7475 quad latch	1.15
7476 dual JK FF	.55
7480 gated full adder	.50
7483 4 bit full adder	1.15
7486 quad exclusive or gate	.65
7489 64 bit RAM	3.00
7490 decade counter	.90
7492 divide by 12 counter	.90
7493 4 bit binary counter	.90
74154 one of 16 decoder	2.50
74192 up/down decade counter	2.25
74193 up/down binary counter	2.00
74195 unv. 4 bit SR	.90
8220 parity gen/checker	1.00
8200 4 bit magnitude comparator	1.60
8280 preset decade counter	1.15
8281 preset binary counter	1.15
8520 25 MC divide by "N" 2 to 15	2.00
7495 4 bit SHIFT REGISTER	1.15
8590 8 bit shift register	2.00
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LM302 voltage follower op-amp	1.25
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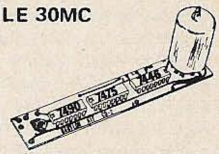
LM309K 5V-1A power supply module	2.50

DIGITAL COUNTER MODULE 30MC



unit includes board, SN7490, SN7475 quad latch, SN7447 7-segment driver and RCA "numitron" display tube W/decimal. 1" x 4.5" module will mount on 1" centers.

kit $10.95 – wired and tested $13

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NE567 Tone decoder, DIP (8 pin)	$3.50 ea.
7447 7 segment decoder driver	$1.30
74181 Arithmetic Logic Unit, 24 pin, DIP	$4.50
8261 fast carry for above	$2.00
8223 256 bit bipolar field programmable, read-only memory	$10.00
8570 9 bit S1, PO, shift register	$2.50
LED Red Emitting Lamp	$.60

All IC's are new and fully tested – leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 35¢ handling and postage for smaller orders. California residents add sales tax. IC orders are shipped within two workdays of receipt of order – kits are shipped within ten days of receipt of order. Money back guarantee on all goods sold.

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...AND MORE!

I was very interested in the WWVB receiver article in the latest issue, even though so far as I know WWVB cannot ordinarily be heard in this area.

I have been trying without any success to find details of LORAN C on 200 kHz. I made a trip to the Coast Guard Station at Woods Hole, but nobody there would tell me anything.

Can you tell me where to get info on this? ditto for OMEGA system?

I should be most appreciative of any help you can give me.

Bill Hunt
336 Marion Road
Middleboro MA 02346

Does anyone have the information Bill needs?

Having trouble with buzzes, yoops, and music from that nearby broadcast station?

Well, put on your old shoes, coveralls, and take a swig out of that hidden bottle of bug juice, and crawl under the house with a flashlight, some bare wire, a file, and a wiping rag or two.

If you find pipes and conduit crisscrossing, or laying upon one another, pry them apart, and put something in between, such as friction tape or old newspapers.

If the pipes can't be pried apart, bind them together wherever they touch. It's usually a dirty job, but will probably put a stop to your trouble.

It's called cross-modulation, and if you are getting music from that pesky broadcast station, you can often stop it for good, and your DX cards from the other side of the world might arrive more often.

W6TG
Reseda CA

In the November 1972 *Stereo Review* there is an article by one Peter Sutheim on "Radio-Frequency Bugs in your Audio System." The article is apparently quite good as far as technical solutions are concerned, but portrays amateurs in the same bag with CBer's as "casual" users of the airwaves who "may not give a damn." I would hope that you and others could find the time to read the article – it reveals the kind of PR problems that we must contend with. I have written a short, polite letter to Mr. William Anderson, the editor of *SR*, to clarify Sutheim's misconceptions and would strongly encourage as many other hams as care about their avocation to do likewise.

If we can't beat RFI, it's going to beat us – for good.

William M. Klykylo WA8FOZ
Ann Arbor MI

I have read with great interest, W9JT's "Petition" in the October issue. His suggested allocations of the amateur frequencies suggest three things to me:

1. HIS favorite mode of transmission is SSB.
2. He seems to think that amateurs have no purpose except to chew the fat.
3. He is an extremely selfish individual.

His impression of amateur service is that hams are nothing more than a lot of people competing for spectrum space to talk, largely about nothing. Unfortunately, a large number of hams have the same impression. They, and Mr. Fyler, should comply with the FCC requirement that amateur operators be familiar with the domestic and international regulations governing amateur service. Specifically, they should read that part of the Geneva radio regulations where the amateur service is defined, "A service of self training and technical investigations carried on by amateurs . . ." This very definition would be completely invalidated, were Mr. Flyer's recommendations or any like them ever adopted.

