AMATEUR RADIO

W8KEY Works 100 Countries on SSTV (p. 120)

SUPER-KEY (p. 31) . . .
Your Own Repeater (p. 76) . . .
OSCAR 7 (p. 46, 54, 62) . . .
SSTV -
Fast Scan Monitor
Grey Scale Generator

DOCKET 20282 COMPLETE!

one inflated dollar
FEBRUARY 1975
the buck passing stops here!

No more buck passing—trading or shopping once you acquire a Hustler two-meter colinear. It is the ultimate in mobile antenna performance—electrical and mechanical—the answer to your search for effective power gain—transmitting and receiving!

SPECIFICATIONS

5.2 gain compared to 1/4 wave ground plane
Frequency coverage - 143 to 149 MHz
SWR at resonance - 1.2:1 or better
Bandwidth for 6 MHz - 1.5:1 or better
Power Rating - 200 watts FM
Radiator - 85” consisting of 1/4 wave lower section, phasing transformer and 5/8 wave upper section

MODEL CGT-144—Easy—no holes to drill installation with trunk lip mount on side or edge of trunk lid. 180 degree swivel ball for optimized vertical positioning of antenna. Stainless steel radiator. Includes 17” MIL SPEC RG-58/U coax with all connectors attached. Antenna is removable from mount.

MODEL CG-144—Antenna supplied with 3/8”-24 base to fit all standard mobile ball mounts (mount or cable not included).

AVAILABLE FROM ALL DISTRIBUTORS WHO RECOGNIZE THE BEST!

THE QUICK – QUICK DISCONNECT

MODEL QD-1—For easy press and twist removal of your two meter colinear or Hustler HF mobile, add this assembly between antenna base and mount. It’s 100% stainless steel, rugged and precision.
W2FJT 26 Sneaky Fast Scan Monitor for SSTV
K6ZN/W6GXN 31 Behold! — Super Key
WB8DQT 46 What Time is the Next Satellite?
W3HUC 54 CQ OSCAR 7
WA4WDL 62 How to Find a Satellite
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W1HCl/W2EDN 76 Build Your Own Repeater — for only $365
K9WQY 90 The Heath SB-103?
W2FJT 93 Get into a Grey Mood — Generate
WA0ABI 96 Instant Neutralization
K7NZA 99 Phoenix Hams Show How It’s Done
WN7KUD 108 Oh, the Lost Art of Diplomacy
W6GXN 111 Further Adventures of the Bounceless Switch
DJ0HZ 115 Is Automated CW Possible?
W8YEK 120 100 Countries on SSTV
W7CSD 123 Joys of the One Night Stand
WA5KPG 129 KOX for CW
W2BJB 137 Quick Capacitor

RESTRUCTURING HAS ARRIVED!

The FCC docket proposing sweeping changes in our rules is reprinted in full in this issue. Instead of telling you what it says, it will be better if you take the time to read the whole docket through carefully — making notes as you go — and consider it as a whole.

Many amateurs will find one or more parts of the proposals which will be objectionable. Though this may be like trying to hold back the incoming tide, it is suggested that you make every attempt to view the proposed rules in the context of an overall pattern and try, as best you can, to overlook any ways that you, with your present grade of license, will be affected. Keep in mind, as much as you can, that the FCC has written these proposals with the view of having a set of rules which will achieve certain ends:

More amateurs instead of fewer. True incentive to upgrade tickets. Minimum impact on present licenses.

In evaluating the docket, it is suggested that references to CB operation only be used if you have been an active CBer and really know what you are talking about. Draw upon your personal knowledge, not what you've read or been told. The fact is that there has yet to appear any honest evaluation of CB operation in the amateur press. The same reservation holds with respect to popular biases for and against Novices, Techs, Conditions, and such. In your comments draw upon personal experience, and try to keep perspective.

It will take a lot of discussion over the air, at radio clubs, and with friends to develop a rounded and clear understanding of the docket and its ramifications such that you will be able to comment and make suggestions intelligently.

It looks as if we will get a good shake on this one — unlike the "incentive licensing" disaster which was turned over to someone with no understanding of amateur radio to be developed — and which failed utterly

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NEVER SAY DIE

EDITORIAL BY WAYNE GREEN

— making this docket necessary. We have five months leeway to work out our responses to 20282, so let's get working on it.

QRP LICENSE PETITIONED

RM2463, filed with the FCC, requests that a new class of license be set up which would avoid all math calculations. It would have a 5 word per minute code exam and a simple test for rules, CW operating procedures and basic CW theory. Privileges would include 5 or 10 watts power in a small segment of a seldom used part of a band...perhaps the lower part of 10m.

Having recently made a set of cassette tapes of the Novice theory as well as the five words per minute code tapes, I think I can say that the present Novice exam is pretty damned simple. I note that kids of 9 and 10 years are able to pass it and I really wonder how many people are really unable to cope with this simple exam. W9EHR/7, who submitted the petition, says that this class of license was inspired by his work with older people and that many of them are unable to make the arithmetic calculations called for on the Novice exam. He feels that many older people don't even try for the Novice license because they don't have a high school education...and he feels that amateur radio would be a great blessing for these lonely people.

Undoubtedly amateur radio has a lot to offer lonely people, if only we could get the word to them and get them interested enough to try it. But do we need to simplify the Novice test for this?

WHAT CAN I DO...?

A great many amateurs are concerned over the steady drop in the number of radio amateurs and feel that something should be done about it — but they are frustrated — for after all, what can one individual do? The fact is that just a handful of seriously interested amateurs could do a lot and could easily turn the whole situation around.

The circumstances that have gone

INTERIOR DECORATION BY
Henderson's Creative Work
into making the situation we have today are mostly the result of neglect — of apathy. "Incentive licensing" may have hurt us a lot more than many amateurs realize and the results are still with us.

Now, to get down to brass tacks, here are some ways of helping that can be undertaken by individuals:

1. Help your local ham club. What clubs can do to help will be covered later.
2. Help high school ham clubs. This means helping them to form, offering advice to youngsters, helping them set up license study classes, helping them get a club station going, etc.
3. Give talks. Civic groups are always looking for speakers — so talk to the Rotary, Lions, etc., about the benefits of amateur radio to the community and to the country. Talk to Boy Scout groups — invite them over to see your station — help them start a ham club. Talk to CB groups.
4. Sport a bumper sticker which says, "Ask Me about Ham Radio." You'll get action from CBers and others.
5. You can spark interest on the air on the low bands or via repeaters if you organize a code practice broadcast — a theory broadcast, perhaps with Q&A afterwards. Perhaps you can set up a beacon to help VHFers know when the band is open. Or perhaps you can broadcast news bulletins of interest to amateurs such as are published in the Hotline and other ham newsletters.

HOW CAN CLUBS HELP?

1. Demonstrations set up in shopping plazas to interest people. This can be followed up with a pamphlet explaining the benefits of amateur radio as far as a career is concerned — as an antidote to loneliness — and for fun. Club bulletins giving info on club meetings and study classes can also be used to follow up leads.
2. Demonstrations at high schools. Half of the Novices last year were 14 and 15 years old. This is where the career pitch can be particularly valuable in attracting new blood.
3. Get license study classes set up with code practice, theory talks, Q&A sessions.
4. Get prospective amateurs to come to club meetings and study courses by means of those demonstrations — ads in the local papers — posters in the radio stores — posters in high schools — publicity on the radio.

Continued on page 135

HOTLINE HEADLINES

... late breaking news for the active radio amateur ... in summary.

OSCAR 7. The launch was successful and much DX is being worked via O7. Couple Murdered? Amateur radio reports responsible for helping catch a woman involved with possible murder of boating couple at Palmyra Island.
CARF Opposes GRS Skip Proposal. The Canadian Federation filed in opposition to the proposed plan to permit Canadian CBers (GRS) work skip and hobby on 11m.
Aviation Week Oscar Article, October 28th issue has a great article on Oscar 7.
KC4NI Makes It. Navassa Island active again as W2 group fired up.
FK0 DXpedition. California group active from New Caledonia. Previous stop was Wallis as FWO.
Most Wanted DX List. Top DXers need Cliperton, Bouvet, So. Sandwich, etc.
Restructuring News. Communicator Class license certain now — Conditional to be non-renewable — new calls.
Truck CB Prohibition. The ICC proposes to prohibit CB in trucks! May be able to get away with this.
Police CB Licenses Issued! State police heading for massive installation of CB units — 2000 in Illinois alone — Smoky may soon talk back — and bite.
WR Calls Mandatory Soon. FCC will soon require all repeaters to have WR call if they are to continue to operate.
Sun Spot Madness. 73's expert Nelson predicts incredible events for the next cycle.
New ID Plan Proposed. Standardized tone for 1D of 102 Hz so it can be filtered out by receivers when not needed.
CB Dealers Fight 20118. Dealers and manufacturers furious over CB linear outlaw rule.
Oregon CB Couple Caught. CB was used in the bomb threat and direction finding units located them.
License Fees. New wrinkle — FCC license fees may be dual taxation and thus illegal.
FCC Sideband Policy. Standards for unwanted sidebands which seriously effect 3990ers and other band edge ops released.
Clegg Synthesizer. Details released on the new Clegg rig — looks fantastic.
Clegg Contacts Coordinators. Clegg is working with frequency coordinators before shipping repeaters to make sure channels have been cleared.
ARRL Elections. All incumbents elected again. Ho hum.
Jordan Off VE Banned List. The recent visit of JY1 to Canada helped to clear the red tape and make it possible for Canadian amateurs to contact JY stations.
Direct Mail Sales Gaining. Genave switch to mail order was successful — many other firms considering the switch.
OST Printing Costs Up. The ARRL reported that costs have risen about 33% in 1974 over the same period in 1973. Loss in third quarter was a reported $45k!
Amsat Oscar 7 Covers. First day stamped covers available for collectors.
Electronic Design Apologizes. Their boo-boo labeling CBers as hams brought an apology.
Dallas War Chest. The DARC is getting ready for a fight against a local tower ordinance — asking for contributions.
W8YEK Makes 100C on SSTV! The first 100 country slow scanner.
FCC. Caught in sneaky "editorial revision."
DX Advisory Committee Changes. ARRL committee gets four new-comers.
New IRC Coupons Issued. Old ones will be good for two years.
New FCC Prefix Issued. Look for WD6's — honest.
IFRB Study of HF in Progress. Report due ITU later this year, key to possible new bands.
Alien Licensing. Senate bill 2457 has passed Congress and awaits Presidential signature.
Flying Magazine Ham Article. Stresses autotapatch 2m repeater operation. Many alarmed.
A5 Magazine in Trouble? Another specialized ham magazine folding?
ATV Repeater DX. WA3BI8 works into Washington from 70 miles out.
VE3AHH Awarded Trophy for work in building CARF.

FEBRUARY 1975 3
Looking West

Bill Pasternak WA2HVK/6
14725 Titus St. #4
Panorama City CA 91402

It’s hard to be objective when I write about the Palisades Amateur Radio Club and the many things that we accomplish. In the past I tended to avoid writing about P.A.R.C. inasmuch as I am very involved in the club and my remarks would tend to be anything but impartial. However, any radio club that brings along it’s own repeater, complete with voice ID and special call sign, more than deserves a mention here. When we realized how many P.A.R.C. people were planning to attend the San Diego Convention, the idea of a portable repeater on the .01 – .61 WR6ABB channel was born in the mind of Fred Deeg K6AEH now P.A.R.C.’s Vice President. Fred applied for and was granted the Special Events Call sign WR6FM for use at the convention. Neil McKee WA6KLA, who might know more about Motorola two way FM equipment than the people that designed it, put a Motrac, a Mocom, my Norelco Carry-Corder and a few other pieces of peripheral equipment together and made an instant repeater with better coverage than the .34 – .94 official convention talk-in machine. (Personally tried both and .01 – .61 was usable for a greater distance than .34 – .94.) Did WR6FM get use? When a radio club full of .01 – .61 users invades an Amateur Radio Convention what would you think? Next stop is S.A.R.O.C. and hopefully WR7FM.

There is a growing trend on Southern California repeaters, ones of the non club sponsored variety, toward formation of user representation groups. These are amateurs who have organized to provide financial support to their favorite repeater while leaving matters of technical performance and operating practices to the discretion of the licensee. Organizations such as the Mt. Wilson Repeater Association and Mt. Lee Repeater Association coordinate monetary donations, user technical assistance to the licensee and social functions amongst themselves. One of the matters discussed at length at the Southern California Repeater Association meeting held at the San Diego Convention was the official recognition of these groups by S.C.R.A. and granting them voting privilege. Though a number of different plans were offered in this direction, it was decided that giving user vote in an organization designed to coordinate repeaters and the needs of their owner/licensees/trustees might tend to undermine the organization in the future. At the moment it is the repeater owner who is responsible in the eyes of the FCC for his system (though 20112 will substantially change this) and it is felt among the majority of repeater owners attending this meeting that many decisions that affect their respective systems are theirs alone to make. Therefore, such user groups can only remain as non-voting associate members. While this gives them and any other interested associate member a voice in any debate on any question, it will remain to the voting members, the repeater owners and licensees to make any final decisions.

About a year ago, the hottest controversy in the Los Angeles FM world was if a .34 – .94 repeater could survive in an atmosphere divided heavily pro and con. Those opposing it went as far as starting a group then called “Save our Simplex” to oppose it. It seems that all the controversy was for naught since, after a few tests, WR6ABO never went into full time operation. After waiting about nine months, six months more than necessary under the S.C.R.A. rules, the sanction of WR6ABO was cancelled by the S.C.R.A. Technical Committee due to total inactivity. Whether anyone else will apply for it in the future is in doubt. It’s one of those hot-potatoes, as is .16 – .76. However, the latter has been sanctioned to the San Diego area and it will be interesting to see the reaction when that system gets into operation. In the L.A. area, and here in the San Fernando Valley especially, 146.76 is a heavily used simplex channel 24 hours a day. If care is taken to keep its signal out of L.A. proper it may well survive with little opposition.

When the S.C.R.A. was formed two years ago, there were so many pressing problems locally that our neighbors “South of the Border” were all but forgotten. At that time there was little FM activity and no repeater operation in that area. But times change and so do the needs of amateurs everywhere. Mexico is a very dramatic example of this. Our XE brothers have discovered the advantages of FM Repeater operation and are busily at work setting up a band-plan along with a number of wide coverage machines to provide coverage from the border on South. One of the most important needs of the Mexican amateurs to implement this communication system was a couple pairs of standard 30 kHz channel allocations; ones that would not interfere with or be interfered with by existing Southern California repeaters. By reshuffling a couple of existing smaller repeaters to either shared or split channels, our XE neighbors now have at least one of the two allocations they requested and the second will be following in short order. Looking West would like to hear from the amateurs in Mexico to know how their work is progressing.

Finally, as of this writing, December 1, 1974, none of the split-split allocations for Southern California have been officially designated, so it will be a little time yet till we can let you know how well things are working. As soon as we know, you will know.

Not long ago I was forced to report the demise of the open autopatch function on the WR6ACK repeater in West L.A. While ACK was the first attempt at such a service, another such system has come into existence and from all reports is having far less trouble than did ACK. Operating on 147.72 – 147.12 is WR6ADH in its home in the Monterey Park area of Los Angeles. ADH offers better coverage, both radio and telephone dialing area than did ACK and has been quite lucky in that the phone-freaks have left it alone to grow. On the ADH system, you can call from Malibu on the west to Fontana on the east; Newport Beach on the south to Palmdale on the north. In fact, there are few areas that you cannot call, and over a hundred dialing prefixes are toll free. Anyone desiring more information on the WR6ADH autopatch system should send a SASE to WR6ADH, P.O. Box B, San Gabriel, California 91778. They will supply you with an informative letter that goes into far more detail than I have room for here.

As you read this in February, another meeting of the Southern California Repeater Association will be taking place. If you read this before February 2, and want to see how a well organized repeater coordinating organization is run, the time
is about 10 AM at the Belvedere Park Gym in East Los Angeles. The mid-February issue of HOTLINE will carry the highlights and a complete update will appear in April Looking West. Oh yes, the Mt. Wilson Repeater Association will be host for this S.C.R.A. meeting.

---

**novice**

Schley Cox WB9LHO
1613 Colburn Avenue
New Albany, IN 47150

LESS IS BETTER

Some Novices can't wait to put away their key when they get their General ticket. For them CW operation has become a horror to be endured at the insistence of the FCC.

Other Novices learn to appreciate CW for what it can do and find themselves at home with either a key or a mike when they upgrade their ticket. One group probably learned the proper use of abbreviations and Q-signals; the other one didn't.

Consider the two following statements. (A) THANK YOU FOR THE CALL OM // YOUR SIGNAL RST IS 569 569 AND MY QTH QTH IS NEW ALBANY, INDIANA NEW ALBANY, INDIANA // NOW BACK TO YOU...; and then; (B) TU RST 569 QTH NEW ALBANY, IN // HW?...

The statement (A) may sound a little friendlier at first than (B) but it contains 77 more characters. It takes three times as long to send. If a CW operator carries on a conversation spelling out every word, repeating almost every other word and being redundant with the Q-signals, it won't take long for him or her to decide that a microphone is the only way to go in amateur radio.

There's no need to send "MY QTH IS..." because sending "QTH" means "My location is...". Sending it the first way actually means "MY MY LOCATION IS...". That sounds silly when you read it that way but many amateurs (not just Novices) send four extra characters every time they tell someone where they are.

How about "YOUR SIGNAL RST IS 579"? "RST 579" means the same thing and is a lot shorter to send: A little savings here and there begins to add up.

"WHAT KIND OF ANTENNA DO YOU HAVE?" could be sent "WHATS UR ANT?". "WELL I GUESS I HAVE RUN OUT OF THINGS TO SAY HERE" could be sent "QRU".

An efficient CW operator, whether sending at 5 or 25 wpm, avoids sending what is already obvious. What do the numbers 40475 or 80816 mean to you? Of course they are ZIP codes. There is no need to send "ZIP HR IS 40475." Just send the numbers after the address. The operator on the other end will understand.

Once you get the preliminaries out of the way, rag chewing can go a lot faster and be a lot more enjoyable if both operators use some common abbreviations and techniques.

Keep a list of CW abbreviations and Q-signals at your operating table. Try to use them as much as possible while keeping your meaning clear.

A little on-the-air experience will tell you if you need to repeat your location or name in order for the operator on the other end to copy you most of the time. If you live in Chicago, there's no need to send "QTH CHICAGO, IL CHICAGO, IL". Most operators will know where you are the first time around. If they don't they can send "QTH?".

If you live in Paoli, IN or Florissant, CO or someplace with a less than common name, some on-the-air experience may tell you that you should repeat the name so that the operator on the other end won't have to wonder if he copied correctly.

Despite urges to adopt some nickname like "Rocky" or "Bob" I stick with my given name on the air. I send "NAME SCHLEY SCHLEY OM".

The operator on the other end can check his copy with the repeat and not have to worry about my gender.

If you can think of a way to shorten how you say what you have to say on CW you may find that your key, or bug gets to stay on your desk next to your mike when you drop the N.

If you have a particularly good (or bad) experience getting your Novice ticket, waiting for it to arrive, learning the mode, studying for the written test, or setting up a station, let me know. I would like to get some information together for a column or two on preparing for the test and setting up that first station.

If you have an idea for a topic you would like to see discussed here drop me a line (or better yet, send an amateur radiogram). GL ES HPE CU SOON.
three months the usual application for a Danish amateur radio license should be sent in. The Danish repeaters were listed in the last traveling ham column.

The two meter scene in Italy is also humungous. There are nearly one thousand amateurs on two meter FM and they are planning a repeater chain to cover the whole country. Italy does have a reciprocal agreement with the other common market countries and last summer over 60 Europeans took advantage of that agreement to obtain permits to operate in Italy. Most of those were from West Germany. For prefix hunters the IW prefix identifies stations having a "Technician Class" license who are permitted to operate on frequencies above 144 MHz with a maximum input power of 10 W.

To those of you who sent in encouraging notes and QSLs, here are my thanks. It is nice to know that the long hours spent pecking away at the keyboard are appreciated.

...G3ZCZ

Bob W9LUO of SSTV fame. I'm sure many of you know of his "W9LUO Monitor."
and need assistance, drop me a cassette tape or meet me on 14.230 kHz Saturdays around net time.

Newsg Happenings

Henry WA4NXZ is operating Independent Sideband using a pair of NCX-5's slaved to one remote vfo. He pulled the oscillator transistors from each rig and fed the remote vfo signal to both transceivers. One NCX-5 was switched to upper sideband and the other NCX-5 was switched to Lower Sideband. Henry is building a four-811 linear which will have the capability of operating all four tubes on audio or video - or switched to operate two 811's on voice and two 811's on video. The linear's output will feed one antenna.

Although WB5IXK didn't submit a log last year, he placed second in the world-wide Slow Scan TV contest. He used a felt pen and fast hand to rack up a high score. I understand that he will be operating a SSTV Keyboard this year. Hmm quite a few fellows are beginning to build PC board circuits. BRAVO!

KH6HJF has been transmitting SSTV to several JA's via Oscar, but still awaits a two way Slow Scan QSO via the satellite.

W2DD, an old time SSTV'er, is now writing the SSTV column in World Radio News. W6EYY reports that Slow Scan activity in Japan is steadily increasing. JA activity is heard between 0530 and 0700 GMT around 14.230 MHz, and on 21.340 MHz between 2200 and 0100 GMT. His list (in this month's column) of JA's worked on SSTV is a nice guideline of Japanese stations presently operating SSTV. Now you know who you should hunt.

JA0BZC
JA0CVF
JA6DG
JA1EOD
KA2EI
JA7GY
JA8ACP
JH1PZN
KA2DF
KA2MW
JA00E
JA2KB

List of Japan SSTV Stations worked by W6EYY.

SSTV ADDRESSES

WA9UHV - Phil, 4012 Carmelita Blvd., Kokomo, Indiana 46901. Slow to Fast Scan Converter boards and info.

W6MXV - Mike, 6941 Lenwood Way, San Jose, California 95120. Fast to Slow Scan Converter Boards and kits.

W8OZA - Russ, 1411 Lonsdale Rd., Columbus, Ohio 43227. Fast to Slow Scan Converter and SSTV keyboard, boards.

K7OLO - Jim, 2930 Sorrel Way, Eugene, Oregon 97401. SSTV Keyboard info and boards and Fast to Slow Scan Converter boards.

SLOW SCAN CONTEST

ANNOUNCEMENT

The yearly worldwide Slow Scan TV contest is happening again during the eighth and ninth of this month, and a large amount of activity is expected. This will be a joint contest with 73 awarding a year's subscription to the world winner. U.S. stations should send me, K4TWJ, a duplicate of their logs and scores to be eligible for the 73 award. Don't forget to include a photo with your results. We will run the photo (and contest results) in this column, then return it to you. Notice in the accompanying rules that past winners face a six per cent deduction handicap, and each U.S. call area is considered as a separate country. As usual, the information exchange (call sign, report and QSO number) must be made by means of the SSTV mode. For the 73 awarding, a photo must be included with each log. Good luck, and we hope to "see" you in the pileups!... K4TWJ

World Wide SSTV Contest Rules

Sponsored by the cq electronica and 73 Magazine.

The Italian Magazine cq electronica and the American 73 Magazine have pleasure in announcing the 5th Worldwide Slow Scan Television Contest. The purpose of this Contest is to promote increased interest in the SSTV mode of operation as used by Radio Amateurs.