The present amateur service knows many modes of transmission. Consequently amateur radio has always served as a source of self trained personnel for all phases of the communications industry. In spite of the great popularity of SSB fone, all the present modes of transmitting information have, and always will have, their place. For example, AM phone is still the prime means of voice transmission outside of the amateur service. (Name one commercial broadcasting station that uses suppressed carrier single sideband.) FM phone holds a close second. There are still a great many commercial and government CW stations. How can there be any self training if these still widely-used techniques are closed to the amateur?

In the amateur service itself, AM phone still offers audio quality far superior to SSB. I am yet to hear the SSB station that, even on equipment designed for SSB, sounds any better than a constipated duck. Phone nets are, in fact, handicapped when they use SSB since every station must be within a few Hz of net frequency – a difficult thing to achieve, even with today's sophisticated equipment. Without intending to degrade the many capable operators who utilize SSB, I must also say that I have run across many operators who now don't know how to properly tune in an AM signal and whose equipment gives decidedly inferior performance when receiving an AM signal. On the other hand, SSB certainly is the better medium for casual conversation.

For handling third-party traffic, CW cannot be beat. I won't elaborate on this; I will merely suggest listening in to a phone net, then to a CW net.

RTTY is also superior to phone for message traffic, although, because of its extreme complexity, I feel it is still second to CW.

If Mr. Fyler's recommendations were ever adopted, the ham bands would shortly become more polluted than Lake Erie. His statement that "It is imperative that SSB fone have the right of way over CW . . ." betrays him as the sort that would eventually degenerate amateur radio to the point of eliminating CW altogether, leaving his favorite medium in exclusive control of the entire amateur spectrum and cluttering it with the multitudes of individuals who today are crying in their beer that they can't learn the code which, to date, millions of eleven-year-old boy scouts have learned. We've kooks enough on the air without that lot.

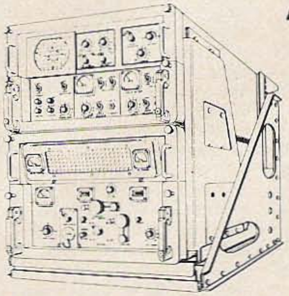
I recently received a letter from WA4RMF asking for an article enumerating the contributions of amateurs to progress in the electronic industry. No mere article, not even a full-sized volume, can do justice to this subject. The better engineers and technicians in every electronic firm in the country, and most commercial radio and TV stations are hams, to say nothing of the hams that pervade the telephone companies, and recording studios. The bulk of them got their start as amateurs. I am indebted to my hobby for a fifteen-year career in electronics. I know as a fact that many ideas which are eventually absorbed in commercial and military hardware have their origins in amateur tinkering – the hams merely take them to work next day and use them. How could amateur radio ever continue this contribution to progress if it is stifled for the convenience of a large number of gasbags? Our hobby presently offers a great many outlets for public service, personal and cultural improvement, and development. It has been so from its beginning, and he that will so demean himself so as not to be endeavoring to add to his stock of knowledge and operating skill may be deemed a drone on the airways – a useless member of the fraternity and totally unworthy of being called a radio amateur.

W2FEZ

P.S. I've got a sneaky feeling you will disagree with me and support W9JT. If so, I hope you will still be man enough to print this letter.

There is some weird idea going around that I censor the stuff I print in 73, and that, therefore, everything I publish means that I agree with it. This is not the policy of 73 – this never has been the policy of 73 – and I hope it never will be the policy of 73. Just because your adored QST seems to operate this way does not mean that 73 is going to imitate them. Stuff is printed in 73 that appears to be of interest, whether I think it a bunch of bananas or not. . . wayne.

Save over $9,000.00 on this AN/WRR-2 SSB Receiver!



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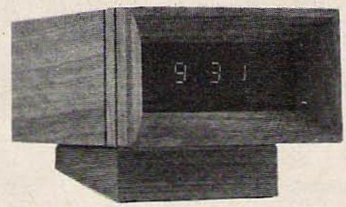

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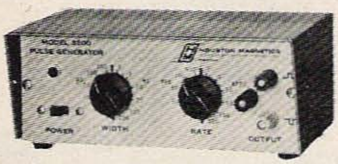

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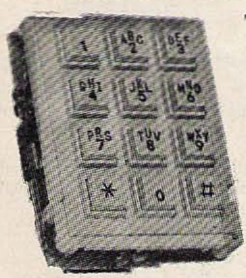

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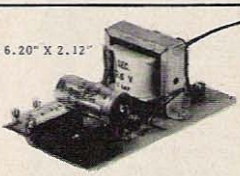

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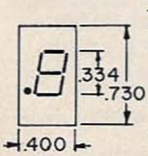

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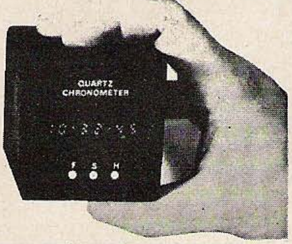

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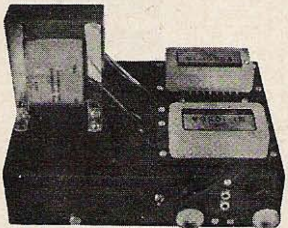

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16 DIGIT ELECTRONIC DESK TOP CALCULATOR KIT

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Sincerely,

Arthur Pennell

Arthur Pennell
President, ARIES/BF

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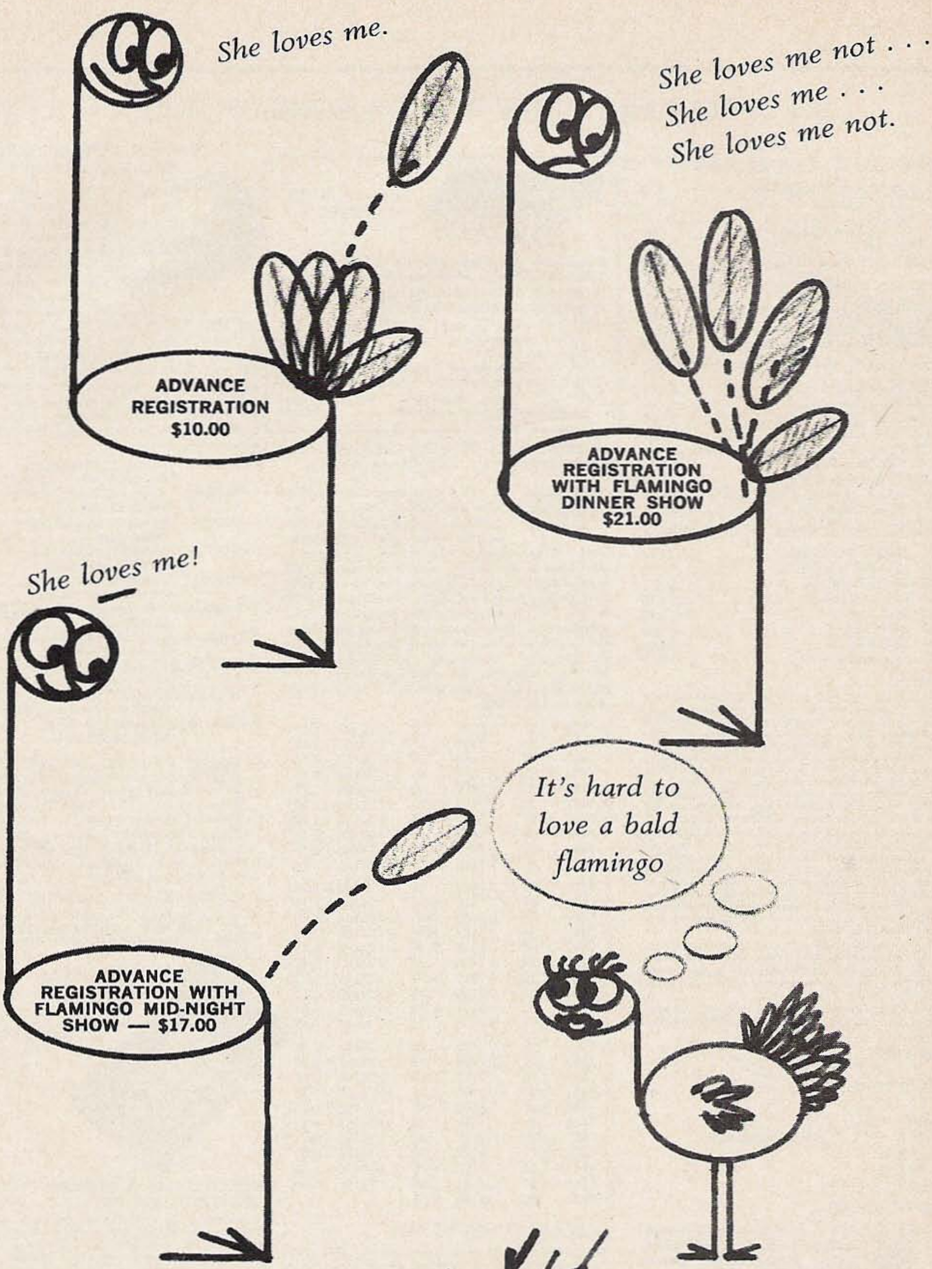