RULES

1) PERIOD OF CONTEST

Part 1 15.00-22.00 GMT on February 9th

Part 2 20.00-14.00 GMT on February 9th

1975

2) BANDS

All authorized frequencies within the 3.5-7.0 - 14.0-21.0 & 28.0 MHz bands.

3) MESSAGES

Messages will consist of: Exchange of pictures and also included are a) the call sign; b) report (RST); c) serial number.

The serial number must start at 001 and is increased by one for each successive contact during the period of the Contest and the serial number is irrespective of the Band(s) used. Exchange must be made exclusively with the SSTV mode. For the "W" are accepted the FCC rules.

4) EXCHANGE POINTS AND MULTIPLIER

a) Contact score 1 point per contact on the 3.5, 7.0, 14.0, 21.0 MHz Bands. 2 points per contact on the 28.0 MHz Band.

b) A multiplier of 5 points for each Continent (Max 30 points) and 2 points for each Country (ARRL List) worked can be utilised on each band. In addition to the ARRL List will be considered as separate Countries the W call areas W0 to W9 and VE call areas from VE0 to VE7.

The same Continents and Country is only valid once on each Band. The same station can only be worked once on each Band (Max 5 contacts) during Contest period.

5) SCORING

Total exchange points multiplied by the multiplier total.

6) HANDICAP

Winners of precedent Contest: less 6% of the total final score.

7) SECTIONS

a) Entrants transmitting and receiving video.

b) Entrants receiving video only. For this purpose the same general rules apply and the same station heard is valid once on only each Band.

A separate results table will be made for each of these two classes of entry.

8) LOGS

Logs should contain: Date, Time of contact (GMT), Band in use, Call sign, Report (RST) sent and received. Serial numbers sent and received, points, multipliers and final score.

Although not essential, it would be appreciated if entrants could enclose a cover sheet with a short description of the Station (With photo if possible) together with any comments on the Contest.

All logs must be received by not later than March 25th 1975 in order to qualify. Send them to: Prof. Franco Fantu Via A. Dallolio n. 19 40139 Bologna ITALY

9) PRIZES

1) A free 12 month's subscription to cq electronica Magazine.

2) A free 6 month's subscription to cq electronica Magazine.

3) A free 6 month's subscription to cq electronica Magazine.

10) RULES OF BEHAVIOUR AND PENALIZATION

The Logs must be compiled in accordance with the Rules listed in (7). The contacts must be made by means of the SSTV mode and it is not permitted to use other mode of transmission either before, during or after the exchange of message by Slow Scan Television. During the Contest it is expected that Amateurs will observe the fundamental rules of courtesy and good operating during contacts.

Failure to observe any of the above rules will result in the exclusion of the entry from the final results and any such Log received will be considered as check Logs.

All Logs received become the property of the Edition CD and will not be returned.

The decision of the organising Committee in any dispute will be final and any subsequent controversy cannot be referred to the Civil Court.
REPEATER OWNERS

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

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.
One of the more interesting items on the surplus market these days is a "broadband tuner," stock number RT-45, offered by Fair Radio Sales Co. Inc., 1016 East Eureka Street, P.O. Box 1105, Lima Ohio 45802. This item is stated as covering 14 to 50 MHz, but slight modifications in the form of adding shunt capacitance or rewinding the coil would allow coverage of about any HF/VHF frequency range you might need. As received, the unit is enclosed in a nice aluminum box measuring approximately 2" x 3" x 4" (50 x 75 x 100mm). The lower half contains an octal socket (intended for a 6SJ7) along with an assortment of resistors, capacitors and chokes. A few minutes with screwdriver, soldering iron and hacksaw will reduce the 100mm dimension to about 60mm if space is critical.

Electrically this tuner is an ordinary parallel tuned circuit but mechanically it is definitely something else. The double bearing, 150 pF capacitor's rear shaft is extended approximately 40mm and is fitted with a 30mm diameter drum which is provided with a spiral slot. A pin rides in this slot and drives the ferrite slug of a 3/8" (9mm) coil mounted parallel to and below the capacitor shaft. As the capacitor shaft is rotated clockwise the plates unmesh and simultaneously the core is withdrawn from the coil. This combined action decreases both the inductance and capacitance and allows the tuned circuit to cover a much greater frequency range than would normally be possible.

There are any number of uses to which this tuned circuit could be adapted. The original intent was to use it for a general coverage converter for a ham band only receiver but so many other uses have come to mind that I have bought several more to allow experimentation. The following may give you a few ideas of what you can do with this $1.95 item.
OSCAR 7

The satellite continues to do a splendid job. Mode A is operative on odd days and mode B on even days. Don't use it on Wednesdays please. It's out, but should be left alone.

A little rf interference has developed on a few of the telemetry channels (1A-2D).

The space-only on-off RTTY function is a normal one, but unpublicized previously. Please send in reports of TT contacts via this mode.

The 2m-10m signals have been heard from way over the horizon by several English ops and East Coast ops are asked to particularly keep an ear peeled for any European signals coming through on over the horizon passes. Reports on this will be appreciated.

The Oscar 7 QSLs are now being sent to those who furnish reports.

A German op heard a Spanish station coming through the 70/2m link and further information on this is hoped for soon.

Oscar 6 continues to work well and G3IOR reports that he has now made contact with 50 countries via the satellite! Amsat reports 87 countries so far reported via Oscar 6 and nearly 3000 users.

There are three new Amsat nets. One on Saturdays at 1000z on 14280, one on Sundays at 1015z on 3780, and one in London with net control G8CSI on 144.28 at 1730z.

Amsat reports that it has sent out a list of the predicted orbits for both satellites to everyone on their mailing list, complete with a list of some of the accomplishments so far. They also report that reprints are available of some of the tech articles from the Amsat bulletin with good info on equipment to use, modifications of equipment, and how to work through the satellites.

HR report erroneously said Amsat had some slides of the project — these are available, but from ARRL, not Amsat.

The mailing address for Amsat is:

Amsat, P.O. Box 27, Washington DC 20044.

OSCAR 6 ORBITING DATA

A little study of these figures should allow extrapolation of times for future dates.

<table>
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<th>Time (GMT)</th>
<th>Longitude of Eq. Crossing</th>
<th>(W)</th>
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<td>59.1</td>
<td></td>
</tr>
<tr>
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<td>2</td>
<td>0137.4</td>
<td>72.8</td>
<td></td>
</tr>
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<td>0037.4</td>
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<td>0006.5</td>
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</tr>
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</table>

Voltage regulators are required in many solid state circuits today to compensate for the effects of varying line voltages. Also, regulators allow use of power supplies with poor load regulations for non-critical parts of a circuit, and the addition of regulation to only those portions requiring a stable power source. Regulators with built-in short circuit protection provide some protection for the main power supply as well as the load circuit.

A very useful series of ICs has been introduced by Fairchild. This is the 78LOO series of 3-terminal positive voltage regulators. These regulators employ internal current limiting and thermal shutdown, making them essentially indestructible. If adequate heat sinking is provided, they can deliver up to 100 mA output current. They are intended as fixed voltage regulators in a wide range of applications including test equipment, onboard regulation for elimination of noise, solving distribution problems associated with single point regulation, and general purpose power supply use. In addition, they can be used with power pass elements to make high current voltage regulators. The 78L00 used as a zener diode/resistor combination replacement, offers an effective output impedance improvement of two orders of magnitude, along with lower current.

Typical output voltage change is 1% with input voltage variations, and 1% with from 5 mA to 100 mA load current variation. Available output voltages are 2.6, 5, 6.2, 12, and 15 V dc. The units are available in either ± 5% or ± 10% voltage tolerances. Maximum input voltage is 30 V dc except for the 12 and 15 V devices which are rated at 35 V dc.

The superiority of the 78L00 compared to the standard 400 or 500 mW zener (1N746 or 1N5221 series) is shown in Fig. 1. The resistor/zener combination can supply a load current of 17 mA with a quiescent current of 20 mA, while the 78L00 can couple up to 100 mA of load current with a quiescent current of 5 mA. At 5 mA the temperature coefficient of the 78L00 output voltage is equal to or better than the zener and output noise voltage is reduced when using the 78L00 series.

This regulator is available in a TO-39 metal and the more common TO-92 plastic package. The 3-lead plastic package is available from your Fairchild distributor as the 78L12WC (12 V version – last digits indicate voltage and tolerance) for $0.75 in single quantities.

For higher current requirements, Motorola has a series of 3-terminal voltage regulators for both positive (MC7800C series) and negative voltages (MC7900C series). The 7800 series of fixed positive regulators is available in voltages of 5, 6, 8, 12, 15, 18, and 24 V. The 7900 series is
to obtain even higher output currents. Each of the regulator series will accept a maximum input voltage of 35 Vdc except for the 24 V versions which safely accept up to 40 V. The simplicity of the 3-terminal high current regulator permits you to locate regulated power supplies exactly where they are needed avoiding long runs of power leads. The regulator circuit becomes very small and compact compared to the normal discrete parts version. Normally, no external components are required. The 3-pin package shown in the photo is designed for easy mounting to a heat sink to allow the greatest power dissipation rating.

The positive MC7812CP (12 V) can be obtained from your Motorola distributor for $2.20 and the MC7912CP negative (-12 V) for $4.15 in single quantities.

Motorola has introduced a major package innovation to the rf power industry. The MRF227 contains a unique beryllia-insulated die mounting technique used to significantly improve the power dissipation and gain of the standard TO-39 style package. These improvements enable a designer to replace expensive stud mounted, medium power devices, in rf applications, with a low cost alternative. Resultant price savings of 2 to 1 over stud mounted devices are achieved.

This package innovation enables the use of the TO-39 style at medium power levels. By mounting the transistor die on a beryllia insulator, the collector is electrically isolated while still allowing heat to be conducted to the case header. The photo shows an enlarged view of the die and insulator mounted on a TO-39 header as well as a 220 MHz amplifier test circuit.

The emitter is connected directly to the case which is soldered to circuit ground; this provides lower emitter inductance and reduced parasitics in the common emitter configuration. In a typical installation, as shown in the photo, the device is mounted directly to a heat sink or the case of the equipment. No more insulating washers and associated mounting hardware!

Compared to stud mounted devices, where the collector is tied to the case for thermal reasons, this new technique can provide improved performance. A typical stud configuration requires bond wires from the transistor die to a substrate solder bridge. The bridge is connected to package leads and these leads are then soldered to the circuit. The beryllia insulated die mounting technique offers a lower cost part.

The MRF227 is the first device available from Motorola using this new mounting method. This device and new packaging technique was originally developed for the proposed class E CB section of 220. We all hope that this great development never finds its way into that type of equipment (and that the FCC leaves 220 as it is), but instead into the final or driver slots of homebrew or commercial 220 portable and mobile FM gear for ham use.

The MRF227 is conservatively rated at 3 W with a power gain of 13.5 dB minimum and an efficiency of 60%. Two more devices are expected to follow the MRF227. They are the MRF237, a VHF driver, and the MRF629, a UHF driver. More on these as info becomes available.

The unit price of the MRF227 is $2.50 (not bad eh, for a VHF power transistor?) and down to $2.00 for those who can find a use for 100 of them! This transistor could really start off an interest in building for a band that needs our attention and participation. Remember – 220, USE IT OR LOSE IT!!!
The first World War came along and I was kept busy as an infantry 2nd Lieutenant until I was discharged in June 1919. I returned to Littleton with the idea of taking the rest of the summer to demilitarize myself, do a little fishing and prepare for the next phase of my life. Two or three weeks after my return Bob Fogg arrived in Bethlehem in his Curtiss OX-5 Jenny. He was carrying one passenger at a time from a hillside field on Lewis Hill. I was interested enough to pay him $5 each for three ten minute rides. By that time my mind was made up. I wanted to learn to fly as a start in the aviation business that I felt was sure to develop in a few years. If I had known then that it was going to be another ten years or more before aviation would amount to much as a business I might have made a different choice.

Since I was then a 2nd Lieutenant in the Army Infantry Reserve I thought I might be able to get the Army to put me on active duty assigned to the next Air Corps flying school class. However, when I got to Washington in the fall of 1919 I found that I was about the only one to which my plan appealed. So I went over to Bolling Field in Anacostia and asked some of the officers for their advice on how best to go about getting an appointment to the Air Corps Flying School. Their advice was to get as many letters as possible from the New Hampshire Senators and Representatives to the Chief of the Air Corps recommending me for appointment as a Flying Cadet. I finally got letters from both Senators and one Representative and delivered them together with an application to the office of the Chief of the Air Corps. I was told that it would take some time to process the application and that I would be notified of their decision. I then got one of the Senators who knew my father quite well to phone the Chief once in a while to inquire about my application. Thus matters drifted on for a few months. I was back in Littleton when, in March, I received a letter from the Chief of the Air Corps requesting me to appear before a selection board at Bolling Field in April. This board would determine my fitness for appointment as a Flying Cadet. I appeared as requested, answered all of their questions and asked a few of my own. The decision of the board was to recommend my appointment provided I could pass their physical examination for flying. The next day I took the physical examination and passed
with no waivers. After this the board advised me that, since the 1920 class was full, they would enter my name for the class starting in Sept. 1921. Next month I’ll tell you about the air primary and advanced flying schools.

50 MHz BAND

Bill Turner WA0ABI
Five Chestnut Court
St. Peters MO 63376

WB0CHL writes that he is a convert to 6 meters and when he says convert, he means converts. Jim has converted an E. F. Johnson solid state SSB CB rig to 6 meters. The power output isn’t too great at the moment, about 2 W PEP, but a 60 W solid state amplifier is in the works to make it competitive with the 6146 tube rigs. Jim hasn’t had too much success “on the air” as yet but mentions openings from Northfield, MN on November 18th, 21st, 25th and 30th. I am sure everyone has read articles on converting CB rigs to 10 meters and even a few have been converted to 6 but to my knowledge this is the first SSB rig converted. Congratulations Jim.

K8DFR “Mac” writes from Lansing, Michigan to inquire about VHF Communications Magazine. For the benefit of those who don’t know, this is the English language translation of the German VHF/UHF magazine UKW Berichte (Ultra Short Wave Report). Published quarterly for a subscription price of $5.75, this magazine is basically construction and features all size PC layouts of all projects or you may obtain parts kit and/or PC boards from the subscription representatives. The rep. for the east is VHF Communications, 915 North Main St., Jamestown, N.Y. 14701. Those in the central and west should contact Bob Eide W0ENC, 53 St. Andrew, Rapid City, SD 57701.

While listening to the band trying to open to Fla. the evening of November 25 I heard WA4PXW working several stations. Signals were QSBing rather badly so I started tuning around a little. Up the band I heard a weak signal and stopped to listen, it turned out to be K7PXi from Phoenix. I immediately turned the beams from SE to SW only to find the signal had completely disappeared. After much beam swinging it was determined that Carl was weak but consistent with the beams SE with absolutely no copy to the SW. I listened as contacts were made in Texas, Oklahoma and (as I remember) Louisiana. All during this time WA4PXW could be heard occasionally but never for more than a few seconds at a time.

Forrest K4YPO telephoned just to say hello while on vacation in the area... K0KYZ/8 called to ask questions about the SBE SB-50, he is thinking of buying one... Yaesu planning to ship the first FT-620B’s to dealers the third week in December, they should be available in quantity by now... WA4BDW has petitioned the FCC to require all Technician examinations be taken before the FCC or designated authority, a good idea I think... it would remove some of the stigma and at the same time make it simpler to study for the General. Did you see the excellent 50 MHz propagation article in Ham Radio’s December issue or the 6 meter conversion for the SB-220 in December’s QST?

From Dallas WA5IKU mentions a number of openings: “Good to better on 11-17 - WB4LDO/4, WA9RDF, K8RZB, and many others... all good strong signals.” Unusual opening 11-25, “worked WA4IMG and WB4YSE... band very noisy... tuned down around 50.085... beam south... Spanish QSO on AM... very strong for a few minutes.” By later postcard Perry mentions another opening 11-30 “band really opened up today. Heard 0, 1, 4, 6, 20 to 30 over 9. Very good contact with W8CZ - Marty - New Mexico... great signal.” Perry would like to hear from other hams who are postal employees; write him at 2240 Prichard Lane, Dallas, TX 75227.

Joe WB4OSN says the band has been rather dead in Florida but we did talk twice during the month and other later reports indicate an upturn late in the month.

By the time this appears in print 1975 will be well under way and it will be time to begin any projects which are to be completed before the spring DX season. If your rig needs to be overhauled, do it now. If you want that linear finished, you had better get underway. It isn’t too early to start planning the antenna and tower modifications either. Plans here include a cathode driven single 4CX250B in a case to match the SB-50 and pulling down the time ravaged pair of 6 element Telrexes and installation of a single 8 element KLM along with raising the tower an additional 10 feet (3.6M).

...WA0ABI

QSL CONTEST

There is no way to do justice to this month’s winner on a black and white page. The colors are brilliant. Those that abut look gorgeous together and all the colors are balanced well, with careful consideration given not only to the letters which touch each other but the overall effect of the design, that the result is a terrific piece of op art. George wins the free one year subscription this month. Send in your entry to 73, QSL Contest, Peterborough, NH 03458.

Photo taken by WA4WBR in Betheny Beach, Delaware.
NOTICE OF PROPOSED RULE MAKING

Adopted: December 4, 1974;
Released: December 16, 1974

By the Commission: Commissioner Quello absent.

1. The Commission has before it the above listed petitions (also listed in more detail in Appendix I) for rulemaking. Principally, petitioners are seeking amendment to the Rules for the Amateur Radio Service regarding operator classes, requirements, and privileges. Some desire additional privileges for only one specific operator license class, or desire lower requirements for one specific class. Others want more extensive amendments, such as the deletion, or addition, of an entire license class. Some would establish a new “Hobby” operator license class, having no telegraphy skill requirement. Of these, RM-1841, RM-1901, and RM-2063 would have this operator class in the Citizens Radio Service. Since operation of a radio station as a hobby or diversion, i.e., an activity in and of itself, is prohibited in the Citizens Radio Service, we consider such operation to be one more suitable to the Amateur Radio Service. Thus, these three petitions are included in this proceeding. RM-1633, RM-1656, RM-1793, and RM-1841 are also included in Docket 19769, but will be considered herein to the extent applicable. Additionally, petitions RM-1947 and RM-2256 contain proposals otherwise pertaining to operator privileges and are included herein for that reason.

2. RM-1629 relates to the possibility for conducting operator examinations at places other than regular Commission examination points by persons other than Commission employees. Since the entire matter of amateur radio operator examinations will be under consideration in this proceeding, it is also incorporated.

3. The type of amendments requested by the petitioners cover a broad scope of thoughts and ideas. In summary, the salient requests are:
   a. Authorize some, or all, Novice Class privileges to the Technician Class.
   b. Permit a person to hold both a Novice Class license and a Technician Class license.
   c. Authorize some privileges in the 144-148 MHz frequency band to the Novice Class.
   d. Authorize all of the 144-148 MHz frequency band to the Technician Class.
   e. Authorize some privileges in the 28-29.7 MHz frequency band to the Technician Class.
   f. Reallocate the frequency subbands among the various license classes.
   g. Establish new frequency subbands for incentive purposes in the 1800-2000 kHz bands.
   h. Authorize Amateur Extra Class operator privileges to Advanced Class operators.
   i. Limit transmitter power privileges for General Class operators to 250 watts on the 3.5 MHz, 7.0 MHz and 14.0 MHz frequency bands.
   j. Limit transmitter power privileges for all operator classes to 300 watts on amateur frequency bands below 30 MHz.
   k. Specify maximum transmitter power in terms of output.
   l. Establish a new Hobby Class license, or a new VHF Telephony Class license having no telegraphy requirements or privileges.
   m. Establish a new Beginner Class and a new Code Class of operator licenses.
   n. Combine the Novice Class license and the Technician Class license into a new VHF Telephony Class.
   o. Establish a new Intermediate Class license and a new Communicator Class license.
   p. Establish a new Advanced Technician or First Class Technician Class license.
   q. Discontinue the Conditional Class and Technician Class operator license.
   r. Issue the Amateur Extra Class operator license for life.
   s. Reduce Element 1(B) telegraphy requirement from 13 words per minute to 10 words per minute.

Obviously, we cannot accommodate all of these requests because some are in conflict with others. We do not believe it is desirable to deal with these petitions on a piecemeal basis, since many are interrelated. Accordingly, we conclude the time is propitious for a review of our entire amateur licensing structure. To this end, we have reviewed the petitions carefully, together with the existing system of operator privileges and requirements, against the fundamental basis and purpose of the Amateur Radio Service. The following represents our best forecast of the direction we should move in this matter.

4. We recognize the desire by some amateurs, and would be amateurs, as expressed in RM-1633, RM-1793, and RM-1976, for a class of amateur oper-
operator license having requirements that do not include a knowledge of telegraphy. Although every amateur radio operator license has traditionally required the applicant to demonstrate some level of proficiency in International Morse Code, goals within the basis and purpose of the Service could be met, at least in part, without this requirement. Moreover, as several of the petitioners point out, the International Radio Regulations do allow the Commission to waive the requirement for an amateur to "... have proved that he is able to send correctly by hand and to receive correctly by ear, texts in Morse code signals ..." 2/ in the case of stations only operated above 144 MHz. A survey and analysis 3/ conducted in 1971 indicated that there may be as many non-licensees interested in amateur radio activities, if not more, than there are persons already licensed in the Amateur Radio Service. The most often mentioned reason for not obtaining an amateur license is the telegraphy requirements. We are aware the need for, and the use of, telegraphy in amateur radio communications is much less on amateur frequency bands above 50 MHz than it is on the amateur frequency bands in the High Frequency (30-30 MHz) and Medium Frequency (3-3 MHz) range, where spectrum conservation, tolerance to interference, and other factors, make telegraphy an important mode of amateur radio-communication. We believe, under carefully-established provisions, a new "telephony-only" type of operator license, limited to frequencies above 144 MHz, could and should be incorporated into the Amateur Radio Service.

5. The present operator license structure is shown in Figure 1. For all intents and purposes there are ten classes of operator licenses available in five ascending levels of operator privileges. Qualification for an operator license is established by means of the various examination elements shown in Figure 1. These may be administered either by a Commission examiner or by a volunteer examiner through the mail examination system. The Amateur Extra (C) Class, the Advanced (C) Class, and the Conditional (P) Class licenses are issued to physically disabled applicants qualifying on the basis of a mail examination administered by a volunteer. The Conditional Class license is issued to applicants qualifying on the basis of a mail examination administered by a volunteer, because of distance or other unusual difficulty in appearing at a regular examination point. The Technician (C) Class and Novice Class licenses are issued to applicants qualifying on the basis of a mail examination administered by a volunteer, the normal procedure for these license classes. Except for the Novice Class license and the Conditional Class license, the absence of the designator (C) or (P) following the operator class on the license means the licensee has qualified before a Commission examiner, and is not subject to re-examination. Any licensee qualifying on the basis of mail examination may be required by the Commission to appear before a Commission designated examiner for re-examination. Periodically, a sample number of licensees who have obtained their licenses on the basis of a mail examination are selected at random and asked to appear in order to verify the validity of the mail examination system. Those who do not appear, and those who do not pass the re-examination, are subject to license cancellation.