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7403	.26	.25	.23	.22	.21	.20
7404	.28	.27	.25	.24	.22	.21
7405	.28	.27	.25	.24	.22	.21
7406	.52	.50	.47	.44	.42	.39
7407	.52	.50	.47	.44	.42	.39
7408	.32	.30	.29	.27	.26	.24
7409	.32	.30	.29	.27	.26	.24
7410	.26	.25	.23	.22	.21	.20
7411	.28	.27	.25	.24	.22	.21
7413	.58	.55	.52	.49	.46	.44
7416	.52	.50	.47	.44	.42	.39
7417	.52	.50	.47	.44	.42	.39
7420	.26	.25	.23	.22	.21	.20
7421	.26	.25	.23	.22	.21	.20
7423	.80	.76	.72	.68	.64	.60
7425	.50	.48	.45	.43	.40	.38
7426	.34	.32	.31	.29	.27	.26
7430	.26	.25	.23	.22	.21	.20
7437	.56	.53	.50	.48	.45	.42
7438	.56	.53	.50	.48	.45	.42
7440	.26	.25	.23	.22	.21	.20
7441	1.73	1.64	1.55	1.46	1.37	1.27
7442	1.27	1.21	1.14	1.07	1.01	.94
7443	1.27	1.21	1.14	1.07	1.01	.94
7444	1.27	1.21	1.14	1.07	1.01	.94
7445	1.71	1.62	1.53	1.44	1.35	1.26
7446	1.24	1.17	1.11	1.04	.98	.91
7447	1.16	1.10	1.04	.98	.92	.85
7448	1.44	1.37	1.29	1.22	1.14	1.06
7450	.26	.25	.23	.22	.21	.20
7451	.26	.25	.23	.22	.21	.20
7453	.26	.25	.23	.22	.21	.20
7454	.26	.25	.23	.22	.21	.20
7460	.26	.25	.23	.22	.21	.20
7470	.42	.40	.38	.36	.34	.32
7472	.38	.36	.34	.32	.30	.29
7473	.50	.48	.45	.43	.40	.38
7474	.50	.48	.45	.43	.40	.38
7475	.80	.76	.72	.68	.64	.60
7476	.56	.53	.50	.48	.45	.42
7480	.76	.72	.68	.65	.61	.57
7482	.99	.94	.88	.83	.78	.73
7483	1.63	1.55	1.46	1.38	1.29	1.20
7485	1.43	1.35	1.28	1.20	1.13	1.05
7486	.58	.55	.52	.49	.46	.44
7490	.80	.76	.72	.68	.64	.60
7491	1.43	1.35	1.28	1.20	1.13	1.05
7492	.80	.76	.72	.68	.64	.60
7493	.80	.76	.72	.68	.64	.60
7494	1.18	1.12	1.05	.99	.93	.87
7495	1.18	1.12	1.05	.99	.93	.87
7496	1.18	1.12	1.05	.99	.93	.87
74100	1.52	1.44	1.36	1.28	1.20	1.12
74107	.52	.49	.47	.44	.42	.39
74121	.56	.53	.50	.48	.45	.42
74122	.70	.67	.63	.60	.56	.53
74123	1.21	1.06	1.00	.94	.89	.83
74141	1.63	1.55	1.46	1.38	1.29	1.20
74145	1.41	1.33	1.26	1.18	1.11	1.04
74150	1.63	1.55	1.46	1.38	1.29	1.20
74151	1.20	1.13	1.07	1.01	.95	.88
74153	1.63	1.55	1.46	1.38	1.29	1.20
74154	2.43	2.30	2.16	2.03	1.89	1.76
74155	1.46	1.39	1.31	1.23	1.16	1.08
74156	1.46	1.39	1.31	1.23	1.16	1.08
74157	1.56	1.48	1.39	1.31	1.23	1.15
74158	1.56	1.48	1.39	1.31	1.23	1.15

Catalog Number	Any Quantity Per Item (Mix) 1-99	100-999	1000 up	Multiples of 10 Per Item (Mix) 100-990	1000 9990	10000 up
74160	1.89	1.79	1.68	1.58	1.47	1.37
74164	1.89	1.79	[illegible]	1.58	1.47	1.37
74166	1.98	1.87	[illegible]	1.65	1.54	1.43
74176	1.62	1.53	1.45	1.36	1.28	1.19
74177	1.62	1.53	1.45	1.36	1.28	1.19
74180	1.20	1.13	1.07	1.01	.95	.88
74181	5.20	4.90	4.59	4.28	3.98	3.67
74182	1.20	1.13	1.07	1.01	.95	.88
74192	1.98	1.87	1.76	1.65	1.54	1.43
74193	1.98	1.87	1.76	1.65	1.54	1.43
74196	1.98	1.87	1.76	1.65	1.54	1.43
74197	1.98	1.87	1.76	1.65	1.54	1.43
74198	2.81	2.65	2.50	2.34	2.18	2.03
74199	2.81	2.65	2.50	2.34	2.18	2.03
SCHOTTKY TTL						
74S00	1.14	1.08	1.02	.96	.90	.84
74S01	1.14	1.08	1.02	.96	.90	.84
74S03	1.14	1.08	1.02	.96	.90	.84
74S04	1.37	1.30	1.22	1.15	1.08	1.01
74S05	1.37	1.30	1.22	1.15	1.08	1.01
74S08	1.14	1.08	1.02	.96	.90	.84
74S09	1.14	1.08	1.02	.96	.90	.84
74S10	1.14	1.08	1.02	.96	.90	.84
74S15	1.14	1.08	1.02	.96	.90	.84
74S20	1.14	1.08	1.02	.96	.90	.84
74S21	1.14	1.08	1.02	.96	.90	.84
74S40	1.37	1.30	1.22	1.15	1.08	1.01
74S50	1.14	1.08	1.02	.96	.90	.84
74S51	1.14	1.08	1.02	.96	.90	.84
74S60	1.14	1.08	1.02	.96	.90	.84
74S64	1.14	1.08	1.02	.96	.90	.84
74S65	1.14	1.08	1.02	.96	.90	.84
74S73	1.98	1.87	1.76	1.65	1.54	1.43
74S74	1.98	1.87	1.76	1.65	1.54	1.43
74S76	1.98	1.87	1.76	1.65	1.54	1.43
74S78	1.98	1.87	1.76	1.65	1.54	1.43
74S107	1.98	1.87	1.76	1.65	1.54	1.43
74S112	1.98	1.87	1.76	1.65	1.54	1.43
74S113	1.98	1.87	1.76	1.65	1.54	1.43
74S114	1.98	1.87	1.76	1.65	1.54	1.43
74S140	1.37	1.30	1.22	1.15	1.08	1.01
LINEAR IC'S						
NE501	2.99	2.82	2.66	2.49	2.32	2.16
NE526	3.59	3.38	3.17	2.95	2.74	2.53
NE531	3.81	3.58	3.36	3.14	2.91	2.69
NE533	3.81	3.58	3.36	3.14	2.91	2.69
NE536	7.31	6.88	6.45	6.02	5.59	5.16
NE537	7.53	7.09	6.65	6.20	5.76	5.32
NE540	2.16	2.04	1.92	1.80	1.68	1.56
NE555	.98	.93	.88	.83	.78	.73
NE560	3.57	3.36	3.15	2.94	2.73	2.52
NE561	3.57	3.36	3.15	2.94	2.73	2.52
NE562	3.57	3.36	3.15	2.94	2.73	2.52
NE565	3.57	3.36	3.15	2.94	2.73	2.52
NE566	3.57	3.36	3.15	2.94	2.73	2.52
NE567	3.57	3.36	3.15	2.94	2.73	2.52
N5111	.90	.86	.81	.77	.72	.68
N5556	1.87	1.77	1.66	1.56	1.46	1.35
N5558	.80	.76	.72	.68	.64	.60
N5595	3.40	3.20	3.00	2.80	2.60	2.40
N5596	1.87	1.77	1.66	1.56	1.46	1.35
709	.42	.40	.38	.36	.34	.32
710	.42	.40	.38	.36	.34	.32
711	.44	.42	.40	.37	.35	.33
723	1.00	.95	.90	.85	.80	.75
733	1.90	1.80	1.70	1.60	1.50	1.40
741	.44	.42	.40	.37	.35	.33
747	1.05	.99	.94	.88	.83	.77
748	.48	.46	.43	.41	.38	.36