6. The privileges associated with each operator license class are intended to provide the necessary incentives for amateurs to upgrade their skills. This system has been largely responsible for thousands of amateurs to upgrade, particularly to Advanced Class and to Amateur Extra Class. The current number of operators in each license class is shown in Figure 2. While it is gratifying to see even the limited success of this system toward fulfilling the basis and purpose of the Amateur Radio Service, it is a desirable goal for most amateurs to reach a higher operator class, say the Advanced Class, or even the Amateur Extra Class. 4/

7. An inherent principle in arriving at any new licensing system is a logical relationship between the qualification requirements and the operator privileges authorized at each license class level. For instance, it would not be rational to require an applicant to demonstrate a certain specific proficiency in order to qualify for a particular operator license class which authorized no corresponding privileges requiring that proficiency. Conversely, an operator license class should not authorize significantly more privileges than the requirements for that license class reasonably justify. While we believe there are the means available within the Amateur Service to satisfy the reasonable needs of most United States citizens having a genuine interest in pursuing radio activities within the basis and purpose of the Service, there are basic limitations brought about by practical realities. For example, the vast array of interests and levels of ability among amateurs must be provided for within a fixed number of different operator license classes. The resources available to the Commission for regulating the Service are not unlimited. Issuing licenses, preparing and conducting examinations, monitoring the frequencies, enforcing the regulations, etc., are all activities that must be provided by the Commission. In this proceeding, we are moving on the assumption the amateurs' record of cooperation and assistance will continue in the future, and an unduly large increase in the Commission's workload will not be necessary.

8. We are proposing in this pro-

Fig. 1. Present structure of operator license classes, examination elements and frequency privileges.

Fig. 2. Percentage of amateur licenses in each class, May, 1974.
ceeding to establish a new Communicator Class operator license, having no telegraphy requirements nor privileges. Operation under this license would be limited in a manner similar to that of the current Novice Class, except frequency privileges would be above 144 MHz. The objective would be to enable beginners to enter the Amateur Radio Service and, through the experience gained by operation of low-power radiotelephony station, develop the necessary interest and skill to qualify for higher class operator licenses.

9. Those petitions calling for another new operator license class above the current Technician Class raise significant questions regarding the scope of the Technician Class as presently constituted. For example, in RM-1535, the American Radio Relay League (ARRL) states:

"It is readily apparent from the various pronouncements of the Commission over the years and from the present interests and operations of Technician Class licenses that the purposes for which the Technician Class was established ... require review. It is respectfully suggested that any Notice of Proposed Rule Making invite comments and suggestions for major revisions of the Technician Class license ... In numerous disasters ... including the Alaskan earthquake in 1964 and the recent Hurricane Camille, the contributions of Technicians in providing internal communications have been valuable beyond estimation. Participation by Technicians in the League's Amateur Radio Emergency Corps (AREC) has grown over the years. The evolution of Technicians as communicators as well as experimenters ... since the class was established must be recognized."

Although interest in the communication aspects of amateur radio has emerged among the some 49,000 Technician Class licensees, apparently they are not sufficiently persuaded by the additional communication privileges in the High Frequency (HF) and Medium Frequency (MF) amateur bands afforded to General Class licensees to the extent of increasing their telegraphy skill from 5 words to 13 words per minute, the only real difference in qualification between the two license classes. The needs and interests of this group probably are fully satisfied by the operation of an amateur radio station in the VHF (Very-high Frequency) regions and above. Accordingly, we can conclude technological and operational developments by amateurs in the VHF, and possibly in the UHF (Ultra-high Frequency) bands, have reached the point where the interest to amateurs is comparable to, if not already exceeding, that in the MF and HF "short-wave" bands. Therefore, in order to provide meaningful incentives for amateurs interested in this part of the radio spectrum to upgrade their skills, the incentive principles should also be applied for these bands similar to those now in effect in the shortwave bands. A new higher class operator license comparable in requirements and privileges to the Advanced Class, except based upon operation above 29 MHz, may be desirable. Obviously, for this new higher class license, any additional telegraphy skill is not meaningful since telegraphy is not a major communication mode in these frequency bands. However, other modes, such as television, remote control, facsimile, repeaters etc., are very meaningful, and need to be emphasized. Therefore, we are proposing another new operator class license, the Experimenter Class, as the means toward fulfilling these needs.

10. We have examined several possible revised operator license class structures in a search for the best way to incorporate the proposed Communicator Class and the proposed Experimenter Class licenses. As broad objectives, we desire to 1) preclude, or at least minimize, any adverse impact upon presently licensed amateurs, 2) closely relate requirements to privileges for each license class, 3) provide realistic upgrading steps and incentives, 4) provide the opportunity and flexibility for persons interested only in shortwave radio, or only in VHF and above, or interested in both, to obtain a license and pursue their particular interests. As a result, the structure we are proposing is shown in Figure 3, and the specific proposed rule amendments are given in Appendix II. In general, we favor this structure because it seems to more fully reflect our objectives and to satisfy most of the objectives of petitioners. Two series of operator license would be offered, Series A and Series B. Amateurs would be permitted to hold one operator license permitting privileges in one or both series. For example, an amateur could hold an operator license authorizing Novice Class privileges in Series A and also Technician Class privileges in Series B, a request asked for by several petitioners. Operator licenses in Series A would authorize only privileges on amateur frequencies below 29 MHz, and operator licenses in Series B would authorize only privileges on amateur frequencies above 29 MHz. Operator licenses would normally be issued for a 5 year renewable term, including the Communicator Class and the Novice Class in order to compensate for any increased administrative burdens resulting from the proposed amendments. (Novice Class licenses are currently issued on a 2 year, non-renewable basis, no filing fee). Section 303(L)(1) of the Communications Act of 1934 does allow us to issue operator licenses for life, as requested for the Amateur Extra Class in RM-2030. Under our current rules, the operator license 5/ is always combined with the Primary station license which cannot be granted for a term longer than 5 years, a requirement of Section 307(d) of the Act. We are proposing to adopt the request. Our records indicate very few amateurs drop out of amateur radio after they have attained the Amateur Extra Class. The license would still be required to renew his station license(s) every five years, so in effect, this proposed rule would amount to eliminating the need to retake the examinations should the amateur neglect to renew his license.

11. Under the proposed license class structure, new Advanced Class licenses and General Class licenses

5/ Although large certificates are awarded to Amateur Extra Class licensees upon request, the certificates do not satisfy the availability requirements of §97.32.
would no longer carry requirements and privileges above 29 MHz. The Experimenter Class and the Technician Class would be the counterpart operator licenses in Series B, and would not carry any requirements and privileges in Series A frequency bands. The Current Amateur Extra Class would be shortened in name to Extra Class, and would authorize full amateur privileges in both series. We are proposing to discontinue the written examination and the exclusive telephony segments available only to this class. The material in the current Element 4(B) examination required for Amateur Extra Class would be combined with the material for the current Advanced Class Element 4(A) and, together with other new material, be used in new examination Elements 4(A) and 4(B) for the Advanced Class and Experimenter Class respectively. Material related to the shortwave domain would be used in 4(A) and material related to the other domains would be used in 4(B). After obtaining both the Advanced Class and Experimenter Class, an amateur would then only need pass the Element 1(C) 20 word per minute telegraphy examination to qualify for the Extra Class. Because of this additional telegraphy requirement, the Extra Class would continue to have exclusive telegraphy subband privileges.

12. Under the proposed license structure, every currently licensed amateur radio operator would automatically be eligible to renew upon application, his current operator license to include privileges in at least one, and in most cases both series without further examination. Table 1 illustrates the highest class, or classes, of operator license that could be obtained without further examination.

13. Both of the proposed license series would be based upon three levels of difficulty: a beginner level, an intermediate level, and an advanced level. Ideally, this type of system would offer a newcomer the opportunity to enter the Amateur Radio Service at the beginner level with a minimum of proficiency, gain the experience and practical knowledge necessary to qualify for the intermediate level, and then move on to the advanced level. The privileges authorized at both the beginner and intermediate levels would be only those necessary to provide the desired experience for upgrading. Similarly, the related qualification requirements would be only the minimum necessary to assure that the licensee understands the privileges, limitations, and responsibilities associated with the license, with particular emphasis on methods for properly evaluating emissions of the type(s) authorized by the license. 14. We are proposing three principle areas of operator privileges: operating frequencies, emissions, and maximum transmitter power. For Series A, the authorized frequency bands would be basically the same as at the present below 29 MHz, except the exclusive telephony segments reserved to the Amateur Extra Class would be also available to the Advanced Class. In Series B, the Technician Class would be authorized all amateur frequencies above 50 MHz, thus gaining additional frequencies 50.0-50.1 MHz and 144-145 MHz. The Experimenter Class would be authorized all above 29 MHz, and the Communicator Class all above 144 MHz. The Extra Class and Experimenter Class would be authorized all amateur emissions. The Advanced Class would be authorized all amateur emissions permitted below 29 MHz. The General and Technician Classes would be authorized emissions A1, A3, and F3. The Novice Class would continue with A1 only, while the new Communicator Class would be permitted emission F3. Related examination elements would contain questions concerning the technical and operational aspects of the emissions authorized.

15. In proposing maximum transmitter power levels, we have taken into consideration a number of factors. Amateur transmitters have not been a significant source of interference to other services, and where there has been a problem, amateurs have been very cooperative. Also, amateurs, by and large, do use the minimum transmitter power necessary to conduct their communications. Therefore, there should be no real problem if the limits were to be increased in some instances. We would like to improve the technique specified in the Rules for determining power. Modern communications requires better methods for determining transmitter power than the "plate voltage times current" method. We are proposing to specify the maximum transmitter output in terms of peak envelope power (PEP), except at the beginner level where the emissions authorized do permit a fairly accurate measurement to be made of the input power using the method now specified. Under current rules and practices, the maximum output peak envelope power that could be developed would be on the order of 2000 watts (100% modulated, full carrier, double sideband A3). Specifying this level as advanced amateur practice, and 6 dB (approximately one "S" unit) as intermediate amateur practice (500 watts PEP output) is the method used to establish these proposals. An additional 6 dB lower step (250 watts input approximates 125 watts output PEP for A1 and F3 emissions) would be the beginner level.

16. The requirements for a new license, as shown in Appendix II, are similar to those now in effect, except the content of the various examination elements would be adjusted to more closely correlate with the privileges for each particular license class.

17. Under the proposed system, the operator license for an amateur

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qualifying by means of a mail examination on the basis of a protracted physical disability would have the letter (D) inserted following the operator class (example: Advanced (D) class). A license of this type would be renewable without re-examination upon satisfactory showing of the disability continued, and they could not appear for a regular Commission supervised examination. Otherwise, they would be required to demonstrate their proficiency through re-examination. The operator license of an amateur qualifying by means of a mail examination on the basis of difficulty in traveling to a regular Commission examination point, would have the letter (C) inserted following the operator class (example: General (C) class). The only purpose of this conditionally issued type of license would be to provide a temporary authorization until the person could qualify before a Commission examiner. Hence, these licenses would not be renewable, since it would not be unreasonable to expect a conditionally licensed amateur to travel to one of the many Commission examining points sometime within the five year period. He would then have to successfully complete a regular Commission supervised examination in order to continue as an amateur radio operator.

18. In the best interests of the Amateur Radio Service, and to be fair to all amateurs, we believe that every applicant should clearly establish his qualifications for the privileges authorized by an amateur operator license. Overall, our experience indicates mail examinations are not as effective as Commission supervised examinations in establishing qualifications. Because of our experience in re-examining amateur radio operators, and considering the proposed amendments may place additional demands upon a mail examination system, we are proposing some amendments in Appendix 2 intended to improve the system. Only an Extra Class licensee would be eligible to serve as a volunteer examiner for all examination elements. Advanced Class licensees would be eligible to administer examination elements for the General (C) and (D), and Novice Classes. Experimenter Class licensees would be eligible to administer examination elements for the Technician (C) and (D), and the Communicator Classes. Another proposal is to increase the required number of persons administering a volunteer examination. The second person may be the holder of any class of amateur operator license.

19. A specific call sign proposal is not included in this proceeding. However, because of the ramifications of this proposal, some relative comments are appropriate. Existing licensees will be able to retain current call signs if desired, and if authorized for both privileges, the same call sign may be used in both Series A and B. Licenses in Series B entering amateur radio as a result of this proceeding, will be issued a distinctive call sign for operation in that Series. If a later authorization for Series A privileges is granted, the single resulting call sign will reflect the dual Series authorization. Under this proposal, Technician Class licensees could obtain Novice privileges in Series A without examination, and therefore could retain their present call signs if desired. Further details will be contained in the call sign proceeding to be issued.

20. In view of the extensive amendments to the rules requested by the petitioners, and those proposed herein, it is imperative those submitting comments carefully consider the future needs of the Amateur Radio Service. To this end, we are allowing more than the normal amount of time for suggestions and comments to be filed. These proposals represent our best thoughts in these important matters. We are interested in receiving comments from informed amateurs in these areas.

21. Authority for the proposed rule changes herein is contained in § 4(1) and 303 of the Communications Act of 1934, as amended.

22. Pursuant to applicable procedures set forth in § 1.1415 of the Commission's Rules, interested persons may file comments on or before June 16, 1975, and reply comments on or before July 16, 1975. All relevant and timely comments and reply comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision on the rules which are proposed herein, the Commission may also take into account other relevant information before it, in addition to the specific comments invited by this Notice.

23. In accordance with the provision of § 1.419 of the Commission's Rules and Regulations, an original and 14 copies of all comments, pleadings, briefs, or other documents shall be furnished the Commission.

24. All filings in this proceeding will be available for examination by interested parties during regular business hours in the Commission's public reference room at its headquarters in Washington, D.C., (1919 M Street, N.W.).
APPENDIX II

Part 97, of Chapter I of Title 47 of the Code of Federal Regulations is amended as follows:

1. §97.5 is amended to read: §97.5 Classes of operator licenses.

(a) The following Series A operator licenses authorize operations in the amateur radio frequency bands below 29 MHz:

(1) Advanced Class, Advanced (C) Class, Advanced (D) Class. Licenses to conduct amateur radio communications using advanced level amateur practices.

(2) General Class, General (C) Class, General (D) Class. Intermediate grade licenses to conduct amateur radio communication for the purpose of developing individual proficiency toward qualifying for the Advanced Class license.

(3) Novice Class. Introductory grade license to conduct amateur radio operation for the purpose of developing proficiency toward qualifying for the General Class license.

(b) The following Series B operator licenses authorize operations in the amateur radio frequency bands above 29 MHz:

(1) Experimenter Class, Experimenter (C) Class, Experimenter (D) Class. Licenses to conduct amateur radio communication using advanced level practices.

(2) Technician Class, Technician (C) Class, Technician (D) Class. Intermediate grade licenses to conduct amateur radio communication for the purpose of developing individual proficiency toward qualifying for the Experimenter Class license.

(3) Communicator Class. Introductory grade license to conduct amateur radio communication for the purpose of developing individual proficiency toward qualifying for the Technician Class and Novice Class licenses.

(c) The Extra Class and Extra (D) Class licenses authorize amateur radio operation using all authorized privileges, including certain exclusive privileges.

(d) The designator (C) following the type of operator license class indicates the license is conditionally issued because the licensee qualified under the provisions of §97.28.

(e) The designator (D) following the type of operator license class indicates the license is conditionally issued because the licensee qualified under the provisions of §97.27.

(2) §97.7 is amended to read as follows:

§97.7 Privileges of operator license.

The following operating privileges are authorized by the class of operator license indicated for all new amateur licenses issued after (effective date of new rules). Amateurs licensed prior to the date will receive a new license upon the first renewal after (effective date of new rules).

(a) Extra Classes. All amateur radio operator privileges.

(b) Advanced Classes. All amateur radio operator privileges below 29 MHz, except for frequencies 3500-3525 kHz, 7000-7025 kHz 14000-14025 kHz, and 21000-21025 MHz.

(c) General Classes.

(1) Frequencies 1800-2000 kHz, 3525-3775 kHz, 3890-4000 kHz, 7025-7150 MHz, 7225-7300 MHz, 14025-14200 kHz, 14275-14350 kHz, 21025-21250 MHz, 21350. 21450 MHz and 28029.0 MHz within the limitations of §97.61.

(2) Emissions A1, A3, and F3.

(3) Except for power limitations set forth in §97.61, the maximum transmitter output power shall not exceed 500 watts peak envelope power.

(d) Novice Class.

(1) Frequencies 3700-3750 kHz, 7100-7150 kHz, (7050-7075 kHz when the amateur radio operation is not within Region 2), 21100-21200 MHz, and 28100-28200 MHz.

(2) Emission A1.

(3) 250 watts input power to the transmitter final amplifying stage supplying radio frequency energy to the antenna, exclusive of power for heating the cathode of a vacuum tube(s), within the limitations of §97.67.

(e) Experimenter Classes. All amateur radio operator privileges above 29 MHz.

(f) Technician Classes.

(1) All amateur frequencies above 50 MHz.

(2) Emissions A1, A3, and F3.

(3) Except for power limitations set forth in §97.61, the maximum transmitter output power shall not exceed 500 watts peak envelope power.

(g) Communicator Class.

(1) All amateur frequencies above 144 MHz.

(2) Emission F3.

(3) 250 watts input power to the transmitter final amplifying stage supplying radio frequency energy to the antenna, exclusive of power for heating the cathode of a vacuum tube(s), within the limitations of §97.67.

3. §97.9 is revised to read as follows: §97.9 Eligibility for a new operator license.

Any citizen 1/ or national of the United States is eligible to apply for an amateur radio operator license. A person may be issued no more than one operator license in Series A, and no more than one in Series B. A holder of an Extra Class operator license may not hold any other amateur radio operator license issued by the Commission. The requirements for each operator class are:

(a) Extra Class: Applicant shall have successfully completed examination elements 1(C), 2(A), 2(B), 3(A), 3(B), 4(A), and 4(B).

(b) Advanced Class: Applicant shall have successfully completed examination elements 1(B), 2(A), 3(A), and 4(A).

(c) General Class: Applicant shall have successfully completed examination elements 1(B), 2(A), and 3(A).

(d) Novice Class: Applicant shall have successfully completed examination elements 1(A) and 2(A).

(e) Experimenter Class: Applicant shall have successfully completed examination elements 1(A), 2(B), 3(B), and 4(B).

(f) Technician Class: Applicant shall have successfully completed examination elements 1(A), 2(B), and 3(B).

(g) Communicator Class: Applicant shall have successfully completed examination element 2(B).

4. Section 97.13 and headnote are revised to read as follows: §97.13 Eligibility for renewal of operator license.

(a) An amateur radio operator license, other than a conditionally issued license, may be renewed upon proper application, in which it is

1/ Senate Bill 2457 if enacted, would delete citizenship requirement.
stated that the applicant is fully qualified in the requirements for the original license of the class being renewed. If the applicant is not fully qualified, the license will not be renewed, and the applicant may apply for a new operator license if and when he qualifies by examination at a later date.

(b) If a license, other than a conditionally issued license, is allowed to expire, application for renewal may be made during a period of grace of 1 year after the expiration date. During this 1 year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be back-dated to the date of its expiration.

(c) Application for renewal of an amateur radio operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's operator license or photocopy thereof. Application for renewal of unexpired licenses must be made during the license term. In any case in which the licensee has, in accordance with the provisions of this section, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(d) Operator licenses obtained on the basis of §§ 97.28 are not renewable.

(e) Operator licenses obtained on the basis of §§ 97.27 are not renewable unless the application is accompanied by a current physician's affidavit.

(f) Extra Class operator licenses are issued for the life of the licensee, and do not have to be renewed.

5. Section 97.15 is added new to read as follows:

§ 97.15 Modification of operator license.

(a) Application for modification of an amateur radio operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's operator license(s) or photocopy(s) thereof.

(b) When only the name of the licensee is changed, or when only the mailing address is changed, a formal application for modification of license is not required. However, the licensee shall notify the Commission promptly of these changes. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in the Commission's records, the new name and/or address, as the case may be, the primary station call sign and class of operator license. The notice shall be sent to Federal Communications Commission, Gettysburg, Pennsylvania 17325, and a copy shall be kept by the licensee until a new license is issued.

6. Section 97.21 is revised to read as follows:

§ 97.21 Examination elements.

Examination for amateur radio operator privileges will comprise one or more of the following elements:

(a) Element 1(A): Slow speed telegraphy test in International Morse code at 5 words per minute.

(b) Element 1(B): Intermediate speed telegraphy test in International Morse code at 13 words per minute.

(c) Element 1(C): High speed telegraphy test in International Morse code at 20 words per minute.

(d) Element 2(A): Rules, basic principles, and amateur practices essential to beginners' amateur radiotelegraphy operation using the privileges authorized to the Novice Class.

(e) Element 2(B): Rules, basic principles, and amateur practices essential to beginners' amateur radiotelephony operation using the privileges authorized to the Communicator Class.

(f) Element 3(A): Rules, intermediate level principles, and amateur practices essential to amateur radio operation using the privileges authorized to the General Class.

(g) Element 3(B): Rules, intermediate level principles, and amateur practices essential to amateur radio operation using the privileges authorized to the Technician Classes.

(h) Element 4(A): Advanced level principles and amateur practices essential to amateur radio operation using the privileges authorized to the Advanced Class.

(i) Element 4(B): Advanced level principles and amateur practices essential to amateur radio operation using the privileges authorized to the Technician Class.

7. Section 97.23 is revised to read as follows:

§ 97.23 Examination requirements.

(a) The telegraphy test required of an applicant for an amateur radio operator license shall determine the applicant's ability to send correctly by hand using a hand key (or, if supplied by the applicant, a semi-automatic or electronic, hand operated key, other than keyboard type) and to receive correctly by ear, in plain language, messages in the International Morse code at not less than the prescribed speed, counting 5 characters to the word, each numeral or each punctuation mark counting as 2 characters.

(b) All written examinations for an amateur radio operator license shall be completed by the applicant in legible handwriting or hand printing by means of ink or pencil. Whenever the applicant's signature is required, his normal signature shall be used. Applicants unable to comply with these requirements, because of a physical disability, may dictate their answers to the examination questions and to the receiving code test. If the examination, or any part thereof, is dictated by the applicant, the examiner shall certify the nature of the applicant's disability and the name and address of the person(s) taking and transcribing the dictation.

8. Section 97.25 is revised to read as follows:

§ 97.25 Examination credit.

(a) An applicant for an amateur radio operator license will be given credit for those examination elements required for any other class or operator license held when the application is filed. However, credit will not be given for examination elements 1(B), 3(A), 3(B), 4(A), and 4(B) given under the provisions of § 97.30 for a class of operator license other than that being applied for, except for holders of Advanced (D) Class, Experimenter (D) Class, General (D) Class, and Technician (D) Class when qualifying for a license under the provisions of § 97.27.

NOTE: Credit for examination elements will be given to applicants holding a valid operator license at the time of the adoption of this rule, in accord with the following schedule, during a period not exceeding one year following the expiration date on the current license:

(1) Amateur Extra Class: All examination elements.

(2) Amateur Extra (C) Class: Elements 1(A), 2(A) and 2(B). Also all other examination elements as if passed on the basis of § 97.27.

(3) Advanced Class: Elements 1(A), 1(B), 2(A), 2(B), 3(A), 3(B), 4(A), and 4(B).