TRANSISTORS & DIODES

Catalog Number	1-99	100-999	1000 up	100-990	1000 9990	10000 up
1N270	.15	.14	.13	.12	.11	.10
1N751A	.30	.28	.26	.24	.22	.20
1N914	.10	.09	.08	.07	.06	.05
1N4001	.10	.09	.08	.07	.06	.05
1N4002	.11	.10	.09	.08	.07	.06
1N4003	.13	.12	.11	.10	.09	.08
1N4006	.15	.14	.13	.12	.11	.10
1N4154	.15	.14	.13	.12	.11	.10
2N3860	.25	.23	.21	.19	.17	.15

All IC's are supplied in 8–, 14–, 16–, or 24– pin DIP (Dual-in-line) plastic or ceramic package except for NE533, NE536, NE537, and NE540 which come in TO–5 package.

We give FREE data sheets upon request, so ask for those data sheets that you NEED, even for those listed IC's that you are not buying. On orders over $25.00 we'll send you a new 270-page COMPLETE TTL IC data book FREE. Or, you may obtain a new 240-page LINEAR data book instead. Orders over $50.00 will receive both books. Orders over $100.00 will receive a complete LIBRARY of DIGITAL & LINEAR data & application books totaling 1,000 pages FREE. PLEASE NOTE: Data books are shipped separate from your order. Please allow two weeks for delivery.

UNIVERSAL DECADE COUNTING UNITS

1. Easy to read single plane LED or Filament-type Readout with wide angle viewing.
2. BCD Outputs, Readout Lamp Test, Ripple Blanking and Counter Reset are available.
3. Plug-in Module.
4. Molex Sockets for all IC's and Readout.
5. Tin-plated G-10, 2-oz Copper, Glass Epoxy Board.
6. Your choice of 1 to 6 decades on one P. C. Board.
7. Grouping of 2 or more readouts on the same display board.
8. Display board mounts perpendicular to counter/driver board.
9. Up/Down counting and counter preset functions available with 74192.
10. 60 MHZ typical toggle rate with 74196.
11. Operates from 5 Volt TTL compatable single supply.
12. First in a series of Universal plug-in modules: for frequency counting, time measurements, event counting, DVM, magnitude comparison, etc.
13. P. C. Boards only are available for $3.00 per decade.

Price (Per Decade):

Basic Unit consisting of 7490, 7447, Filament-Type 7-Segment Readout. $9.00

Options:
For LED Readouts instead of Filament-Type, add$2.00
For 7475 Latch, add $1.25
For 74176 instead of 7490, add $0.50
For 74192 instead of 7490, add $1.00
For 74196 instead of 7490, add $0.75
For Fully assembled and tested unit, add $2.50

LED 7-SEGMENT DISPLAY

$4.95 Each

50-99	*$4.75*
100-999	*$4.50*
1000-	*$4.25*

Large ¾" 7-segment LED readout similar to the popular MAN-1 but with improved brightness. Has left-hand decimal point. Fits in a DIP socket. Expected life: Over 100 Yrs. Regularly $12.95 in single Lots. These are BRAND NEW with full data sheet and 4-page MULTIPLEXING Application Note. Needs a 7447 for driver and ONE CURRENT-LIMITING RESISTOR PER SEGMENT. We can supply you with one or ten thousand FROM STOCK. Also available, ±1 OVERFLOW digit at the same prices. Mixing of Regular & Overflow digit allowed.

Package of 8, ¼W Limiting R's .... 30¢

Incandescent Type of 7-segment display. With right-hand decimal point. Rated 8mA per segment at TTL supply of 5V. Design life of 50,000 hours. Needs a 7447 as a driver. In DIP Package. Each $3.25

MOLEX IC SOCKET PINS: Use these economical pins instead of soldering your IC'S to PC boards. Sold in continuous strips in multiples of 100 pins only.
100 for $1.00; 200 for $1.80; 300 for $2.60;400 for $3.40; 500 for $4.20; 600 for $5.00;700 for $5.80; 800 for $6.60; 900 for $7.40;1000 for $8.20. Each Additional 1000 $7.50

ALLEN-BRADLEY MIL-GRADE (5-band) RESISTORS. Any of the 84 STANDARD 10% values from 2.7Ω to 22MΩ. ¼ or ½ WATT. EACH .... 5¢

CERAMIC DISC CAPACITORS. Type 5GA-1000WVDC.
5, 7.5, 10, 12, 15, 20, 22, 25, 27, 30, 33, 39, 50, 56, 68, 75, 82, 100, 120, 150, 180, 200, 220, 250, 270, 300, 330, 360, 390, 470, 500, 560, 680, 750, 820, 1000, 1200, 1500, 1800, 2000, 2200, 2500, 2700, 3000, 3300, 3900, 4700, 5000μμF.
EACH .... 10¢
0.01μF. EACH .... 11¢
0.02μF. EACH .... 12¢

LOW VOLTAGE DISCS, Type UK.
1.0 μF, 3V .... 25¢
0.1 μF, 10V .... 12¢
0.47μF, 3V .... 25¢
2.2 μF, 3V .... 30¢
0.2 μF, 10V .... 20¢
0.01μF, 16V .... 10¢

ELECTROLYTIC CAPACITORS:
All values are available in both, axial or upright (PC Board) mount. PLEASE INDICATE YOUR CHOICE.
10 μF, 15V .... 10¢
30 μF, 15V .... 10¢
50 μF, 15V .... 10¢
100 μF, 15V .... 10¢
220 μF, 15V .... 15¢
500 μF, 15V .... 20¢
1000 μF, 15V .... 30¢
20 μF, 25V .... 15¢
30 μF, 35V .... 20¢
50 μF, 35V .... 20¢
100 μF, 35V .... 20¢
500 μF, 35V .... 40¢
1000 μF, 35V .... 50¢
1 μF, 50V .... 10¢
2 μF, 50V .... 10¢
3 μF, 50V .... 10¢
5 μF, 50V .... 10¢
10 μF, 50V .... 15¢
20 μF, 50V .... 20¢
50 μF, 50V .... 20¢
100 μF, 50V .... 20¢
200 μF, 50V .... 40¢
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STANCOR P-8180, 25.2 VCT, 1-Amp Transformer.
Ideal for use with LM-series. Each $3.00

DUAL–IN–LINE Wire-Wrap Type IC Sockets. BRAND NEW with gold plated pins.

	1-99	100-249	250-999	1000-4999	5K-UP
14 PINS	0.40	0.35	0.30	0.25	0.20
16 PINS	0.75	0.70	0.65	0.60	0.55

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☐ 560	Phase lock loops TO-5	3.25
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☐ 566	Function generator (Mini DIP)	3.25
☐ 567	Tone decoder (Mini DIP)	3.25
☐ 595	Four quadrant multiplier	3.10
☐ 702C	Hi-gain, DC amp, TO-5	.44
☐ 703C	RF-IF, amp, 14 ckts, TO-5	1.00
☐ 709C	Operational amp (A)	.39
☐ 710C	Differential amp (A)	.39
☐ 711C	Dual diff. comp (A)	.39
☐ 723C	Voltage regulator (A)	.95
☐ 741C	Frequency compensator 709(A)	.41
☐ 741CV	Frequency comp 709 (mini DIP)	.49
☐ 747C	Dual 741C, (A)	1.25
☐ 748C	Freq. adj. 741C (A)	.44
☐ 709-709	Dual 709C (DIP)	1.00
☐ 739-739	Dual stereo preamp	1.98

(A) TO-5 or DIP dual in line pak

☐ 75450	Relay Line Driver	.49
☐ 4250	Programmable Op Amp	2.50
☐ 741CG	Military Gold Cased DIP	.49

(G) Military Gold Encased Pak

Type	Sale
☐ SN7400	$.21
☐ SN7401	.21
☐ SN7402	.21
☐ SN7403	.21
☐ SN7404	.27
☐ SN7405	.27
☐ SN7406	.45
☐ SN7407	.45
☐ SN7408	.29
☐ SN7409	.29
☐ SN7410	.21
☐ SN7411	.25
☐ SN7413	.50
☐ SN7416	.48
☐ SN7417	.48
☐ SN7420	.21
☐ SN7421	.21
☐ SN7426	.32
☐ SN7430	.21
☐ SN7437	.50
☐ SN7438	.51
☐ SN7440	.21
☐ SN7441	1.00
☐ SN7442	1.12
☐ SN7443	1.21
☐ SN7444	1.21
☐ SN7445	1.50
☐ SN7446	1.17
☐ SN7447	1.10
☐ SN7448	1.25