(4) Advanced (C) Class: Elements 1(A), 2(A), and 2(B). Also elements 1(B), 3(A), 3(B), 4(A), and 4(B) as if passed on the basis of § 97.27.

(5) General Class: Elements 1(A), 1(B), 2(A), 2(B), 3(A), and 3(B).

(6) Conditional Class: Elements 1(A), 2(A), and 2(B). Also elements 1(B), 3(A), and 3(B) if passed on the basis of § 97.28.
LETTERS

ANOTHER TROUBLEMAKER

Please take your magazine and shove it — into my new mailbox. Sunday folk say you're biased, muck-raking, and print too much on subjects other than ham radio. So what? I get two ham mags, and yours is the one which gets read first and more thoroughly (even with the small type).

Maybe it's because I'm a gadfly myself in other areas, that keeps me behind you — just don't let me forget to renew, or you'll really get a nasty letter.

Jim Tolson WA9JTW

HE KEEPS UP

Personally, I find the satellite interesting — even after 42 years as a ham! For example, I have four uplink antennas and three downlink antennas, all on coax switches. Changing from one to the other is most educational, as you can imagine. Listening, with your own ears, to the results of your tests by monitoring your own downlink signal on 29 MHz, leaves no room for inflated reports, baloney reports, etc., etc.

Very illuminating. I also, with a Variac, have changed transmitter output from 35 Watts to 1 Watt and observed what happened.

Stuart D. Cowan W2LX

MORE FAN MAIL

Would you like some fan mail? Here it is!! First I am not a Ham or Radio Amateur. I am just interested in general electronics and its many applications. Also since I work with Low Light Level TV on AC-130 gunships in Thailand, I am also interested in electronics as it applies to TV both transmitted and closed circuit. I like the idea of your proposed Solid State column. The only problem is I can't decide which columnist from the samples published would be the best, they are all good! As for your publishing your problems with the IRS, KEEP DOING IT!!! Maybe if more people spoke up the US Internal Police Service would be put back in the normal judicial system where it belongs.

Ralph A. Linder Jr.

RESPONSE TO "FAN MAIL"

Under the "Fan Mail" section, the letter from K6BR should be disregarded. Hillsborough, California is a town reserved for the VERY RICH. Obviously Mr. Naylor can be critical of you and your tax problems. He probably has never had to pay any. And he probably owns several shares of stock in the IRS.

Alan Christian WA6YOB

PROBLEM SOLVED

The Baltimore Amateur Radio Club maintains a machine on 07/67. Sometime this month the present 07/67 will switch to 34/94. This will be a calling repeater only, with 30 seconds time out. Once it times out it will take 30 seconds to reset, so it won't be much good for anything except a quick call. BARC is putting up a whole new repeater on 07/67 which will have a lot better coverage.

What they eventually want with the calling repeater is for everyone to monitor 94. Then you can make a call and switch to a rag chewing repeater. The way it is now is I have to call people on as many as 4 repeaters before I find the one they are monitoring. A calling repeater will solve this problem.

Steve Uhrig WA3SWS

EXPERIMENTERS NEEDED

Wanted: Serious, qualified, intelligent hams interested in vital fundamentals of life to read the "Fields of Life" by Dr. Harold S. Burr, Ballantine paperback 23559 $1.50 and/or "Design for Destiny" by Ed. W. Russell, Ballantine 23405 $1.25 and then develop suitable direct current amplifiers that are stable and can be duplicated with reliability and economy so that these Fields of Life can be measured in millivolts with extremely high input resistance. To be used with ordinary test meters such as 20k ohms per volt VOM. Special electrodes needed too.

Use in family planning and as an indicator of disease. It gets down to what really makes us tick and where we go from here. From Ballantine Books Inc., 201 E. 50th St., NYC 10022 plus two bits postage per order. Doctors and others here interested. All correspondence answered.

Charles A. Moore XE1CMB
Av. 27 Poniente 2520
Puebla, Puebla, Mexico

RF CLIPPER

That Clipper is built around the low cost filters from Ampex. I checked with the company. They are no longer in Houppagae and dropped the filter line. The Clipper is good but other sources of filters have to be found.

Kurt Bittmann WB2YYV
Can't win 'em all. . . Wayne

In reference to 73 Magazine, Sept. '74 page 27. I was reading the address of the author of "A Ham Radio Severe Weather Warning Net". Is the street number printed correct, or was the typist thinking about transistors while writing the draft.

. . . WA3RSP

While the typist MAY have been thinking about transistors at the time, she also had her mind on her work. Yes, the address is correct.

. . . Wayne

Continued on page 131.
(7) Conditional Class (P) Class: Elements 1(A), 2(A), and 2(B). Also elements 1(B), 3(A), and 3(B) as if passed on the basis of §97.27.
(8) Technician Class: Elements 1(A), 2(B), 3(A) and 3(B).
(9) Technician (C) Class: Elements 1(A), 2(A), and 2(B). Also elements 3(A) and 3(B) as if passed on the basis of §97.28.
(10) Novice Class: Elements 1(A) and 2(A).
(b) Upon request, an applicant for an amateur radio license will be given credit for element 1(A) and 1(B) if within 5 years prior to the receipt of his application by the Commission, he held a commercial radiotelegraph operator license or permit issued by the Federal Communications Commission.
(c) Upon request, an applicant for an amateur radio operator license will be given credit for elements 1(A), 1(B), and 1(C), if he holds a valid First Class commercial radiotelegraph operator license or holds any commercial radiotelegraph operator license or permit issued by the Commission containing aircraft radiotelegraph endorsement.
(d) Applicant submitting evidence of having held the Amateur Extra First Class operator license and having held its successor license will be given credit for examination element 1(C) if he so requests. An applicant must present his proof in advance of the desired examination time to the Amateur and Citizens Division, Washington, D.C., 20554 and receive a letter of certification for presentation to the Commission Field Office where the examination will be taken. No credit for the telegraphy requirement will be given without the letter of certification.
9. Section 97.27 and headnote are revised to read as follows:
§97.27 Availability of operator license to persons residing at great distances from Commission examination points.
(a) A new Advanced (C) Class, Experimenters (C) Class, General (C) Class, or Technician (C) Class license may be issued on the basis of examinations successfully passed under the provisions of §97.30 under one of the following conditions:
(1) If the applicant's legal residence, mailing address, and/or any station location or proposed station location are more than 175 miles actual distance from the nearest Commission examination point.
(2) If the applicant is shown by certificate of the commanding officer to be in the armed forces of the United States at an Army, Navy, Air Force, or Coast Guard station and, for that reason, to be unable to appear for examination at a Commission examination point.
(3) If the applicant demonstrates by sufficient evidence that he is unable to appear at a Commission examination point because his current temporary residence, for the 12 coming months is outside the continental limits of the United States, its territories or possessions.
(b) Operator licenses obtained under the provisions of these rules are not renewable.
11. Section 97.29 and headnote are revised to read as follows:
§97.29 Manner of conducting Commission supervised examinations.
(a) Except as provided by §97.27 and §97.28, examination elements 1(B), 1(C), 3(A), 3(B), 4(A) and 4(B) may only be administered by an authorized Commission employee or representative at locations and at times specified by the Commission.
(b) Examination element 4(A) may only be administered to a person having successfully passed element 3(C).
(C) Examimation element 4(B) may only be administered to a person having successfully passed element 3(B).
(d) Examination element 3(A) may only be administered to a person having successfully passed element 2(A).
(e) Examination element 3(B) may only be administered to a person having successfully passed examination elements 2(B).
12. Section 97.30 is added new to read as follows:
§97.30 Manner of conducting mail examinations.
(a) Unless otherwise prescribed by the Commission, examination elements 1(A), 2(A), 2(B), and any elements administered under the provisions of §97.27 and §97.28 will be conducted and supervised by two proxy volunteer examiners proposed by the applicant and approved by the Commission. The volunteer examiners shall be at least 21 years of age, shall be unrelated to the applicant, and at least one shall hold the proper class of license to administer examinations in accordance with the following schedule:
(1) Extra Class: All examination elements.
(2) Advanced Class: Examination elements 1(A), 1(B), 2(A), and 3(A).
(3) Experimenters Class: Examination elements 1(A), 2(B), and 3(B).
(b) Written examinations shall be obtained, administered, and submitted in accordance with the following procedure:
(1) Within 10 days after successfully passing any required telegraphy examination element, an applicant shall submit an application (FCC Form 610), together with any filing fee prescribed, to the Commission's office in Gettysburg, Pennsylvania 17325. The application shall include a written request from the volunteer examiners for the appropriate examination papers. The examiners' written request shall include (1) the name and mailing address of the volunteer examiners, (2) the name of the applicant, (3) a statement by the volunteer examiners that the applicant has passed the telegraphy examination element for the class of operator license, if required, under their supervision within the 10 days prior to the submission of the request, and (4) the volunteer examiners' signatures. Examination papers will be forwarded to one of the volunteer examiners.
NOTE: When the applicant is entitled to credit for any telegraphy examination element under the provisions of §97.25, an application may be submitted without regard to the 10 day limitation. The examiners' request should then state that a telegraphy examination was not administered for that reason. The applicant should furnish details as to the class, number, and expiration date of any license involved.
(2) The proxy volunteer examiners shall be responsible for the proper conduct and necessary supervisions of the examination. Administration of the examination shall be in accordance with the instructions included.
with the examination papers.

(3) The examination papers, either completed, or unopened in the event the examination if not administered for whatever reason, shall be returned by the volunteer examiner to the Commission's office at Gettysburg, Pennsylvania, no later than 30 days after the date the papers are mailed by the Commission (the date of mailing normally stamped by the Commission on the outside of the examination envelope).

13. Section 97.33 is amended to read as follows:

§97.33 Eligibility for re-examination.

An applicant who fails an examination for an amateur radio operator license may not take another examination for the same or higher class license in the same series within 30 days.

14. Section 97.35 and headnote are revised to read as follows:

§97.35 Additional requirements for licensees holding licenses on the basis of mail examinations.

(a) A licensee holding an amateur radio operator license obtained by a mail examination administered by proxy volunteer examiners may be required to appear for a Commission supervised examination at a location designated by the Commission. If the licensee fails to appear for this examination when directed to do so, or fails to pass such examination, the amateur radio license(s) involved shall be subject to cancellation. When a license is cancelled under this provision, a new license will not be issued for the same class of operator license as that cancelled.

(b) A holder of an amateur radio operator license obtained on the basis of a mail examination under the provisions of §97.27 shall make application for re-examination within one-year upon becoming able to travel to any Commission examination point.

(c) A holder of an amateur radio operator license obtained on the basis of mail examination under the provisions of §97.28 shall apply for re-examination within one-year of when the licensee changes his legal residence, or mailing address, and/or any station or proposed station location within 175 miles actual distance to the nearest Commission examination point, or when a new examination point is established within 175 actual miles distance to the licensee's legal residence, mailing address, or station location.

15. Section 97.38 is added new to read as follows:

§97.38 Types of station licenses and eligibility.

(a) The following types of station licenses are available to properly licensed amateur radio operators.

Type of station
Series A Primary station.
Series A Secondary station.
Series B Primary station.
Series B Secondary station.
Series A Club station.
Series B Club station.
Repeater station, Control station, Auxiliary Link station, Space station.
Military Recreation station.

Eligible licensees
Extra Class, any Series A Class operator.
Extra Class, any Series B Class operator.
Extra Class, Advanced Class operator.
Extra Class, Experimental Class operator.
Extra Class, Experimental Class operator.
Individual, whether or not a licensed amateur radio operator, who is in charge of a proposed Military Recreation station.

16. Section 97.67(a) & (b) are amended and part (d) added to read as follows:

§97.67. Maximum authorized power.

(a) Within all other limitations specified herein, amateur radio stations shall use the minimum amount of transmitter power necessary to carry out the desired communications.

(b) Except for power limitations set forth in §97.7 and §97.61, the maximum transmitter output power shall not exceed 2000 watts peak envelope power.1

(d) Any transmitter capable of exceeding the power limitations specified herein shall not be operated in the Amateur Radio Service unless there is incorporated adequate measures to assure the limitations will not be exceeded.

1/ This is one proposal under consideration. The Commission is also considering alternatives such as PEP-input, average power input, ratios of peak to average power output and limitations on discrimination ratios of final power amplifier devices or a combination of these. Specific comments on the practicability of these proposals, alternate proposals and the practicability of attendant power measuring techniques by amateur station are requested.

We request comments on the need for rules limiting the use of techniques which increase the average power in A3 single sideband suppressed carrier transmissions, without increasing the peak envelope power. The comments should discuss the various techniques utilized for the purpose in the Amateur Radio Service, the engineering standards that must be observed for good amateur practice where using these techniques, the nature of any unnecessary interference that can be caused by the improper use of these techniques, and the capabilities of amateurs to make the measurements necessary to proper usage.

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- Receiver sensitivity of 0.35 mV for 12 dB SINAD on FM
- Dual power output of 20 watts or 5 watts across entire band
- Adjacent channel rejection (30 kHz) 100 dB minimum
- Image spurious and intermodulation (EIA) 80 dB minimum
- 10 pole, 13 kHz crystal filter

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Sneaky Fast Scan Monitor for SSTV

When operating SSTV the use of a fast scan monitor provides the means to adjust the scene at a 15 frames/second rate rather than the standard 8 seconds/frame rate — a ratio in round numbers of 120:1. Commercial fast scan display units sell for about $250. Oscilloscopes now sell in the $120 range and are usually large and bulky. Who wants to tie up a scope for display only? This article describes modifications that can be made to a standard Heathkit monitor scope, found in many stations, to provide the fast scan display feature for the popular Robot 80A Camera.

The modification is based upon the assumption that the trapezoidal display found in the HO-10 is seldom used. I have used it only once in 5 years.

Circuit Descriptions

Vertical Amplifier

The vertical amplifier, Fig. 1, was modified to satisfy two criteria:
1. Maximum sensitivity to a positive sawtooth at VIA.
2. No voltage transients on external vertical input line when mode switch is operated from display to EXT.

The vertical fast scan signal, from the 80A camera, is taken directly from the vertical yoke. This is a positive going sawtooth with a negative magnetic overshoot. C7 is used to minimize that overshoot. Notice that the coupling capacitor C3 is located on the input

![Circuit Diagram](image-url)
side of mode switch-A to prevent voltage transients from being applied to the external vertical input line when the mode switch is operated. Such voltage transients could damage external semiconductor circuits.

**Horizontal Amplifier**

The horizontal fast scan signal from the 80A camera is a positive going sawtooth. The amplitude of this signal is about the same as the fast scan vertical signal and requires two stages of amplification, Fig. 2. V1A the horizontal preamplifier must pass a 15Hz signal which accounts for the large capacitances (CB,CC). Notice also that both coupling capacitances have been moved to the input side of mode switch-B. This was done, as in the case of the vertical amplifier, to prevent voltage transients from being applied to the external horizontal input line when the mode switch is operated.

**Video Amplifier**

The HO-12 has no provision for video, or Z input. A video amplifier, Fig. 2, described by ROBOT in their Field Service note #4 was installed in V2B. This circuit is sensitive to negative pulsing signals. The video grid resistor, RF, or the bias resistor, RG, can be made variable for gain control. I found 150Ω for RG satisfactory using the intensity control to vary the display. If the display is
too contrasty RG can be increased to 240-300Ω as required.

**CRT**

Three basic modifications were made to the CRT, Fig. 3, circuitry to:
1. Increase the vertical deflection.
2. Provide Z or video input.
3. Provide means to shut off the rf signal vertical input.

The 1MΩ resistor connected to the vertical deflection plate pin 9 was increased to 3.3μM. C8, through which the lowest level rf signal is applied to the vertical deflection plate, was removed and the switch point grounded to provide a means to shut off the rf input. This allows the display to be viewed while the picture is being transmitted — good if you’re prone to move. In most cases it is not necessary to view the rf unless setting up or in case of troubles.

**Mode Switch/“A” Scan Feature**

The mode switch was changed from a 2-pole 3-position to a 2-pole 4-position switch, see Figs. 1 and 2. The currently installed mode switch has 2-poles 5-positions with only 3 being used, and can be modified with some difficulty. I recommend a new 2-pole 4-position switch.

The extra position allows amplified fast scan video to be applied to the vertical input and fast scan deflection to the horizontal input. These two signals result in an “A” scan, allowing synchronized video to be displayed. An “A” scan display is used for precise adjustment of the camera brightness control (see operation).

**Physical Modification**

In order to keep the fast scan signals together, the video input was entered via the two tone jack. The two tone signal was relocated to the lower antenna connector. Since there was no room to mount a terminal strip near the two tone tube, V4, the junction of R30, R38 and R52 was soldered to a short length of stiff wire the other end of which connects to the lower antenna connector. The junction is, therefore, self-supporting. In order to prevent the junction from shorting to pot R29 a strip of plastic tape was placed on the pot. The antenna is connected to the single connector via a coax “T” fitting.

The two exciter connectors, now no longer needed, were used for the external inputs; the top for vertical and the bottom for horizontal. The location of these connectors is convenient for connecting shielded wires to the mode switch.

The .003μF, 1600V video coupling capacitor CE and the 24K 2W RF are connected via a 3 lug terminal strip. This strip is mounted on the side of CRT neck that is closest to the bottom side of the chassis. It is mounted using the same screw that mounts a terminal strip already in this location, Fig. 4. The strip currently mounted must be positioned such that its body is towards the CRT neck.

Coupling capacitors 2μF 600V CD, and .02μF C3 are mounted in the area of the mode switch.

The .22μF C6 is relocated from pin 8 to pin 3 of V1. Do not remove the ground end.

Don’t physically remove the wire connecting pin 7 of V1 to pin 7 of the CRT. This wire is later used from pin 6 of V1B to the .033/1600 CE located on the CRT neck.

The shielded lead from V1 pin 2 is relocated to V1 pin 1.

**External Inputs**

Two external inputs, vertical and horizontal, were wired to the mode switch to
permit attachment of an audio frequency spectrum analyzer or other device. The sensitivity of the vertical input is too negative pulsing. The sensitivity of the horizontal input is either polarity. Note that both external inputs are direct, not ac coupled. This was done in order to keep these inputs flexible. This allows the coupling capacitors to be matched to the external signal source frequencies and voltage polarities.

**Power Supply Considerations Under No-Signal Input Conditions**

The 6BN8 required 600mA of filament current. The 12AT7/12AX7 requires only 300mA, a net reduction of 1.9W.

The original V2B required 7.2mA at 580V, the revised V2B requires about 1.5mA at 580V — a net savings of 3.3W.

The new horizontal preamp requires 3.3mA at 230V or an additional .76W.

The new video amplifier requires 4.9mA at 230V or an additional 1.2W.

The net high voltage current drain is plus 1.5mA.

These values will vary of course, under signal conditions. But the net change is towards less power consumption.

**Chart**

In order to adjust camera brightness, set mode switch to “A” scan. Black will be towards the top of the screen and white will be towards the bottom of the screen. Adjust camera brightness for maximum difference between black and white signals levels. Notice that any further increase in brightness causes an increase in the overall down position of the vertical spikes (background shading), but does not increase the white to black ratio of the picture elements. This can be checked by switching to the display mode and “rocking” the brightness control either side of the optimum setting. The contrast can now be adjusted by looking at both display and “A” scan positions of the mode switch and touching up the brightness as required.

**Conclusion**

The display obtained with these modifications completely fills the screen and then some. The linearity of the display is not of TV quality but is more than sufficient for this application.

The camera was operational for one week before the modifications to the HO-10 were completed. The difference in performance and picture quality and the ease which they are obtained, has definitely established the need for Fast Scan Display. The estimated cost of $11 for new parts is, without a doubt, a good investment to increase the versatility of an already valuable piece of monitoring equipment.

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<td>Complete TX and RX alignment &amp; tuneout</td>
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Your "out-of-warranty" cost
Model SR-146                         $32.00 total
Model SR-146A                        $32.00 total
Model SR-C806                        $38.00 total
Model SR-C826 M                      $38.00 total
Model SR-C826 MA                     $38.00 total
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Most electronic keyers either do not offer a variable dot-to-dash ratio, or if they do, then the dot-to-dash ratio usually changes with speed or weight. Timing is normally done by a multivibrator, which inherently causes the dot-to-dash ratio to vary with speed or weight. To solve this problem, a keyer was constructed which uses an integrator as the timing element. This circuit offers the following features:

1. A single potentiometer adjusts the speed continuously over a 3 to 1 range, and a switch changes ranges. Changing the speed has no effect on the ratio of dots to dashes or the weight (on-to-off time) of a character.

2. A single potentiometer adjusts the ratio of dots to dashes by changing the speed of the dots but not the dashes. This adjustment does not affect the weight.

3. The weight is controlled by two separate potentiometers, one for dots and one for dashes. These adjustments are not interacting and do not affect the speed or ratio.

4. Characters are self-completing. When a dot or dash is started, it is automatically completed and a space inserted between it and the next character.

5. Dot insertion is used. This permits dots to be inserted between a train of dashes, without releasing the dash key.

Fig. 1, shows the circuit which forms a dot or dash. An operational amplifier is used as an integrator. An operational amplifier is simply a very high gain amplifier. As far as the external circuit is concerned, the operational amplifier can be considered to have infinite gain, infinite input impedance, and a low output impedance. In Fig. 1, the two inputs to the operational amplifier are labeled (-) and (+). When a capacitor is connected between the output and the inverting input (-), it becomes an integrator. It is called an integrator, because all of the current, \( i_1 \), must flow into the capacitor, \( C \), and the output voltage \( V_o \) adjusts itself so that the capacitor voltage is equal to the integral of the current, \( i_1 \), divided by \( C \). In other words, the capacitor voltage, \( V_o \), equals:

\[
\int \frac{i_1}{C} \, dt = \frac{\Delta t}{C}
\]

where \( i_1 \) is the average current over a time interval, \( \Delta t \). If \( S1A \) is closed and \( S1B \) is open, then \( i_1 = +V_1/R_A \) flows into \( C \), and the output voltage, \( V_o \), falls linearly from \( V2 \) to \( V3 \), as shown in the graph, Fig. 2. If at time \( t_1 \), \( S1A \) is opened and \( S1B \) is closed, then \( i_1 = -V1/R_B \) flows into \( C \). \( V_o \) then starts rising from \( V3 \) toward \( V2 \). When \( V_o \)
reaches V2, if S1A and S1B are reversed again, the cycle repeats. V0 is fed to a flip flop which changes state each time V0 reaches V2 or V3, as shown in the graph in Fig. 2. The flip flop powers the switch S1. The flip flop also forms the dashes and dots. When the flip flop is in the ON state a dash (or dot) is being made, and when in the OFF state the spacing between dashes (or dots) is formed. In the practical circuit two R1s are used and are switched in and out electronically. The smaller R1 is used for dots and the larger R1 for dashes. As the setting of the potentiometer arm changes, RA and RB change in such a manner that their sum is always equal to R1. It can be demonstrated that even though t1 changes as the potentiometer is varied, t2 does not change. In other words, the ON time plus the OFF time of a character is constant. Thus, variation in the weight has no effect upon the speed. Because there are two R1s, one for dashes and one for dots, the weight of dashes and dots are independently variable, and neither has any effect upon the speed. The ratio of dots to dashes is controlled by changing the value of V1 as the dot and dash potentiometers are switched in and out. That is, a different value of V1 is applied to the dash potentiometer than is applied to the dot potentiometer. The ratio of dots to dashes changes, because the speed of a character is directly proportional to V1.

Fig. 4, shows the logic block diagram, Fig. 5, the circuit diagram of the keyer, and Fig. 6, the circuit diagram of the power supply and sidetone oscillator.

In the ensuing discussion, the logic gates shown in Fig. 4, are called NOR gates and work in the following manner. A schematic diagram of the Motorola MC724P quad 2-input gates is shown in Fig. 3. Each package contains four separate two input gates. Let us illustrate with gate U3 (pins 12, 13, and 14), in the lower left hand corner of Fig. 4. Zero or low voltage is called logic "0" level. Positive or high voltage is called logic "1" level. If inputs 12 and 13 are both at zero voltage or "0" level, then the output on pin 14 is at "1" level. At a "1" level output, both of the gate transistors are open circuited, and the output terminal is driven by a 640Ω resistor to +3.6V. If either input 12 or 13, or both, are at logic "1," then one or the other gate transistor, or both, are saturated, and the output terminal is at logic "0," because the transistors effectively act as a short circuit to ground.

In the logic block diagram Fig 4, when the dash key is closed, the output of gate U3 at pin 14 rises to the "1" logic level. This assumes that pin 12, U3, is at the "0" level, which it will be if the dot control flip flop is in the quiescent state. When pin 14 (U3), rises, pin 14 (U1), drops to the "0" level. In the quiescent state, the "recharge" flip flop places a "1" level at pin 3 (U7), and pin 9 (U7), and a "0" level at pin 8 (U7), and pin 7 (U4). Therefore, pins 6 and 7 (U4), are both at "0," which causes a "1" at pin 5 (U4), which triggers the dash formation flip flop to the ON state. Pin 5 (U1), is changed from "0" to "1," which does several things. This causes pin 8 (U4), to move to the zero state, which means that the dash key can be released, and the dash control flip flop will still remain in the ON state. All of the foregoing happens in about a microsecond, which means that a slight touch of the dash key is all that is necessary to start a dash.
When pin 5 (U1), goes to "1," this turns off the recharge current source by causing pin 14 (U4), to drop to "0." The dash charge current source is turned on, which causes a constant charging current to be fed to the operational amplifier, U8. When pin 5 (U1), goes to "1," the base of Q5 goes to +1.3V, and about 1/3 milliamper of current flows through Q5 to Q4, which turns on and saturates Q4.

When Q4 is saturated, the voltage from emitter to collector is nearly 0V, which means that the voltage at the emitter of Q3 is applied directly to the top of R17. The voltage at the center arm of R33 is connected to the (-) input of the operational amplifier, U8. The trimpot, R50, is adjusted so that the (-) input remains within a millivolt of ground potential. A current flows from the emitter of Q3, through Q4, R17, and R33, into C4, C5, or C6 (whichever is connected). The magnitude of this current is equal to $V_a/(R_{17}+R_a)$, where $V_a$ is the voltage at the base of Q3, and $R_a$ is the resistance from the top of R33 to the center arm. As discussed earlier, the operational amplifier integrator causes the integrating capacitor to charge at a linear rate. The quiescent value of the voltage on the integrating capacitor is +9V. It is clamped at this level by the voltage divider action of R20, R36, and Q11. When the charging current flows into the integrating capacitor, the voltage starts falling linearly from +9 toward -9V. When it reaches -9V, the voltage divider action of R29 and R30 turns off.

![Fig. 3. Motorola MC 724P quad 2-input gate.](image)

![Fig. 4. Logic block diagram.](image)
An F M M odel For Every Purpose . Every Purse

which applies a positive voltage to pin 2 (U7), which sets the “recharge” flip flop to the ON state. In the ON state pin 14 (U7) goes to “1” level, which resets the dash formation flip flop to the OFF state. This turns off the dash charging current and turns on the dash recharging current. When pin 5 (U1), goes to “0,” pin 14 (U4), rises to “1.” This assumes pin 13 (U4), is at “0,” which it must be, because pin 9 (U5), is at the “1” level. When pin 14 (U4), rises to “1,” about 1/3 milliamperes of current flows through Q16 into Q18, which saturates Q18. The voltage drop from Q18 collector to emitter drops to nearly zero, and a current flows out of the integrating capacitor equal to \( V_b (R_{35}+R_b) \), where \( V_b \) is the voltage at the emitter of Q19, and \( R_b \) is the resistance from the bottom of R33 to the center arm. This reverse current causes the integrating capacitor voltage to recharge from -9V back toward +9V. When +9V is reached, Q11 is again turned on, which clamps the voltage to +9. Q11 also turns on Q10, which applies a positive voltage to pin 12 (U7), which resets the recharge flip flop to the OFF state. Pin 14 (U7), goes to “0,” which causes U4 (pin 8), to supply a “1” pulse to the dash control flip flop, resetting it to the OFF state. C3 and R25 insert a 2 micro-second time delay in the output of U7, this is so that the dash control flip flop can be reset to the OFF state, before pin 8 (U7), can fall to the 0 level. Otherwise, gate U4 (pin 5), could retriger the dash formation flip flop, starting a new dash cycle. The dash cycle is now complete and everything is again in the quiescent state, awaiting initiation of a new character by the dash or dot key. If the dash key had not been released but had been kept continuously depressed, a new dash would have been started as soon as the recharge flip flop returned to the OFF state.

The formation of dots is similar to the formation of dashes. When the dot key is closed, pin 14 (U5), goes to “1,” which sets the dot control flip flop to the ON state. Pin 10 (U5), goes to “0,” and if pin 9 (U5), is at “0,” which it would be if the dash control flip flop were in the OFF state, pin 8 (U5), goes to “1,” pin 5 (U5), goes to “0” and U6 (pin 5), goes to “1,” setting the dot formation flip flop to the ON state. This turns off
the dot recharge current, and turns on the dot charge current by turning on Q9, which saturates Q8. Q6 and Q7 are emitter voltage followers, so that the voltage at the center arm of R14 is applied to the top of R16, which causes a charging current to flow through the center arm of R34 into the integrating capacitor. The action of the integrator is exactly the same as for dashes, except that the integration is faster, because of higher charging current. The charging current is equal to $V_c/(R_{16}+R_c)$, where $R_c$ is the resistance from the top of R34 to the center arm, and $V_c$ is the voltage at the center arm of R14. Varying $V_c$ by adjusting R14 changes the dot speed, which is directly proportional to the voltage $V_c$. It can be shown that with the center arm of R14 set at the top, the ratio of dash cycle time to dot cycle time is 3.1 to 1. By varying the setting of R14, this ratio can be lowered to as little as 1.7 to 1. When the integrator has charged from +9 to -9, the recharge flip flop is set to the ON state, which resets the dot formation flip flop to the OFF state. This turns off the charging current and turns on the recharge current by turning on Q13, which saturates Q14. The integrator recharges from -9 to +9, at which time the recharge flip flop is reset to the OFF state. The negative going reset pulse from pin 14 (U7), is differentiated by the network R23, C2, and R22, and passes through the gate U5 to reset the dot control flip flop to the OFF state. The differentiation network permits only the negative going leading edge of the pulse to do the resetting. The other input to

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the U5 gate comes through the U3 gate from the dash control flip flop. When the dash control flip flop is on, U3 (pin 3), supplies a “1” level to pin 1 (U5), through the 1N270 diode. The “1” level prevents the dot control flip flop from being retriggered * until about 1/2ms after the dash control flip flop has returned to the OFF state. This permits the use of what is called “dot storage” or “dot insertion.” During a train of dashes if the dot key is pressed, even for an instant, the dot control flip flop is set to the ON state. This places a “0” at pin 14 (U2), and a “1” level at U6 (pin 3), and U3 (pin 12). Gate U3 is then closed, causing the dash control flip flop to be reset to OFF at the end of the dash cycle. At that instant the dot control flip flop assumes control, and a dot is started. When the dot is completed, another dot will be started, if the dot key is still depressed. If not, the dot control flip flop is reset to OFF, which opens gate U3 and the dash control flip flop is again triggered, providing the dash key is still depressed. It can thus be seen how one dot or a string of dots can be inserted between two dashes without releasing the dash key. This is called “squeeze” or “dot insertion.”

*While the dash control flip-flop is in the on state, R24 and C1 prevent retriggering.

keying, which some operators prefer. Of course, one does not have to use this “squeeze” feature.

The potentiometer R37 varies the speed. It does this by varying the voltage at the emitters of Q3 and Q19 in such a manner that these voltages are always equal but opposite in polarity. The voltage is divided down further by R14, to vary the dot speed relative to the dashes. R14 adjusts the ratio of dots to dashes. This ratio is not affected by the speed control, R37.

When a dash is being formed, pin 13 (U6), is at a “1” level, which produces a “0” level at pin 14 (U6), stopping the recharge current. Otherwise, it would interfere with the timing of the dash. Likewise U4 (pins 13 and 14) stops the dash recharge current while a dot is being formed. The diodes CR21 and CR22 serve no purpose except to prevent the dot and dash formation flip flops from latching up.

Code output is produced at U6 (pin 8), by combining the outputs of the dash and dot formation flip flops. Transistors Q1 and Q2 amplify the level, producing a 0 to +14V output pulse.

Fig. 6, shows the schematic diagram of the power supply and sidetone keyer. The power supply uses a Stancor transformer.
with the third secondary windings connected in series. Capacitors C7 and C8 charge to the peak ac voltage, about +25V above and below ground. The voltage regulator circuit uses a Motorola MC1469R regulator. The circuit was taken from the Motorola Microelectronics Handbook, Second Edition. Load current is about 42mA at +15V dc and 13mA at -15V dc. As described in the notes, R62 and R63 are first selected to provide -15V dc output, and then R59 and R60 are matched to produce +15V dc output. Additional rectifiers produce -8V across C9, and +8 across C10, unregulated. The +8V powers the audio amplifier, U10. The +8V is dropped by regulator transistors Q26 and Q27, which give +3.6V for the logic.

A Wien bridge is used as a 400Hz sine-wave sidetone oscillator. U11 is a type 741 operational amplifier with input from a conventional Wien bridge circuit. CR19 and CR20 limit the oscillation amplitude. R76 is a variable resistor, which should be adjusted for ±8V peak oscillation amplitude at the output of U11. If difficulty is experienced in getting a ±8V oscillation amplitude, R75 might have to be varied slightly, possibly as much as 1 or 2K either way. The output of the oscillator is fed to a keyer circuit. Keying is accomplished by Q24, which acts as an open or short circuit to ground. Output from the volume control, R79, is fed through R80 to the power amplifier, U10, which drives a 16Ω speaker. Approximate normal listening levels are ±0.5V peak ac on the speaker with ±0.06V peak ac at pin 1, U10.

The code speed potentiometer produces about a 3.1 to 1 range of code speeds. This gives about 8 to 25 words per minute with the 0.2 microfarad integrating capacitor. The other two integrating capacitors change a factor of two, so that the total speed range is about 4 to 50 words per minute.

Construction

The keyer is housed in a cabinet made by L.M. Bender (L.M.B.), type WIC. Two etched circuit boards are used to provide the circuitry shown in Fig. 5 and 6. The boards accommodate all the smaller components—that is, all except the power transformer, large filter capacitors, panel switches, speaker, and panel controls. The two boards both are made to fit standard 22 pin card connectors, and are mounted one above the other to save cabinet space. The top-most card, Fig. 7, represents the circuitry shown in Fig. 5, and is the more complex. The bottom card, Fig. 8, is considerably simpler and represents the circuitry of Fig. 6.

The top card has all the digital ICs mounted on it plus the ZEL-1 hybrid IC op amp (U8). The digital ICs (U1 through U7) may be directly soldered into the board, or (as the authors prefer) 14 pin sockets may be used. The ZEL-1 (U8) was soldered into the board directly because the only socket available for this excellent op amp is huge and clumsy. There are a fairly large number of wire jumpers (insulated wire) on this board, because it is rather complex and only a single-sided board was used. However, the time to install the wire jumpers is small compared to the much more tedious task of laying out and etching a double-sided board. All but two of the transistors used on the top board are epoxy types made by Fairchild (and National Semiconductor). The two exceptions are also plastic-encapsulated types, but they are Darlington pairs: the 2N5307 (NPN Darlington) by G.E. and the MPS-A65 (PNP Darlington) by Motorola. All these transistors are soldered directly into the board.

The bottom card, on which is the circuitry of Fig. 6, has three ICs and eight transistors on it. Like the other card, the transistors are soldered directly into the board. However, in addition to six more of the inexpensive epoxy transistors, two metal can T05 types are used where greater dissipation is required in the voltage regulator section (2N3053's). U11 may be any of three different styles of the 741 type op amp, as manufactured by nearly every producer of linear ICs. The DIP (14 pins) and the "Half DIP" (8 pins) style of 741 will fit the board with or without the appropriate IC socket. The "T05" version of the 741 can be soldered in directly by spreading the leads slightly. U10 is soldered directly into the board, and has a heat dissipator clipped onto its T05 can. U9 is also directly soldered into the board, but mounted on .64cm (.4") metal spacers above the board. This way of
THE SEEC HCV-3KB SLOW SCAN TV KEYBOARD

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- 4 shade gray scale generator.
- Dual Fast and Slow Scan rf and video outputs (special optional).
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- ICs, op amps, transistors in plug-in sockets.
- Built-in 115/230 V 60 Hz power supply.
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Circuit board will accept any D.I.P. or TO5 style as manufactured by Fairchild, National, Motorola, Signetics, etc. (μA741C, LM741C, MC1741C/HEP-C6052P, N5741, respectively).

Resistors are 20% tolerance, % watt, values in ohms, except where otherwise noted.

- R1 470 ohms
- R2 470 ohms
- R3 470 ohms
- R4 470
- R5 2k
- R6 470
- R7 2k
- R8 470
- R9 10k, 1% tolerance
- R10 10k, 1% tolerance
- R11 6.2k
- R12 2k
- R13 680
- R14 2.5k potentiometer, linear taper, 10% tolerance.
- R15 3.6k, 5%
- R16 30k, 5%
- R17 200k, 5%
- R18 330
- R19 1 Megohm
- R20 6.8k, 5%
- R21 15k
- R22 10k
- R23 47k
- R24 10k
- R25 1k
- R26 470
- R27 470
- R28 20k
- R29 15k, 5%
- R30 10k, 5%
- R31 13k, 5%
- R32 9.1k
- R33 250k potentiometer, linear taper, 10%.
- R34 100k potentiometer, linear taper, 10%.
- R35 43k, 5%
- R36 30k, 5%
- R37 5.1k, 5%
- R38 10k, potentiometer, clockwise logarithmic taper, 10%.

All switches are black with white figures and snap-in front mounting.

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<tr>
<td>Blank Body</td>
<td>$0.30</td>
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</table>

**March Specials**

- 11 MFD - 10kV dc capacitor - 19 x 13 x 5. Ship wt. 90 lbs. | $25.00
- 4 MFD - 10kV dc capacitor - 9 x 8 x 4. Ship wt. 30 lbs. | $15.00
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**Gearhead Motor**

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mounting U9 allows the IC leads to flex and thus better register with the board layout pads. It is quite important that the case connect electrically with the pad on the board nearest the card edge (via a metal machine screw, spacer, and nut), since the case of the IC is one of its terminals.

As can be seen in the photographs, the "plug" ends of the circuit boards are toward the front panel where they mate with the two 22 pin card plugs. This puts the various inputs and outputs of the two boards immediately adjacent to the front panel controls to which they connect. The rest of the construction is conventional, and anyone building the keyer will probably add his own variations in the exact layout.

... K6ZN & W6GXN

Parts List

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Design & Engineered by K20AU
Fig. 8. Board layout of circuitry for Fig. 6.
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R39
R40 R41
R42
R43
R44
R45 thru R48
R49 & R50
R51
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R53
R54
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R56
R57
R58
R59 & R60
R61
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R70
R71
R72 & R73
R74
R75
R76
R77

R78
R79
R80
R81
R82 & R83
R84
R85
R86

Cabinet Bud LMB-W1C.
Transformer Stancor P8364
Capacitors are 20% tolerance, value in microfarads, unless otherwise noted.
C1 0.047 microfarad
C2 0.001
C3 0.002
C4 0.33 microfarad, Mylar, 10%
C5 0.1 microfarad, Mylar, 10%
C6 0.1 microfarad, Mylar, 10%
C7, C8, 2200 microfarads, 40 volts Mallory CG5222U040B1.
C9, C10, 3200 microfarads, 10 volts, Mallory CG5222U10A1 or HC1040A.
C11 10 microfarads, 25 volts.
C12 100 microfarads, 25 volts.
C13 0.1 microfarads.
C14 10 microfarads, 10 volts
C15 0.01 microfarads.
C16 0.012 microfarads, 5%
C17 0.012 microfarads, 5%
C18 200 picofarad, 20%
C19 200 picofarad, 20%
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What Time is the Next Satellite?

An Electronic Timer for Satellite Tracking

For anyone engaged in satellite tracking, either with the OSCAR communications satellites or the numerous weather satellites presently in orbit, there is a constant need for data on the position of the satellite in its orbit. The usual practice for both OSCAR and weather satellites is to receive the W1AW bulletins and utilize the data to calculate acquisition times. Logging the daily bulletins can become somewhat of a chore if time is limited and the calculations required for either short or long term acquisition data are also time consuming, even with a calculator. Two authors in a recent issue of QST (McKim and Simpson) presented ingenious mechanical timing systems for display of OSCAR orbital data. Both of these systems require a fair amount of mechanical work and reprogramming. Either for a new satellite requires a fair amount of effort in selection of the proper gear ratios and possible mechanical alterations. In the course of my own experiments in reception of NOAA weather satellite imagery, I developed a series of digital timing arrays to permit unattended reception and tracking of the weather satellites I was interested in. The heart of the system that finally evolved was an all electronic timing unit that provides a visual display of equatorial crossing data, indicating the elapsed time since the last equatorial crossing. Since many of the tracking techniques adopted by amateurs utilize such data (Direct Transmission System, Users Guide, etc.) the unit would be very useful for stations engaged in OSCAR communications experiments. The unit will run for a month or more without requiring

Fig. 1.
correction and reprogramming for a new satellite orbital period requires less than five minutes and involves little more than changing four solder connections within the unit.

The satellite timing unit is nothing more than a glorified digital clock. Normal digital clocks count seconds, minutes and hours and reset the count to zero at the end of a 12 or 24 hour period. The satellite timer is essentially a clock that counts in seconds and resets at the end of each orbital period of the satellite. If the clock is started at any satellite equatorial crossing the unit begins

The author's satellite timer. The front window display indicates minutes since the last equatorial crossing. Since the timer is presently programed for a period of 116 minutes, 11 seconds, the 115 minutes displayed indicates that the satellite will shortly complete an orbit. The use of a red plastic filter behind the display windows allows the numbers to be viewed while blocking out details of the LEDs and circuit board. The toggle switch on the lower left is used to reset the timer two or three times a month to minimize accumulated errors. The switch on the lower right is a simple on/off power control.

displaying accumulated time and resets on the next crossing. The front panel display indicates the time in minutes since the previous crossing and can be used as the time base for tracking the satellite for any pass within range of the ground station.

Circuit Function

The timer unit has three principal sub-assemblies: A time base derived from the 60 Hz ac line to provide accurate 1 second and 1 minute pulses, an orbital timer board that provides an accurate reset of the display at the end of each orbital period, and a display board that provides the timing display on the front panel. TTL logic is used throughout and although a fairly large number of devices are used, they are available at very reasonable cost from a large number of surplus outlets.

The time base board, Fig. 1, consists of six integrated circuits. IC1 is a quad 2 input NAND gate which shapes the 60 Hz ac from the power supply transformer to provide 60 Hz square waves for the counters. IC2 and IC3 comprise a divide by 60 chain that provides square wave output pulses at a one pulse/second rate. These square waves drive a transistor (Q1) which switches a LED on and off at the one second rate. This LED doubles as a pilot lamp and also indicates the proper function of the early sections of the time base circuit. The output of IC3 is also routed to IC4, a single shot multivibrator which provides short pulses (1 ms) at the one second rate for the orbital timer board. IC3 is followed by IC5 and 6 which divide the 1 Hz square wave by 60 to develop a one pulse/minute square wave that drives the display board. The reset line of these two ICs is connected to a common reset bus for the entire unit. The reset bus is activated automatically by the orbital timer and resets the visual display. A manual reset switch (S1) is also provided on the reset line to start the timer at an equatorial crossing.

The orbital timer board, Fig. 2, counts seconds and resets all of the circuits when the proper total is reached for the satellite in question. The timer uses four decade counters (IC7-10) which can accumulate a total count of up to 9,999 seconds (slightly over 166 minutes), more than sufficient for any conceivable orbital configuration of OSCAR or weather satellites. Each of the ICs, storing counts of units, tens, hundreds, or thousands of seconds, is connected to a 7441 IC which functions as a binary coded decimal (BCD) to decimal decoder. Such decoders develop a low on the appropriate decimal output when a given BCD count appears in the decade counter. The reset function of the counter is based on detecting the presence of the desired total count at the decimal outputs of the 7441s and generating
the proper reset signal when the count has been reached. NOR gates are used to provide this function. A NOR gate will have its output go high only when all its outputs have gone low. IC15 is a quad 2 input NOR gate, meaning that it contains 4 NOR gates, each with 2 inputs.

Programming the timer involves connection of the proper decimal outputs of the 7441s to two of the gates in this package. NOAA 3, with an orbital period of 116 minutes 11 seconds, will be used as an example. This orbital period represents a total of 6971 seconds and when this count has accumulated we want the counter to reset. Fig. 3 shows the logic diagram of the sensing and reset circuits. The inputs of the two ICs are held high by resistors connected to the positive supply. When the counters are all at zero the selected outputs of the decimal converter (6-thousands, 9-hundreds, 7-tens, 1-units) are all high and the outputs of both NOR gates are therefore low. As the count reaches 6000 the 6 output of the “thousands” decimal converter goes low, taking one input of gate 1 low. The output of gate 1 is still low, however, since a NOR gate requires all inputs to be low if the output is to go high. When the count reaches 6900 both the inputs to gate 1 are low and its output goes high. This high is inverted by one section of a hex inverter (IC16) thus becoming a low which is applied to one input of gate 3. At this point however, both inputs of gate 2 are still high and its output is therefore low. This low inverted by another inverter becomes a high applied to the other input of gate 3, thus keeping the output of gate 3 low. When the count reaches 6970 one input of gate 2 will pull low but the gate’s output will remain low. When the count reaches 6971 both inputs of gate 2 are low and its output goes high. The inverted output of gate 2 lowers the remain-

Fig. 2.

Fig. 3. Details of the orbital timer reset circuit. The output of gate 3 goes high only when the thousands, hundreds, tens and units inputs to gate 1 and 2 go low at the end of the programmed orbital period.
ing input of gate 3 which then goes high at
the output. Thus, the only time the output
of gate 3 will be high is when a count of
6971 is stored in the decade counters and
decimal decoders. This high could be used
directly to reset all of the counters in the
unit but improper reset would be likely since
there are so many counters involved. The
high at gate 3 of IC15 is thus used to trigger
a 10 ms single shot (IC17). The 10 ms
output of the multivibrator is sufficiently
long to assure that all of the counters in the
unit will reset. The programing used in this
example is indicated by dotted lines in the
schematic. Other orbital periods can be
accomodated by changing the connections
between IC15 and the appropriate outputs
of IC11-14. One second was chosen as the
basic time base because it provides reason-
able accuracy with moderate circuit com-
plexity. The orbital programing should be
chosen on the basis of the nearest whole
second. A worst case situation thus involves
a maximum error of 0.5 seconds per orbit.
Under such conditions the timer would run
approximately six seconds slow or fast each
day, assuming 12 orbits per day. The
counter would be one minute off every ten
days. The closer the true orbital period to a
whole second, the greater the accuracy. In
the worst case shown above, assuming one
minute as the maximum allowable error, the
counter could be reset a minute early every
ten days if running slow or the count keyed
out of the counter for one minute if it were
running fast.