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☐ SN7460	.21	☐ SN74145	1.25
☐ SN7470	.39	☐ SN74150	1.25
☐ SN7472	.32	☐ SN74151	1.13
☐ SN7473	.44	☐ SN74153	1.25
☐ SN7474	.39	☐ SN74154	1.95
☐ SN7475	.71	☐ SN74155	1.39
☐ SN7476	.44	☐ SN74156	1.39
☐ SN7480	.65	☐ SN74157	1.25
☐ SN7481	1.10	☐ SN74158	1.48
☐ SN7482	.88	☐ SN74160	1.79
☐ SN7483	1.25	☐ SN74161	1.79
☐ SN7486	.49	☐ SN74162	1.79
☐ SN7489	3.50	☐ SN74163	1.79
☐ SN7490	.69	☐ SN74180	1.10
☐ SN7491	1.10	☐ SN74181	4.50
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☐ SN7493	.71	☐ SN74184	2.50
☐ SN7494	1.10	☐ SN74185	2.50
☐ SN7495	.95	☐ SN74192	1.75
☐ SN7496	1.10	☐ SN74193	1.75
☐ SN74107	.49	☐ SN74195	1.19

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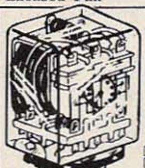

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Excellent for "HAM" use as antenna switching, latching, transmit, receive, etc., and 100's of commercial or industrial uses. Includes plastic dust-cover with diagram and hookup info, 11-pin plug-in base. Contacts movable gold flashed silver, stationary overlay, with silver cadmium oxide movables. All contacts 10 amp 3PDT. Coil data, 115VAC 2250 ohms, 17.5 ma. 12 VDC 21 ohms 168 ohms. Size: 2¼" x 1 5/16". Wt. 4 ozs. Center pin missing. Comar Mfg. type equal too.

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For measuring sound or noise levels. Essentially low range rectifier type voltmeter. Internal imp. 3900 ohms. Steady state reference 1 mw. For 600V line.

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Replacement for tape recorders, PA systems, audio amps. 200 ohms. 6-ft. cord and mini mike plug. 200-5000 Hz. Wt. 6 oz. Fits in "palm of hand." 2⅜" x 1⅝" x ⅞". Impact plastic

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Type G, 1/2" dia. x 1/2" high. Mounts 1/4" hole, with shaft, linear, immersion-proof high freq.

2 for $1

Ohms		
	☐ 2.5K	
☐ 75	☐ 5.0K	☐ 25.K
☐ 100	☐ 7.K	☐ 75.K
☐ 500	☐ 10.K	☐ 100.K
☐ 2.0K	☐ 20.K	☐ 5 Meg

We stock Locknut Bushing & Screwdriver types at same low prices.

ALLEN BRADLEY'S 'TRANSISTOR' POTS

Type F. Screwdriver adjust.

Ohms					
					☐ 100K
☐ 75	☐ 250	☐ 1.0K	☐ 7.5K	☐ 25.K	☐ 250K
☐ 100	☐ 500	☐ 2.5K	☐ 10.0K	☐ 50.K	☐ 2 Meg
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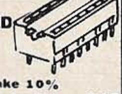

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The lowest price digital clock kit (with cabinet) as far as we can see in U.S.A. Scientific Devices' engineering dept. took extra patience in designing to give you the finest digital clock kit using the latest techniques in an easy-to-understand booklet. The cabinet-making section gives it the "interior decorating" touch so that it may fit into any room at home, shop or office. Walnut laminated tapered front cabinet, with gold-line front. Tapered legs for easy viewing. Large G.E. 7-segment fluorescent "blue-green" polaroid glow for the latest easy-viewing. FEATURES: 6 display tubes, completely etched and thru plated circuit board, all IC's. Includes BCD outputs for use with timer options, may be wired for 12 or 24 hour display. Indicates HOURS, MINUTES, SECONDS. 115 VAC 60 cy. Gift packed. Wt. 3 lbs. ★ 8" x 5½" x 3" case

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