The display circuit, Fig. 4, consists of
three decade counters (IC18-20) driven by
the one pulse per minute output of the time
base. Each decade is connected to a BCD/7
segment decoder (IC21-23) which drives a
seven segment LED numeric display. A reset
pulse from the orbital timer resets the
display to 000. Once each minute the
display will be updated. In the case of the
NOAA 3 orbit used as an example, the
display would accumulate to 116. Eleven
seconds after the initial display of 116 the
display would reset to 000 and a new orbit
begins.

Construction

Although the final unit can be packaged
in any way desired, it simplifies construction
and trouble-shooting if each of the three
subassemblies are constructed on separate
boards. Glass perf board with .1” hole
spacing is ideal for this purpose. IC sockets
are highly recommended even though they
do increase the cost of the project. Normal
digital construction practices should be
followed. Bare #18 tinned wire may be used
for the 5 V, ground, and reset busses with
smaller wires used to interconnect ICs and
routings to each bus. Do not scrimp on the
bypass capacitors indicated, otherwise the

Fig. 4. LED display – minutes since equatorial crossing.
counter will react unfavorably when the transmitter, clothes dryer, or any one of the many possible rf and noise sources in the house are used. The 5 V line from each board should be returned to the common 5 V point on the power supply (Fig. 5) and the same thing for ground lines. Do not ground each board to the chassis! It is recommended that each board be built and tested on the bench using test leads. Once it is determined that each is functioning, they can then be wired into the complete unit with confidence. Begin by constructing the power supply, followed by the base board. With the time base board connected to the 12.6 V ac and the 5 V and ground lines the small indicator LED should flash on and off at a 1 second rate. A voltmeter on the output of IC6 should show a logic high (2.4 V min.) every minute. Note the time when the output goes high, disregard when it drops and note when it rises again — the interval should be 60 seconds.

The next board constructed should be the display. The LED display units mount on 14 pin DIP sockets. By proper positioning of the LED sockets the board can be mounted behind the front panel with a cutout for the LEDs. If you go this route be sure the hundreds indicator is on the left, the tens in the middle, and the units indicator on the right as viewed from the panel. It sounds simple but you will feel very foolish if you have to read your numbers backwards! When the board is finished and checked install all the LEDs and IC 18 and 21. Connect a test lead from the 1pps output of the time base to the input (pin 14) of IC18. Connect the reset circuit of the time base to the reset line of the display board and set S1 to reset. Apply power and the LED should read 0. Switch S1 to run and the LED should count from 0-9 with the count updating every second. If it counts out of sequence or some numbers are incomplete, recheck wiring. If the wiring seems OK and you still have an aberrant count try substituting the LED and IC21. Be sure power is off before changing ICs at any point in the testing procedure. When the first counter checks out remove IC21 and 18 and put in IC19 and 22. Change the 1pps input to the input of IC19 and repeat the entire test procedure. Remove 19 and 22 and insert 20 and 23. Repeat the entire test sequence with the 1pps test lead routed to the input of IC20. When all three display decades have been checked, replace all ICs, route the 1pps input to the input of IC18. Place S1 in reset and apply power. The display should read 000. Return S1 to run and you should observe a nice orderly count. At the end of 1 minute it should read 060, at the end of two minutes it should be 120, etc. As a final test set S1 to reset and connect the test lead from the input of IC18 to the 1ppm output of the time base. Return S1 to run and the count should now occur at the one minute rather than one second rate.

Construction of the orbital timer is the final step. When it is finished it should be interconnected to the 5 V, ground, and reset lines along with the other two boards. Since we don't want to wait around all day to determine if it is operating properly, connect the 1pps input of the timer to pin 8 of IC1. This has the effect of speeding up the count by a factor of 60 (60 Hz input to the timer instead of 1 Hz). When wiring the timer you should select the programing on the basis of the satellite you plan to track. At our speeded up test rate a 116 minute 11 second orbit (used as an example in our earlier discussion) will now occur in just over 116 seconds. While testing the timer, temporarily connect the 1ppm input of the display board to the 1ppms output of the time base. Set S1 to reset and return it to run. The display should start at 000 and advance one unit every second. At the speeded up rate it should reset almost immediately after it.

---

**Fig. 5.** TI-12.6 V 2A., S1, SPST, power. *Regulator IC should be mounted on a good heat sink using mounting grease. All polarized capacitors are electrolytics. All decimal capacitors are low voltage disc ceramic units. All resistors ¼ or ½ W, 10%. Unmarked diodes are general purpose silicon (IN457, IN914, etc.).**
An interior view of the satellite timer. In this version a portion of the time base (the 1 minute count down chain) has been incorporated as part of the display board mounted up against the front panel. The time base ICs, the display 7490s and the decoders are visible while the 7 segment LEDs are on the other side of the board facing the panel cutout. The orbital timer and reset circuits are on the chassis mounted board. The 1 Hz monostable is mounted on a small sub-assembly behind the power transformer. The 60 Hz to 1 Hz timebase circuitry is mounted on a small board beneath the chassis. The cables plugged into the rear apron carry control signals from the orbital timer to automatic control units in the weather satellite station.

reaches 116 (in the case of our example). If it resets at some other value you should double-check your program wiring, if it fails to reset double check the wiring. If all appears well you should follow the signal through the count chain checking for proper logic levels at each point. This is the fastest way to uncover a bad IC — virtually the only thing that can keep a properly wired unit from operating. Once all boards are working you can mount and wire them into the completed unit.

Putting the unit into service involves calculating the nearest convenient equatorial crossing time for the satellite of interest. Set S1 to reset and at the calculated equatorial crossing time return it to run. Spot check the timer for the first few weeks to get an idea of how quickly it is drifting either fast or slow to get an idea of how often you will want to reset it. You will find that calculating one or two crossings a month is much easier than amassing the data every day. Since both weather satellites and OSCAR satellites are in sun synchronous orbits, the time of equatorial crossing can be neatly related to the point that the satellite crosses the equator. Listening to one or two bulletins will provide the raw data you need to convert time of crossing to the point of crossing and a graph can be prepared. With the crossing time available from the timer the graph can be used to orient the satellite track on the plotting board and you are ready to track using the timer as your time base.
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If there is sufficient interest, it would be possible to prepare a short article on tracking techniques — let 73 know if you would like to see such an article. A future article in this series will show some of the automated weather satellite equipment that can be interfaced with the timer. This will include turning on the recorder at preset points in the satellite orbit during the daily “windows” and automated antenna tracking. With this sort of equipment the satellite station can operate while you are away at work or even a month’s vacation and the pictures will be waiting when you return.

...WB8DQT

References

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Four minutes to acquisition of signal. Three minutes, two minutes, one minute. Are these the sounds of a NASA satellite control room? Not necessarily. They just might be the thoughts of a radio amateur as he sits at his operating position waiting for the next OSCAR satellite pass.

If you have receiving equipment for 80-10 meters and haven't listened for OSCAR 6 as yet, you are missing one of the new and exciting facets of amateur radio. This article describes how you can get started, equipment requirements, frequencies and when to listen.

Basically, AMSAT-OSCAR 6 is a linear translator in a 910 mile polar orbit that retransmits the CW and SSB signals it picks up in the band 145.900 to 146.000 MHz down to the 29.450 to 29.550 MHz band. The 910 mile orbit gives this repeater in space a range of communication of about five thousand miles. Truly amazing when you consider the ten meter transmitter runs less than a watt.

AMSAT-OSCAR 7, launched November 15, 1974, is very similar to OSCAR 6 with the addition of a linear translator with a receiver on 432 MHz and a transmitter on 144 MHz. The exact frequencies for both satellites are listed in Table 1. As you can see, OSCAR 7 has several more translators and beacons than OSCAR 6. To accommodate the translators, command and control modules and batteries, OSCAR 7 is larger than its predecessor. OSCAR 7 is 17 inches high and has an octahedral crossection of 14 inches. The photograph of Jan King W3GEY and AMSAT-OSCAR-B (OSCAR 7) should give you a good idea of how small a satellite can be. Specific details on the capabilities of OSCAR 7 can be found in the references at the end of this article.

Getting Started

The best way to get started in satellite communications is to listen to several satellite passes. Most any receiver capable of
receiving 29.45 to 29.55 MHz is fine to begin with. To insure your receiver is at its best, you should consider peaking the rf amplifier for reception at 29.5 MHz. The crystal calibrator is a handy signal source for this operation. Additionally, for serious satellite work, you'll probably need a good ten meter preamp.

Fig. 1 shows a simple preamp useful on 10 or 2 meters, with appropriate coils, of course. Although this design uses two FETs, it needs no neutralization, which is handy. It can be constructed in a mini-box or on a small printed circuit card and placed in your receiver. Any ten meter signal can be used to tune it up.

The preamp will insure that you can hear both sides of each QSO in progress on the satellite when you listen in. This is an excellent test of your receiving set up.

On ten meters I use three antennas, but to start out, any low band antenna will do. When the satellite is low on the horizon I use a 3 element 10 meter beam. For overhead passes I switch to a 10 meter dipole or ten meter vertical. The switch is a wafer type in a mini-box. The vertical has no radials to improve the high angle radiation.

Another test for your receiver is that when OSCAR 6 is in range, you should be able to hear considerable noise in your receiver passband. This is the retransmitted noise from the satellite's receiver.

After listening to several passes, you'll probably want to make some contacts using OSCAR 6. To work through the two to ten meter repeaters of both satellites, one hundred W effective radiated power is recommended. A Johnson 6N2 or Ameco TX-62 at fifty W with 100 feet of RG-8 and a four element beam is one acceptable approach. Good results have been achieved with keying a 10 W 2 meter FM rig on CW and an eleven element beam. Although some satellite users have both azimuth and elevation control, a simpler but very effective compromise is to elevate the VHF antennas by 30 degrees. The antennas I use are shown in Fig. 2.

Operation

To make contacts you'll need to hear your two meter signal as it is retransmitted down to your ten meter receiver. The normal procedure is to send a series of dahs while tuning your receiver until you find yourself. Now you can compare your signal against the other signals in the passband and adjust your power input accordingly. Remember all of the signals in the output of the satellite are sharing the one W in proportion to their strength at the satellite's receiver. Excessive power by one user may overload the satellite's AGC and reduce the strength of other user's signals, thereby causing interference and possibly disrupting QSOs in progress. The FCC has interpreted overloading the satellite as a violation of section 97.67 (b) of the Rules. By monitor-
Fred W2GN displays his compact mobile OSCAR satellite station.

When To Listen

Determining when OSCAR 6 or OSCAR 7 is in range of your location is much easier than you think. In fact, after a few nights of listening to OSCAR you'll probably be able to calculate the passes for the following evening in your head. Oscar 7 has a similar orbit to OSCAR 6. Thus, what you learn for OSCAR 6 will also be useful for OSCAR 7.

OSCAR 6 orbits the earth at an altitude of 910 miles and when it crosses the equator heading north (ascending node), it makes an angle of 101.77 with the equator. The first ascending node orbit after 0000Z has been designated the reference orbit. The time the satellite crosses the equator, point A in Fig. 3, on each day's reference orbit is published in the 73 Magazine AMSAT News Column and in the AMSAT Newsletter, or from AMSAT by sending a self addressed stamped envelope to: AMSAT, P.O. Box 27, Washington, D.C., 20044 for two months orbital data.

The reference orbit information consists primarily of an equator crossing time and degrees west of Greenwich the equator.

<table>
<thead>
<tr>
<th>UPLINK (MHz)</th>
<th>DOWNLINK (MHz)</th>
<th>RECEIVER (28 MHz i-f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSCAR 6 145.9-146.0</td>
<td>29.450-29.550</td>
<td>29.450-29.550</td>
</tr>
<tr>
<td>BEACON</td>
<td>29.450</td>
<td>29.450</td>
</tr>
<tr>
<td>OSCAR 7 145.850-145.950</td>
<td>29.40-29.50</td>
<td>29.50-29.50</td>
</tr>
<tr>
<td>432.125-432.175</td>
<td>145.975-145.925</td>
<td>29.975-29.925</td>
</tr>
<tr>
<td>BEACONS</td>
<td>29.5</td>
<td>29.50</td>
</tr>
<tr>
<td></td>
<td>145.98</td>
<td>29.98</td>
</tr>
<tr>
<td></td>
<td>435.1</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td>2304.1</td>
<td></td>
</tr>
</tbody>
</table>
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crossing will take place. As an example, the information below for orbit 9121 shows that

REV   DATE   GMT   LONGITUDE W.
9121   14 OCT 74   0135    72.1°

OSCAR 6 crossed the equator at 9:35 PM EDT at 72.1° west longitude on Sunday evening, October 13, 1974. From experience, I knew that at about 9:40 PM on this date I would begin to hear stations south of me in QSO via the satellite.

Once you know the pertinent information which occur in the evening, there are also descending node orbits which occur during the morning hours. By using simple calculations, you can determine the time required for the satellite to travel from its equator crossing on the other side of the earth to a point where you can access it. The example in Fig. 4 places the satellite on the equator at 260.9° west longitude at 14:11Z. At approximately 14:40Z the satellite will reach its most northern point and begin its southward journey over North America reaching the equator at 15:09Z. These times can be determined by adding one quarter

for a reference orbit, it is easy to determine the remaining orbits for that day and, in fact, for the rest of OSCAR 6’s life. Since the satellite’s period is 144.99455 minutes, all that you need do is add one hour and fifty-five minutes to the reference orbit equator crossing to get the second crossing of the day.

To determine where the satellite will cross the equator simply add 28.7° to the first equator crossing as shown below.

REV   DATE   GMT   LONGITUDE W.
9122   14 OCT 74   0330    100.8°

This is easily explained since the earth is spinning under OSCAR 6. During the time it takes OSCAR 6 to return to the beginning of its orbit, the earth has moved 28.7° to

\[
\frac{114.994}{4} = 28.748 \text{ min.}
\]

\[
\frac{114.994}{2} = 57.497 \text{ min.}
\]

The satellite will cross the equator at 95.3° west longitude, as determined from the following equation:

\[
260.9° - 180° + 14.37 \approx 95.3°
\]

In addition to the ascending node orbits and one half of an orbit period, respectively, to the time of the start of the orbit.

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>AREA</th>
<th>TIME</th>
<th>NET CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3850 LSB</td>
<td>No. America East</td>
<td>Monday 9PM EDT (0100Z Tues)</td>
<td>W3ZM</td>
</tr>
<tr>
<td>3850 LSB</td>
<td>No. America West</td>
<td>Monday 7PM PDT (0200Z Tues)</td>
<td>W6OAL</td>
</tr>
<tr>
<td>14280 USB</td>
<td>International</td>
<td>Sunday 1800Z</td>
<td>W3ZM</td>
</tr>
<tr>
<td>21280 USB</td>
<td>International</td>
<td>Sunday 1900Z</td>
<td>W3ZM</td>
</tr>
<tr>
<td>3780 LSB</td>
<td>Western Europe</td>
<td>Sunday 0915Z</td>
<td>G3IOR</td>
</tr>
<tr>
<td>3560 LSB</td>
<td>JA Net</td>
<td>Monday 1300Z</td>
<td>JA1ANG</td>
</tr>
<tr>
<td>14320 USB</td>
<td>SE Asia</td>
<td>Thursday 1300Z</td>
<td>JA1ANG</td>
</tr>
<tr>
<td>3850 LSB</td>
<td>ZL Net</td>
<td>Mon., Thur., Sat. 7PM NZT</td>
<td>ZL1WB</td>
</tr>
</tbody>
</table>

Table 2
AMSAT nets provide information to new satellite users

\[
114.994 \times 24 \times 60 = 28.7487°
\]

the east. Thus, the satellite appears to have moved to the west.

<table>
<thead>
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<td>Mon., Thur., Sat. 7PM NZT</td>
<td>ZL1WB</td>
</tr>
</tbody>
</table>
To complete this example, assume your location is approximately 90° west longitude and latitude such that you normally hear the satellite five minutes after an ascending node equator crossing. Therefore, for a near overhead pass, as in this example, you should begin to hear the satellite twenty five minutes before it reaches the equator. For the next twenty minutes until 15:04Z you should be able to access the satellite. Obviously, if you are significantly east or west of this location for this particular pass, the access window would be much shorter than twenty minutes.

Listed in Table 2 are the AMSAT nets where specific questions you may have will be answered for you. The nets provide up to date information for both newcomers and regular users on such items as the status of OSCAR 6, launch date for OSCAR 7, etc. For example, at the time this article was written, OSCAR 6 was turned on at 0000Z for twenty-four hours on the following GMT days: Mondays, Thursdays and Saturdays. During the summer, descending node (southbound) passes for OSCAR 6 were turned on for Sunday mornings. During the school year, Tuesday and Friday morning passes are turned on for use as an educational tool. If the satellite’s battery voltage is sufficient, both the weekday and weekend descending node orbits will be available. OSCAR 7 has been designed with a positive power budget and should be available for more orbits than OSCAR 6. The AMSAT nets will still provide current information on special events for satellite users.

Experiments

There are many simple experiments that can be accomplished using OSCAR 6 and 7. For example, an OSCAR amateur station and a frequency counter can be used to demonstrate that the moving satellite causes a Doppler shift on the downlink signals of plus/minus 5.7 kHz on the ten meter signals.

\[
\frac{28.7487}{2} = 14.37°
\]

Fig. 4. Calculation of descending node access window.
An easier experiment is to determine the minimum ERP which still allows you to hear your own signal. There are many fascinating experiments that are possible from copying the CW telemetry, such as determining the spin rate of the satellite.

Results

Results on OSCAR 6 have been phenomenal. Well over 2400 amateurs have made over 100,000 two way contacts. This is a tremendous growth rate from the previous two satellites designed for two way communications, OSCAR 3 and 4. There were 98 successful users on OSCAR 3 and 11 users for OSCAR 4. Short lifetime was the primary reason for the limited use of these satellites; however, the experience gained by both the users and developers contributed to the success of OSCAR 6.

The list of countries you can work through OSCAR continues to grow. The last count shows that stations from 87 countries have made contacts through OSCAR 6. Prior to the launch of OSCAR 7, the number of stations who had attained the goal of worked all states had risen to sixteen.

In conclusion, whether you wish to write a special computer program for satellite use or study propagation from satellites for a high school project, the only limit is your imagination. If you are a DXer, then working out to the fringes of the satellite’s capability for new countries may appeal to you. Whatever your amateur radio interests are, this is the time to apply them to satellite communications and discover both the enjoyment and challenge of this new frontier in amateur radio.

REFERENCES


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How to Find a Satellite

A Simplified Graphical Technique for Satellite Orbit Prediction

The use of orbiting satellites by amateur radio operators is expanding rapidly. Amateurs were there to pick up the first beeps from Sputnik. Today with the Oscar series of satellites and the various weather satellites, the need for a simple orbit prediction method is increased. The technique used here evolved from such a need. I had been monitoring one of the Essa satellites for several months on weekends only. Each Saturday I monitored the receiver until I heard a pass. The next pass would be one hour and forty-five minutes later. This accuracy sufficed for each weekend but the error in extending it to the next weekend was excessive. Broadcasts of equatorial crossings were available but that method appeared too complex. Surely a simpler method could be found that could be used when such broadcasts were available or not.

The answer was simple: to analyze experimental data you graph it and try to fit an equation to it. So I graphed both the orbits I heard and the predicted times for the previous and next orbit. The graph for several Saturdays is shown in Fig. 1. The horizontal axis shows the date and the time of observation is on the vertical axis. Only daylight hours are shown because the satellite was solar powered. With several weekends plotted, I began drawing straight lines connecting the points from one Saturday to the next and extending them on to the following Saturday. This is illustrated in Fig. 2. A pattern appeared. After all if the orbit is periodic then the pattern should be periodic. A similar gridwork was found for orbits heard on Sundays. The two grids are parallel. By extending the grid lines for any day, passes on that weekday in the future could be determined. The uncertainty of a prediction could be estimated by how well three or more prediction lines crossed. If they all cross at the same point, the accuracy is high. If they cross in an area several minutes high then the uncertainty is roughly equal to the number of minutes between the most separated lines. As more orbits are heard and plotted, the accuracy improves.

Reception times for days other than Saturday or Sunday can be determined as shown in Fig. 3. Here the results of two
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73-1-2
Fig. 3. Prediction of weekday orbits.

successive weekends are plotted. Drawing straight lines from one Saturday point through a Sunday point to a point on the next Saturday, a grid is generated. Where the grid lines cross each day a passage of the satellite should occur.

This method is simple, fast and easy on the brain. The power of graphing cannot be underestimated.

...WA4WDL

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Measuring Heating Oil Usage

Now that winter is here again, and with it another fuel shortage (or, at least, that's the way it looks in October as this is being written), it's time for you to apply your electronics know how to the problem. Measuring how much heating oil you use is not easy. If your oil tank has a gauge, the best it probably does is to tell you whether
you have a half-tank or quarter-tank. And if you have an outside tank buried under your lawn, maybe you don't have a gauge on it at all. But with just a few dollars' worth of parts, you can measure your oil usage day by day, or even by the hour.

A typical oil burner has an oil pump, which pressurizes the oil up to around 100 psi; the oil is then squirted into the firebox through a nozzle which is calibrated in gallons per hour. To determine the number of gallons used, you only need to know how long the burner has run. This is easy to do with a running-time meter, which measures elapsed time.

To do the installation, get yourself a 110 V running-time meter which can be read down to the nearest 1/10 hour or better. The finer the calibrations on the meter, the better. If a 110 V meter is not available, you can use other voltages if you add an appropriate transformer. You mount the unit in a box at a convenient location, and connect it directly across the burner motor. Now every time the burner runs, the time meter runs as well.

Although you can use the nozzle calibration as a rough starting point, for best results you should calibrate the meter yourself. This is easy to do by dividing the total elapsed time between two oil deliveries into the number of gallons consumed. Repeating this calibration a few times should give you a fairly exact figure for the gallons-per-hour usage of your burner; the calibration should be repeated, of course, each time you replace the nozzle.

Once you know the calibration figure, you can easily compute the number of gallons of fuel used for typical household tasks. For instance, if you find that the burner uses 1.1 gallons per hour of running time, you can calculate how much oil your XYL uses in her 1 hour shower. In order to get the best accuracy, during this time you should turn down your thermostats so that the burner is used only for heating the shower water, and not for heating the house. This may leave her slightly cold when she comes out, but you can explain that's necessary for the progress of science. If you then find that the burner ran for 0.7 hour, your figure for the oil needed to heat her shower water is 0.77 gallons.

Other uses are possible too. For instance, on an extremely cold day during the winter you might find that your house simply does not get over 60 degrees and you're freezing. If, during a 24-hour period, you find that the running-time meter has run 23.5 hours, then you can suspect that the boiler/burner combination is too small for your house. On the other hand, if it has run only 12 hours, then you can suspect that the boiler/burner size is OK, but the distribution system (such as radiators and circulator pump) is too small to get all the heat produced in the boiler distributed into the house.

Finally, if oil rationing should come about, you can keep track of your daily oil usage and, if needed, cut down on your usage in the early part of the month so as to leave enough oil for the last few days of the month. You may not have any more oil, but at least such a system will allow you to keep from running out of your allotment altogether.

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### Oil Burner Accessory Information

<table>
<thead>
<tr>
<th>Model</th>
<th>Price</th>
<th>Length</th>
<th>Description</th>
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<tr>
<td>75-10HD</td>
<td>$60.00</td>
<td>66 ft.</td>
<td>0.75 thru 10 meters</td>
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<tr>
<td>75-20HD</td>
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<td>0.75 thru 20 meters</td>
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<tr>
<td>80-40HD</td>
<td>$42.00</td>
<td>68 ft.</td>
<td>0.8 thru 40 meters</td>
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While working a lot of cw with my transceiver it soon became apparent that some control of the agc time constant and selection of agc to the "out" position would be desirable. Also, any modifications that are made should not require the drilling of new holes or marring of the front panel. In this way the unit could be restored to its original configuration.

This modification consists of adding two miniature switches on a small "L" shaped bracket which is mounted to the top right side of the LMO power supply cover utilizing the existing two self-tapping screws. A spst switch is used to control the agc time constant from either "fast" to "slow." The ground end of the existing 3300Ω resistor is raised from the printed circuit board and a small terminal strip is placed on top of the board under an existing screw that holds the circuit board to the chassis. The free end of the resistor is connected to the terminal strip lug. A wire connects from this tie point to the spdt switch as indicated in Fig. 1. At tube V13A, pin 1, the printed circuit foil is cut with an X-acto knife or razor blade. Two slices about 1/32" apart will give the required separation. Wires are now soldered to each side of the cut side of the cut foil and connected the dpdt switch as indicated. This is your agc "in-out" switch. Since the meter bridge circuit is now unbalanced when in the agc "out" position the meter will read below zero on the S meter scale. Not desiring to see meters read below zero the other pole of the dpdt switch was wired as shown. Now, when in the agc "out" position the meter will read zero as it should.

This modification involves simply opening the existing black lead at the socket of V3 and placing the switch in series with the meter switch. With these modifications your transceiver will now have agc features normally found only on deluxe SW receivers. Use of the agc switches involves opening the hinged cover which is really no problem.

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Recently, the use of FM on VHF has grown by leaps and bounds. So have the claims of the fans of this mode. Some have even told me that FM is superior to SSB for weak signal work. Perhaps it is time to objectively assess the relative merits of AM and FM under weak signal conditions. I will try to confine my bias to the title.

A few years ago, around Metropolitan Toronto, there were many 2 meter mobile AM stations. The average rig produced about 10W output. There were also many Twoers producing about ½W output. The popular antennas were halos and turnstiles. Along came the surplus FM rigs. Of course these commercial FM rigs did a better job. They had many things going for them.

1. The FM rigs produced about 40W output. Using the 10W AM rigs for comparison, that is 4 times as much power.

2. The commercial FM rigs used speech clippers as a guard against excess deviation. Hardly any AM rigs around here used speech clipping. You can get about a 10 times power advantage by using speech clipping.

3. The FM boys used vertical polarization. The AM boys used horizontal polarization. If you look at Fig. 8 in VE3AAZ’s article in QST¹, you will see that a vertical antenna, 5 ft off the ground on a car, has a dB or so advantage over a horizontal antenna. For mobile-to-mobile operation, the FM boys have a 2 dB or so advantage. That is a power ratio about 1.6.

If we multiply these three power ratios, we have (4 x 10 x 1.6) a power advantage of 64. No wonder the FM boys do better than the AM boys. Note that none of these advantages are due to the FM mode. The AM boys could build rigs giving 40W out, use speech clipping and vertical polarization. So, the fact that the FM boys are doing much better than the AM boys says absolutely nothing about the relative merits of AM vs FM. The advantage is in the equipment, not the type of modulation.

A common claim for FM is that it is better in the presence of noise. This is valid or not, depending on how you look at it. Every respectable FM receiver has a limiter, which helps to reduce the noise. An AM receiver can also use a limiter. The FMers have an advantage because they can clip their waves as much as they want. The AMers must not clip too much or they will distort the desired wave. For AM, you must be able to control the degree of clipping to fit the amplitude of the wave in the receiver. Noise clipping is available to the FM man and the AM man, but it is easier for the FMer to use this technique.

Bandwidth plays a big part in noise suppression. If the noise is the high amplitude, short duration type, such as ignition noise, a wide bandwidth is better. Narrow bandwidths reduce the amplitudes of the pulses and increase the time during which they are present. This makes limiting less profitable because you are chopping off a smaller part of the pulse. Therefore, when impulse noise is the limiting factor, the wider bandwidths of the FM system are preferable to the narrower bandwidths of the AM system. But even this is not necessarily true. Better impulse noise suppression in either system can be obtained with some sort of noise silencer applied before the filters in the i-f amplifier. With such a silencer, the bandwidth of the i-f amplifiers would not be significant for this type of noise.

In the presence of random noise with low peaks, such as receiver noise, the situation is quite different. The power of such noise is proportional to the bandwidth. Twice as much bandwidth produces twice as much noise.
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noise in the i-f amplifier. So the wideband FM system has a disadvantage to overcome. Comparing a 30 kHz FM system and a 6 kHz AM system, the AMers have a 5 to 1 power advantage with receiver noise before the signal gets to the detector. Clipping such noise is not nearly as effective as the clipping of impulse noise and both systems can use clipping anyhow.

The most interesting and significant characteristic of FM, in my opinion, is the capture effect. It is a factor characteristic of the mode itself. The factors noted above (bandwidth, use of clipping, etc.) were characteristics of the way in which the mode was used. When two signals are present in a system, the little one distorts the big one in amplitude and phase. The amplitude problem is reduced in the FM system by clipping. The phase distortion produces a more interesting story. If you do some vector analysis, as outlined by Terman, you will see that for a given ratio of signal amplitudes, the ratio of resulting deviations at the detector is large. That is, the little signal may be only a bit smaller than the larger signal in the i-f system but it will be much smaller after it gets through the FM detector. Even if a little signal is only slightly smaller than the big signal it will be clobbered by the detector.

Before the FM boys start celebrating, I should point out that it works both ways. When the desired signal is the biggest one, your signal captures the channel and you are the big winner. When the desired signal is the weaker one, as is often the case in ham radio, you lose your shirt. The performance in the presence of noise is similar. When the signal is stronger than the noise, the noise is suppressed. When the noise is bigger than the signal, the signal is suppressed. So there is a relatively sharp threshold of signal strength between solid copy and hopeless QRN.

The capture effect is most pronounced when the modulation index is high. For performance in noise, this means a high modulation index, and therefore more deviation and bandwidth, gives more suppression of the weaker signal. Therefore, wideband systems have sharper thresholds of minimum signal strength, but this does not mean that you can receive weaker signals. A 1 to 1 signal-to-noise ratio is still the threshold.

The factor of the modulation index also produces different results at different audio frequencies. The relationship between the deviation and the modulation index is shown in the following equation.

\[
\text{modulation index} = \frac{\text{deviation}}{\text{modulation freq}}
\]

For a given deviation, lower modulation frequencies give higher modulation indexes than do higher modulation frequencies. That is, under weak signal conditions, noise suppression will be better for the low audio frequencies than for the high audio frequencies. Since the higher audio frequencies carry most of the intelligence, this is an important matter.

The higher audio frequencies are in bad shape in the presence of noise in any system. Random noise (receiver noise) varies according to the bandwidth. There is as much noise between 500 Hz and 600 Hz as there is between 2500 Hz and 2600 Hz. On the other hand, the human voice puts most of its power in the lower frequencies. The higher audio frequencies suffer a poor signal-to-noise ratio in any system.

To give the higher audio frequencies a fighting chance, the FMers use pre-emphasis and de-emphasis. In the transmitter, the higher audio frequencies are made bigger than the lower frequencies (pre-emphasis). This gives the higher audio frequencies a better chance against the noise. In the receiver, the higher audio frequencies (and the noise at these frequencies) are reduced to restore the original relationship in the speech. This trick can be applied in an AM system, but hardly anyone does. The FMers do it not only because it is a good idea for any system, but because they get a double benefit. Not only do they get more deviation at the higher audio frequencies, but the greater deviation gives better noise suppression in the other guy's detector. That is, in the receiver audio system, there is more signal and less noise.

So it is time to try to sum up. Let us assume that we have an AM transmitter and an FM transmitter, both running a legal 1 kW. If we are comparing the two systems alone, the differences are these:
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FEBRUARY 1975
1. The FM signal has a poorer signal-to-noise ratio in the receiver i-f amplifier due to the wider bandwidth. If the FM system uses 5 times as much bandwidth, it suffers from 5 times as much noise power.

2. If the signal-to-noise ratio in the i-f amplifier for the FM signal is just a bit better than 1 to 1, the noise will probably be suppressed so much that the signal will be readable. The detector in the AM system does not improve the signal-to-noise ratio.

With equal transmitter powers, when the FM receiver has a 1 to 1 signal-to-noise ratio (its threshold) the AM receiver has a 5 to 1 power signal-to-noise ratio. So, I submit, the debate should be on the question of whether an AM signal, with clipping and pre-emphasis, can be copied when the power signal-to-noise ratio is 5 to 1. That is a bit over 1 s-point. From my observations on 2 meters, I would say that AM signals two s-points out of the noise are easily readable. With clipping, which is hardly ever used around here, signals one s-point out of the noise should be readily readable. Signals weaker than one s-point out of the noise should be readable with difficulty. Just where the threshold of readability is for AM signals is a matter for debate, but surely the difference between the two systems for weak signal work is small.

You might object to comparing two 1 kW transmitters, so let us deal with the transmitter conditions. What is a fair comparison depends on your point of view. If money is not a problem, you run all the power that the law allows. The above analysis assumes this sort of condition. If you are comparing the two modes with the same final tubes, FM has a small advantage. Tubes usually are rated for more plate dissipation for FM than for plate modulated AM. For a given dc power input, AM also requires a higher peak power capability than does FM. If you want to compare total power drain, AM needs not only the carrier power but almost as much modulator power, if heavy clipping is used. That figure of ½ the carrier power for the modulator that is usually used, is based on sine wave modulation, not clipped speech. Therefore, the cost factors in the transmitter are very much in the favor of FM.

FM is a fine mode when you are sending to the general public (broadcasting) or for those who use radio for business (taxis, police, etc). Such people have little patience with signals that are not free of noise. FM can offer noise-free reception even when the signal is only a bit stronger than the noise. But hams are communications nuts. They love to dig in the noise to work a distant station. We should not assume that FM is best for us just because the commercial VHF mobile services use FM.

If you really want a superior mode, there is always SSB or CW. SSB, particularly with rf clipping in the transmitter, is definitely superior to AM or FM for weak signal work, but that is another argument. If SSB is too rich for your blood, how about some double sideband, suppressed carrier, with clipping? Since the QRM on VHF is no great problem, almost any communications receiver can do an adequate job on sideband, following a crystal controlled converter. A DSB transmitter with clipping is not very hard to build.

Repeaters changed the situation completely, of course. Sideband, single or double, is not practical via repeaters, leaving us with AM or FM. The large amounts of surplus commercial FM equipment got amateurs started with FM and repeaters, so naturally when equipment built for hams came along, it too was FM.

If it hadn’t been for repeaters it seems likely that sideband would have eventually forced the other modes to give way since it is inherently superior where there are no repeaters to extend the range of “base” stations. But all is not DX on 2m and thus repeaters and FM have just about completely eliminated the competition in virtually every part of the country.

At any rate — the next time a dyed-in-the-wool FMer starts talking about the tremendous advantages of FM over other modes, you will have some ammunition to make the contact interesting — interesting for you, at least. ...VE3DNR

References
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VHF Engineering Kits Simplify Construction

Construction of a repeater has been difficult and complex by tradition. This is not because repeater construction must be difficult and complex, but because it just sounds hard. In addition most repeater builders have not used an adequate repeater design, have made poor equipment choices, and have encountered horrendous problems of their own making. The fact is that repeater construction is simple and straightforward provided that a sound design is used and a practical construction approach is taken. We herein describe a simple approach to repeater construction and provide a pattern for building a repeater from scratch. The approach taken is not to give every option, alternative, or possibility for every modular piece of the repeater. Instead, a complete, workable design for a 15 watt 144 MHz repeater is described.

This article gives the necessary instructions for building, packaging, troubleshooting, and maintaining a workable 144 MHz repeater and gives a parts list with the names and addresses of suppliers. The resulting repeater will compare favorably with most commercial repeaters available on the market today.

Equipment Selection

The radio equipment selected for the repeater is listed at the end of the article (see Table 2). The VHF Engineering equipment was chosen over other units for a number of reasons. The equipment is very inexpensive and its performance equals the performance...
of many commercial units. It is fully solid state and thus will have greater reliability than tube units. It is available in kit form, which means that the repeater builder will have to hand wire his own major components. By building the equipment himself, the repeater engineer will get a good feeling for the operation, adjustment, and maintenance of his equipment. Thus, after the repeater is placed in operation, the repeater engineer will be able to maintain it and keep it on the air. There is great danger in buying commercially built equipment unless you are very familiar with it. It is easy to make a repeater operational only to find that you can’t keep it on the air. All of the VHF Engineering equipment operates from 12 V dc; thus, in a power failure, the repeater can be operated from a 12 V battery.

Many circuits have been published for the construction of solid state identifiers. While any of these circuits may be used, the design presented here uses a commercially available kit. Identifiers are difficult to build and difficult to debug if problems are encountered, unless of course, the repeater builder has a background in digital logic. Both time and money economies lead one to buy such a commercially available unit. This repeater uses the ID from Signal Systems. This unit was selected because of its good performance at low cost ($34.00/kit), ($39.00/wired and tested).

The antennas chosen are the ½ wave Ringo from CushCraft. These antennas are low in cost, easy to mount, and have their patterns on file with the FCC.

Coaxial cable is one item overlooked in regard to quality. The selection of poor grade cable can negate all of the gains introduced in the system by using top quality equipment. Do not skimp on cable: Use a good grade of 50 Ohm foam as recommended in Table 2.

Assembling The Kits

Even before thinking about assembling the repeater, it is first necessary to build the individual kits and make sure that they are correctly aligned. It is important to meticulously follow the instructions with each kit. Do not substitute components or attempt to make improvements in the circuits, except as indicated in this article. Make sure that the receiver, transmitter, amplifier, and COR are working correctly as independent units. Do not attempt to hook the units together until each unit operates independently. If problems are encountered, troubleshooting individual units is easier than troubleshooting the system as a whole.

Modifications

For repeater use, minor modifications should be made to the transmitter and receiver, as follows:

Transmitter (refer to instruction manual)
Connect a 100 k resistor between the cathode of D1 and the junction of R19, R20, C31 and C35. This puts a bias of 4 V on the varactor modulator and improves the audio symmetry. Connect a 1.2 k resistor to the junction of R10 and R11 to form the line input. Connect a 1 uF tantalum from the B+ connection to the ground. Place this capacitor right on the board.

Receiver (refer to instruction manual)
Connect a 10 Ohm resistor and .1 uF capacitor from pin 8 of the LM380 to ground to eliminate possible oscillation in the audio stage. Connect a 100 uF capacitor from B+ (audio board) to ground. Place this capacitor right on the board.

Packaging

This simple repeater can be packaged in a variety of ways depending on the whims and tastes of the individual builder. For sake of completeness, however, a single packaging scheme is presented in this section of the article (see Fig. 1). The repeater shown in the photographs was built according to the directions given here and is currently in use at WR2ABS .22-.82 in Binghamton, New York.

As previously mentioned, it is important to maintain complete rf isolation between the transmitter and receiver in order to prevent desensitization from occurring. This is accomplished in this design by mounting the transmitter and power amplifier in a Barry Electronics #085A enclosure. (A smaller usable alternate is a BUD CU247.) The receiver is mounted in a separate 085A enclosure and the two enclosures are in turn mounted on a BUD AC-416 chassis. The
Fig. 1. Wiring System
power supply is built on this main chassis between the two enclosures, with the power supply pass transistors mounted and heat sink on the rear of the main chassis. The front panel is a standard 7" x 19" panel for rack mounting.

Follow the general layout shown in the photographs. When mounting the power transistors for the power supply, care should be taken to use a good silicone heat sink compound on all contact surfaces. Also, before mounting the rf power transistor to the case, coat both the studs and flange with a liberal amount of silicone heat sink compound. The transmitter and receiver boards are easily mounted by soldering them to a right angle brass strip fashioned from shim stock. See Fig. 2. All power leads and circuit connections from inside the enclosures are run to the outside via feed through capacitors. Erie #1202-005 feed throughs are preferred, as they provide a maximum of attenuation. If these feed throughs are not available locally, other good quality units may be substituted.

The die cast box is adequate heat sink for the 15 watt version. If the builder uses a 25 W power amplifier, additional heat sinking should be bolted to the side of the transmitter enclosure. Be sure to use a liberal amount of silicone grease. In addition, for a 25 W version, the pass transistors for the power supply will require larger heat sinks to prevent overheating. A Thermoly #6146-2 heat sink is recommended. Three are required. For continuous repeater operation, it is advisable to run the power supply voltage at around 12 V instead of the normal 13.8 V.

The “audio in” jack is provided for use with external gadgetry such as a phone patch. Mount all units in their respective enclosures prior to testing.
Measuring RCVR Sensitivity

One of the preliminary procedures to perform before assembling the repeater is to measure the sensitivity of the receiver. By doing this at the beginning you can get a feeling of what type of performance to expect. In addition, by keeping a record of your measurements you have a reference to go by at a later time if you think that the performance of the repeater has changed.

The preferred method of measuring receiver sensitivity is the 12 dB SINAD sensitivity method. This method gives accurate measurement of how easily a modulated signal can be understood in the presence of noise. Unfortunately, one of the pieces of equipment needed for this method is a distortion analyzer, a device not normally found in the ham shack. An easier but less meaningful technique is the 20 dB quieting method, described here because of its simplicity.

20 dB Quieting Method

1) Connect a VTVM across the speaker terminals of the receiver. Set the VTVM on a low ac range and adjust the volume control to give 2/3 full scale reading. Note: For convenience, a VTVM with a dB scale is handy. If your VTVM has this scale, set the meter at +20 dB.

2) Connect a calibrated output signal generator to the antenna input of the receiver, set the generator to the proper frequency, and set the output to zero.

3) Increase the output of the signal generator until the meter reading is reduced by 20 dB. This is a ratio of 10:1 — if the original reading was 1 volt, the 20 dB quieting reading would be .1 V. The output reading on the signal generator in microvolts is now the 20 dB quieting sensitivity of the receiver.

Repeater Range

If you have the interest and the time you may wish to consider one of the various techniques for computing repeater range. One such method which gives fairly good approximations is described in the General Electric Data File Bulletins 10003-1, 10003-2. The problem with the theoretical approach is that you can only get an
Top view of repeater showing mounting of modules. Note feed-through capacitors for all power leads.

approximate determination of the range. It is impossible to get an exact picture of the coverage area of your repeater without actual measurements, due to abnormalities in terrain, types of soil, and other factors. Most repeater builders place a transceiver at the proposed repeater location, and, using the repeater antenna temporarily mounted at the proper height, run tests with mobiles throughout the proposed coverage area.

It is poor practice to use significantly more power than is needed for the desired coverage area, since by doing this your repeater may interfere with repeaters in other areas. It is also poor practice to determine the coverage area of a repeater by putting the repeater up first and then driving around "see how it gets out." Plan first, running tests, so that you can determine if location and power are sufficient before you put the repeater on the air. By taking this approach, you have the flexibility to select another site and increase power, without worrying about possible license modifications.

Isolation Between Transmitter and Receiver

When setting up a repeater, care must be taken to avoid getting too much transmitter power into the receiver. If this occurs, the receiver will be "desensed" and will be unable to receive anything but very strong signals. In addition, care has to be taken to avoid getting spurious noise from the transmitter into the receiver. In order to prevent the transmitted signal from causing problems in the receiver, it is necessary to isolate the transmitted signal from the receiver. This can be accomplished by separating the transmit and receive antennas, by using sharp filters, by using cavities, or by a combination of techniques.

Determining The Amount of Isolation Needed

The best approach to determine the
required isolation between the transmitted signal and the receiver is that taken by General Electric Mobile Radio. In their approach, they compute two isolation figures—one based on desensitization and another based on transmitter noise. They then choose the largest figure and use this as the required isolation. In our case, we don’t have the required transmitter noise figures, so we will base our calculations on desensitization and assume that noise from the 15 watt amplifier is included in this figure. This approach will give reasonable accuracy.

The VHF Engineering receiver will take without desensitization 24,000 microvolts of signal removed 600 kHz away from the receive frequency. This figure was determined in the VHF Engineering labs by feeding a 1 microvolt signal into the receiver at the signal frequency and then also feeding a signal from a signal generator into the antenna through a “T.” The generator was set up 600 kHz away from the receiver frequency. Desensitization did not occur with levels of 24,000 microvolts or less. The required external isolation can be determined by calculating the transmitter output power in microvolts and determining the dB relationship between the transmitter power and the tolerable level of 24,000 microvolts. In other words we must determine the isolation required so that the receiver does not see a signal from the transmitter which is greater than 24,000 microvolts. Under this condition, we will have no desensitization. Note that we are making the assumption that we will have signal strengths of 1 microvolt or better.

The required dB of isolation is computed by the formula:

\[ 20 \log \frac{\text{xmtr pwr in microvolts}}{24,000} \]

In order to get the power in microvolts across a 50 Ohm load, use the formula:

\[ V = PR \]

then multiply V by 10^6 to give the voltage in microvolts. As an example, assume a transmitter power of 15 watts. Using the formula:

\[ V = PR, \quad V = 15 \times 50 = 27.4 \text{V or } \pm .74 \times 10^7 \text{ microvolts.} \]

The isolation in dB is then computed as:

\[ 20 \log \frac{2.74 \times 10^7}{2.4 \times 10^4} = 61 \text{ dB} \]

In this repeater design, cavities or front end filters are not used; instead, isolation is obtained by the antenna separations provided in Table 1.

In our example, a vertical separation of about 50 feet or a horizontal separation of about 825 feet would be needed. Note that in the case of vertical separation, the

<table>
<thead>
<tr>
<th>Isolation</th>
<th>Vertical Separation</th>
<th>Horizontal Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>13 feet</td>
<td>85 feet</td>
</tr>
<tr>
<td>50</td>
<td>22</td>
<td>250</td>
</tr>
<tr>
<td>60</td>
<td>45</td>
<td>800</td>
</tr>
<tr>
<td>70</td>
<td>75</td>
<td>2350*</td>
</tr>
</tbody>
</table>

Table 1, (from General Electric Co., “Data File Bulletin”, 10007-4, pp. 14-15)

*Figures approximate; isolations of much greater than 62 dB may be hard to achieve.

antennas must be in a straight line over each other with no horizontal separation. Horizontal separation (although inconvenient) may be used.

When installing the antennas, use good quality coaxial antenna cable and be sure to waterproof antenna connections. Keep in mind that some leakage can occur from the coaxial cable. For this reason, it is a good idea not to tape the receive and transmit cables together as they come down the tower. Separate the cables by 6 or 12 inches.

Once the antennas are erected, the actual isolation should be measured. By doing this, you can check to see if you are getting the isolation that you predicted. If you are getting less isolation, you may have to increase the vertical spacing or use front end filters as previously mentioned. The amount of isolation can be measured as follows: Using a calibrated output signal generator, connected to the receiver, determine the signal required for 20 dB quieting. Next, connect the receive antenna to the receiver and the transmit antenna to the signal generator, and increase the output of the generator until you get a 20 dB quieting signal on the receiver. Take the two readings from the signal generator and compute the path loss by the formula 20 Log S1/S2, where S1 is the signal strength in microvolts of the generator into the antenna and S2 is the signal strength in microvolts directly into the receiver.
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Original Price</th>
<th>Current Price</th>
<th>Additional Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTX-600</td>
<td>6-Meter FM, 100 channels, 35 watts</td>
<td>$309.95</td>
<td>$219.95</td>
<td>(Incl. 52.525 MHz)</td>
</tr>
<tr>
<td>GTX-200</td>
<td>2-Meter FM, 100 channels, 30 watts</td>
<td>$299.95</td>
<td>$199.95</td>
<td>(Incl. 146.94 MHz)</td>
</tr>
<tr>
<td>GTX-100</td>
<td>1 1/4-Meter FM, 100 channels, 12 watts</td>
<td>$309.95</td>
<td>$219.95</td>
<td>(Incl. 223.5 MHz)</td>
</tr>
<tr>
<td>GTX-2</td>
<td>2-Meter FM, 10 channels, 30 watts</td>
<td>$299.95</td>
<td>$189.95</td>
<td>(Incl. 146.94 MHz)</td>
</tr>
<tr>
<td>GTX-10</td>
<td>2-Meter FM, 10 channels, 10 watts</td>
<td>$239.95</td>
<td>$169.95</td>
<td>(Incl. 146.94 MHz)</td>
</tr>
</tbody>
</table>

CLIP OUT AND ORDER NOW!

Hey, Genave! Thanks for the nice prices! Please send me:

- GTX-600 @ $219.95
- GTX-200 @ $199.95
- GTX-100 @ $219.95
- GTX-2 @ $189.95
- GTX-10 @ $169.95
- Lambda/30 2-M Base Antenna @ $39.95
- Lambda/4 2-M Trunk Antenna @ $29.95
- TE-1 Tone Encoder Pad @ $59.95
- PSI-9 Port. Power Package @ $29.95

and the following standard crystals @ $4.25 each: $ __________

Non-standard crystals @ $5.75 each—allow 8 weeks delivery.

For factory crystal installation add $8.50 per transceiver.

Ind. residents add 4% sales tax; Cal. residents add 6% sales tax:

Sub-Total: $ __________

TOTAL: $ __________

All orders shipped post-paid within continental U.S. For C.O.D., include 20% Down.

Payment by: [ ] Certified Check/Money Order [ ] Personal Check [ ] C.O.D.

Note: Orders accompanied by personal checks will require about two weeks to process.

[ ] 20% Down Payment Enclosed, Charge Balance To:

[ ] BankAmericard # __________ Expires ________

[ ] Master Charge # __________ Expires ________ Interbank # __________

Note: Order s accompanied by personal checks will require about two weeks to process.

Prices and specifications subject to change without notice.
Shielding

While it is necessary to maintain the required antenna separation in order to prevent desensitization, this separation is of no value if the output from the transmitter can get into the receiver via other means. This can happen if the transmitter and receiver are mounted back to back in the same cabinet, or if the power cables are carrying the signal from the transmitter to the receiver. In order to make sure that the only signal paths in the system are the antennas, it is necessary to provide complete rf isolation for the transmitter and receiver themselves. This can be accomplished by using standard shielding practices for both the transmitter and the receiver. (See the ARRL Handbook.) The transmitter, amplifier, and receiver should be enclosed in metal boxes and the associated power and control cables should be well bypassed, as indicated in the packaging section of this article.

After the transmitter and receiver have been properly shielded and bypassed in metal boxes, a test should be made to see if the shielding is complete. Connect a meter to the first limiter (test point “A”; refer to instruction manual page on the FM-455A module) of the receiver (receiver on input frequency) with antenna terminals connected to a 50 Ohm resistor at the receiver. Place some electrical tape over the resistor and cover the connector with tightly wrapped aluminum foil. Do this to prevent any rf from getting in via the antenna jack. Connect the transmitter to a shielded dummy load. With the transmitter and receiver in their final locations in the equipment cabinet, key the transmitter and observe the first limiter current. If the current changes either down or up, then you have a problem with either the signal or transmitter noise getting into the receiver. In either case, isolation between the transmitter and receiver is not good enough. If this is the case, check the bypassing of all leads and make sure that all shields are making good electrical connections.

Final Tests

Having completed the previous steps, mount the individual enclosures on the main chassis and complete final wiring as shown in the top view photograph. Note that the identifier shown is hooked up according to the manufacturer’s instructions. After hooking up the repeater, tests should be made to see if desensitization or transmitter noise is present. Connect a “T” coax connector in the receiver antenna lead, connect the antenna to one input, and connect the calibrated output signal generator to the other input. Feed a signal in for 20 dB quieting as you did when checking receiver sensitivity. (Note: If it takes more signal this time, you have noise from an outside source getting into your antenna.) Key up the transmitter and observe the first limiter reading. If the current increases, then transmitter noise is getting into the receiver. If the current goes down, then desensitization is the problem. Ideally the limiter current will not change. If the limiter current changes, the signal will become noisy. Readjust the signal generator to again give a full quieting signal. The amount of desense or noise is then $20 \log \frac{S1}{S2} - S1$ and $S2$ being the two readings on the signal generator.

If either of these problems occur, it may take quite a bit of effort to effect a workable cure. One simple, but disadvantageous, cure is to reduce the transmitter power by $\frac{1}{2}$ or 3 dB. Many times this will provide a temporary solution to your problems. In the case of clear cut desensitization, it is necessary to increase the effective signal isolation between transmitter and re-
ceiver. This can be done by increasing antenna spacing or by better shielding of the transmitter, amplifier, and receiver. If the previously mentioned test and checks are successfully made, desensitization should not be a problem. In regard to transmitter noise, this problem can be stubborn since the problem can be caused by a bad output transistor. The most effective way to eliminate this problem is to insert in the transmitter feed line a HI-Q cavity tuned to "suck out" at the receiver frequency.

At this point, if all problems are solved, the repeater is operational and ready for use with the exception of required means of control.

Extended Local Control

Repeater control can be done on either a local or remote basis, the only difference being the actual location of the on-off switch. Local control is by far the simpler of the two, having the advantages of both easier installation and easier licensing.

Such control can be either a switch right at the repeater or a switch on the premises away from the equipment (extended local control). Fig. 1 shows a simple enable-disable switch at the repeater. This switch disables the repeater by interrupting the current to the transmitter. For extended local control, a relay is used instead of the switch, and wires to control the relay are run to the remote location. Note that it is necessary to monitor the repeater during its period of operation. 73 Magazine and the ARRL should be consulted on current accepted and legal techniques for doing this.

Getting the License

At the present time, there is no sure fire way to get a license for a repeater in a short period of time. In addition, the application requirements are changing rapidly from day to day. Your best bet on getting your license is to write to both 73 Magazine and the ARRL and ask for all information and forms available.

Responsibilities of Operation

Before you undertake to build a repeater, you must recognize the fact that there are serious responsibilities involved with
repeater operation. For example, if the repeater is illegally used, you are responsible. In addition, once your repeater becomes operational you have a responsibility to the amateurs who are using it. You must keep it on the air, and make sure it is operating correctly and in the best interest of amateur radio. You cannot arbitrarily discontinue operation without angering the people who are using it. Just because a repeater is easy to build and put on the air does not mean that everyone should put up a repeater. For one thing, does your area really need an additional repeater, or are you building a repeater for prestige? Can you afford to operate a repeater? Can you afford the maintenance costs, etc., that a repeater will cause? Remember that it is best to line up financing before putting the repeater on the air rather than after. If you wait until after you may wind up paying for the repeater yourself. The authors recommend that a club be formed at the beginning to support the repeater. By doing this you will know how much interest you have and you will be assured of adequate financing.

Emergency Operation

One of the responsibilities of a repeater operator is to keep the repeater on the air during emergencies, especially during periods where there is a loss of ac power. With the equipment described in this article, this can be done easily by using the circuit shown in Fig. 3. A battery charger is trickle charging a 12 V wet cell battery of 60 Ah capacity or more. A relay connected to the ac line switches the power from the ac power supply to the battery when the ac power fails. This system provides emergency back up power and requires little care except a periodic battery water check.

Problems

If the builder follows the instructions and test procedures described in this article, few
Table 2. Equipment List.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx-144/C two meter receiver</td>
<td>$69.95</td>
<td>VHF Engineering</td>
</tr>
<tr>
<td>TX-144 two meter transmitter</td>
<td>29.95</td>
<td>320 Water Street</td>
</tr>
<tr>
<td>PA-144/1515W amplifier</td>
<td>39.95</td>
<td>P.O. Box 1921</td>
</tr>
<tr>
<td>Cor-2 Carrier operated relay</td>
<td>19.95</td>
<td>Binghamton</td>
</tr>
<tr>
<td>PS-12 Power supply</td>
<td>69.95</td>
<td>New York 13902</td>
</tr>
<tr>
<td>Station Identifier</td>
<td></td>
<td>Signal Systems</td>
</tr>
<tr>
<td>(wired and tested)</td>
<td>39.00</td>
<td>2537 Weston Road</td>
</tr>
<tr>
<td>(Above equipment purchased as VHF Engg. package.)</td>
<td>259.95</td>
<td>Colorado Springs</td>
</tr>
<tr>
<td>(Complete rptr. kit, incl. cases and connectors, purchased as VHF Engg. package.)</td>
<td>364.95</td>
<td>Colorado 80910</td>
</tr>
<tr>
<td>(Above complete rptr. kit, wired and tested, purchased as VHF Engg. package)</td>
<td>595.95</td>
<td></td>
</tr>
<tr>
<td>CushCraft Ringo Antennas (2 each)</td>
<td>16.50</td>
<td>Available locally</td>
</tr>
<tr>
<td>Coaxial cable, RG8/u or T-450</td>
<td>.19/ft.</td>
<td>Hatry Electronics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500 Ledyard Street</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hartford, Conn 06114</td>
</tr>
</tbody>
</table>

problems should be encountered. If problems are encountered, go back to the beginning, separate each component and test it individually as previously described. One problem encountered occasionally is that of intermodulation products getting into the receiver and falsely triggering the repeater. Normally this would sound like a garbled commercial service getting into the repeater. Two signals mix together producing a third frequency close to or at the repeater input frequency. Intermod is not easy to cure, let alone to find out why it is occurring. Intermod will occur infrequently on almost every repeater, such as when two mobiles from another service are very close to the repeater. If intermod occurs frequently, action must be taken. The only sure fire way to eliminate intermod which is being generated in the repeater transmitter or receiver is to eliminate off frequency signals from getting into these units. The only reliable method of doing this is to install HI-Q cavities on the receiver and transmitter, tuned to the receiver and transmitter frequencies respectively. This will take care of intermod originating at the repeater. If the intermod is occurring somewhere else and is generating a signal on your input frequency, you’ll have to seek professional help.

Footnotes
1. EIA Standard RS204, Section 3.
3. Ibid., 10007-4, Figs. 9-10.
5. ARRL, Radio Amateurs Handbook, ARRL, Newington, Conn. 1972 and later, chapter on “Interference with other Services”; ‘preventing radiation from the transmitter’.

Additional References on Repeaters:

... W1HCl and W2EDN
GREENBELT, MD – FEB 3

FM Minifest at the Goddard Space Flight Center. Speaker, movie, prizes, free refreshments. Time: 1PM.

MANSFIELD, OH – FEB 7

The Intercity Radio Club annual auction will be held Friday, February 7th at the Naval Reserve Training Center at Ashland Road in Mansfield, Ohio. Doors open at 6:00 P.M. Look, swap, buy at 7:30 P.M. No flea fees nor commissions charged. Auction at 8:00 P.M. Eats. Donation of two dollars at door. For more information write K8JPF, 120 Homewood, Mansfield, Ohio 44906.

LIVONIA, MICH – FEB 23

Michigan’s largest, The Livonia Amateur Radio Club, will present its 5th Annual Swap and Shop on Sunday, February 23, 1975 from 10 till 4 PM at Stevenson High School in Livonia. 2m talk-in on 94 & 52.

LAPORTE, IN – FEB 23

The LaPorte ARC annual Hamfest-Auction will be held indoors at the Civic Auditorium 23 February 1975 beginning at 8 AM CST. First prize is $500.00 cash. Advance tickets are $1.00 each to LPARC, P.O. Box 30, LaPorte IN 46350. Advance table reservations also available $3.00 each. Talk-in on 01-61 and .94 Simplex.

ROCK FALLS, ILL MAR 9

Sterling Rock Falls Hamfest will be held March 9th. For info write Donald Van Sant, 1001 9th Ave., Rock Falls, Illinois 61071.

BERRIEN SPRINGS, MICH – MAR 15

Blissomland ARA Hamfest will be held at the Berrien Co. Youth Fairgrounds. Advance registration $1.50, $2.00 at the gate. Indoor tables $1.00. For info write BARA Hamfest, P.O. Box 175, St. Joseph, MI 49085.

WHITESTONE, WIS. MAR 16

The Tri-County ARC Midwinter Swapfest is March 16th, 9 AM to 5 PM at the National Guard Armory, Whitewater. $1.50 advance, $2 at the door (additional $1.50 reserves one disposable). Advance tickets eligible for special prize. Talk-in on 94. Refreshments, free parking, everything indoors. For tickets and details, Dan Servais, WABA1JW, Rt 4 Box 309AA, Elkhorn, Wis 53121. Tel 414-723-2227, SASE

CERTIFICATE OFFERED

The Massachusetts Chapter of the National Award Hunters Club is offering a beautiful Massachusetts Bi-Centennial certificate. For info on how to win it contact Robert Jennings WD1KD, 15 Cliff Ave., Scituate, Mass. 02066.

WORKED ALL STATES WEEK

The Radio Society of Greater Brooklyn will hold its first annual Worked All States Week Contest March 29 0001G to 2359G April 6. Winner will be the one to work all states in the shortest period of time. Anyone who works all states within the period will receive a certificate. Special certificate to the Novice who works the most states and operator working most states under most unusual conditions. Number of states only counts, not number of QSOs. Logs must include description of your station and the time, date, call and state of all stations worked. Any legal band, mode or power. Send logs to F. Grossman WB2BZO, 9519 Ave. M, Brooklyn, NY 11236.

18th ANNUAL QCWA QSO PARTY

Starts: 2400Z Friday February 7, 1975
Ends: 2400Z Sunday February 9, 1975

Activity will be within about 5 kHz from the following frequencies: CW – 3560, 7060, 14060, 21050 & 28050.
SSB/AM – 3900, 7240, 14270, 14340, 21390, 21435 & 28600.
RTTY – 3595, 7095, 14095, 21070, 28070.

FM – 146.55 Simplex and don’t overlook the repeaters.

The theme this year is Accent on the Chapters. Scoring will be computed by using the number of contacts times the number of chapters contacted times the number of QCWA Directors worked. With 69 chapters (at this writing) plus ten QCWA Directors, the scores are going to be high. Members not associated with a chapter will use “AT LARGE” instead of a chapter name. We are proud of members that belong to more than one chapter but for this contest they will please use one and only one chapter name. Each QCWAer submitting a log will provide a summary sheet with the total number of contacts, total number of multipliers and score. Repeat contacts on other bands or modes do not count for additional score.

The Houston Chapter of the Quarter Century Wireless Association is sponsoring the contest this year. The Contest Committee appointed by President Lindsey W5FR is:
Monty Montemayor W5YZ Chmn, Otho Lindsey W5FR, Jerry Sears W5AIR, C.B. Scott W5GPD, Lee Ruetz W4RDO and Wayne Stenback W5MDV.

Your logs should be sent to W5YZ, QCWA Houston Chapter, Post Office Box 55254, Houston, Texas 77055 by March 10, 1975. See the December QCWA NEWS for further details and information.

Ham Help

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

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

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

James H. Genzling
512 N. Alice
Monahans TX 79756

Philip Smith
2841 E. Sherran Lane
Phoenix AZ 85016
602-956 0954

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*ISC*
3050 Hempland Road
Lancaster, Pennsylvania 17601
The Heath SB-103?

... Not Quite

Well...the "hams at Heath" have done it again! Just as I've almost completed my set of matching Heath SB gear — out comes an entirely new line (SB-104 & accessories) that puts whiskers on my SB-102 and its matching equipment.

Being a resourceful ham (translation: short of funds...) I figured I could update my SB-102 by adding those state-of-the-art features which obsoleted it. All I did was to compare the two rigs and make the necessary changes. What follows is a description of this conversion, which should also work on the KWM-2!

A comparison of the specifications and features of the SB-102 versus the SB-104 indicated the following features needed to be added to my SB-102:
1) solid-state circuitry
2) digital readout
3) broadbanded receiver & transmitter
4) QRP output
5) call sign light

The first two features seemed rather difficult, so I decided to work on my list from the bottom up...to build confidence. This technique is highly recommended as it led to the ultimate completion of all five features of the conversion!

#5 Call-sign Light

First, I selected a clear strip of Dymo label-maker tape and press-typed my call, K9WQY. Then I peeled off the self-adhesive backing and applied it in the middle of the lighted dial. I was careful to put it in the exact middle of the dial for maximum visibility during contest operation (I always seem to forget my call in the middle of a contest...and who cares what frequency I'm on in the heat of a contest anyway?) Having accomplished the first conversion with remarkable ease, I plunged upward through the list.

#4 QRP Output

Actually, the SB-102 was capable of QRP operation all the time. I discovered the QRP output jack on the back of the SB-102 was mis-labeled, "Driver output," Of course, then I had to use my secondary receiver and antenna to hear any replies. I considered installing a TR switch or antenna relay and using the receiver antenna jack on the rear panel of the SB-102, but I wanted to avoid any major changes in the rig to keep resale value high.

As it turned out, I found an even better way to QRP operation. Read on... 

#3 Broadbanded Receiver & Transmitter

SB-102 owners have always been plagued by the "bothersome Preselector, Load, and Tune controls." (Heath catalog) The "hams at Heath" have eliminated this "problem". This was a "toughie" until I realized...no controls = no tuning = broadbanded!

Once over this hump in logic, I began the conversion to broadbanded operation in earnest. First, I removed the following control knobs from the front panel:
1) driver tune
2) final tune
3) final load

The tuning shafts now protruded from the front panel and seemed to defy me. I
decided to hack saw them off flush with the front panel bushings for a neater appearance. To complete the job, I got some matching green-flake paint (from Heath) and covered both the front panel bushings and the end of each shaft. I made a mental note to do "something" about the panel lettering, too...at a later date.

I achieved a couple of unexpected benefits from this step in the conversion process, namely:

1) I no longer needed to use the "driver output" jack for QRP operation, and...
2) my receiver sensitivity now exceeds the reduced sensitivity of the SB-102 (<1.0 uV versus < .35 uV for 10 dB S+N/N for the SB-102). In fact, sometimes I can't even tell if the band is open.

The "SB-103." Notice the critical placement of call sign in full view of operator, and "clean look" of front panel with tuning controls eliminated.

#2 Digital Readout

Heath has had a digital frequency display, the SB-650, available for the SB-102 at a good price for some time now. A good price, that is, unless you're a "resourceful ham" like myself.

First, I constructed a power supply for 8 Nixie readout tubes (I wanted one cycle resolution. .I never do things halfway!). Next, I connected 8 decade switches so that I could turn on any digit in any place at will. Thus, I can "dial up" any frequency I want down to that one cycle resolution. How's that for accuracy! This really works great sitting atop the SB-102 and really impresses non-ham visitors to the shack. However, the transceiver frequency doesn't seem to follow the Nixie tube readout at all. I plan to work that out sometime.

#1 Solid-state

The first step toward solid-state was to partially integrate the circuits by bussing the fuses. Complete integration would require bussing the wires as well. At this point, however, I realized that the biggest disadvantage to my tubes in the SB-102 was the large amount of energy that was wasted in the heating of the filaments. So...I added a switch in my HP-23B power supply so that when I want to conserve power I just switch off the filaments. Simple, eh?

However, a couple of disadvantages to this scheme were noticed immediately:

1) the dial lights usually go out and I can't see my lighted call sign any more...which means I'll probably go on forgetting my call during contests, and...
2) signals tended to fade out rather quickly on receive, but this deficiency was offset by the transmitter becoming truly QRP.

Having completed the conversion, a new model designation seemed in order. After all, my rig was no longer a "mere" SB-102. Not having all of the features of an SB-104, the "skipped over" SB-103 designation seemed to fit. Let's see, where did I put my label-maker...?

All is not right, however. The rig has been in use for several hours and some undesirable characteristics have appeared:

1) the "SB-103" does not work well on transmit or receive with the filaments turned off.
2) with the filaments on, I can operate high power only on 7302 kHz (which is where I was operating before the conversion).
3) no replies to my numerous transmissions have been heard as yet.
4) the green flake paint is flaking off.

Does anybody know how to work on an SB-103?

...K9WQY

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Get Into a Grey Mood - Generate

Modification of the ROBOT Research Inc. Model 80-A SSTV Camera for Grey Scale Generation

A grey scale generator generates frequencies ascending, or descending, between 1500Hz (black) to 2300Hz (white). This spectrum enables the SSTV receiving operator to adjust his/her display brightness and contrast controls for a linear white to black display.

Sophisticated digital timing chains driving digital-to-analog converters, which in turn, drive a VCO (Voltage Controlled Oscillator) through 4 to 16 discrete frequencies (levels of brightness) can be found in the SSTV Handbook published by 73 Magazine. This article describes an alternative method that generates linear, rather than discrete, levels of brightness. Although a linear display may not be considered sophisticated enough for the idealist, I have found a linear display sufficient for the application; and the $3.75 price tag can’t be beat!

Design Considerations

The only constraint placed upon the design was that no modifications be made to the 80-A circuit board. This was done mainly to insure that the board could always be returned to ROBOT on an exchange basis, for an improved one necessitated by engineering changes.

The design is based upon the fact that if the video excursion can be forced, safely, between these limits, then a 1500Hz to 2300Hz, grey scale will be generated.

A forcing signal can only be applied externally to the clamped video line safely at pin “S.” If the signal is applied at either pins “R” or “K,” there is the chance that it will be applied directly to the output of U12, if S2 is in the reverse position, and damage U12. Depending on the normal bias levels at the emitter of Q3 (set by the brightness control) it will require about ±0.3mA to drive the video line to the clamped limits. This value could be as high as ±3.3mA at the lowest brightness extreme, but this is not the normal operational range. The forcing signal is not applied during non-grey scale operation, so as not to deteriorate the existing video levels.

Circuit Description of Modification

The schematic is shown in Fig. 1. The horizontal deflection voltage, a sawtooth signal, approximately ±3V centered about ground, is applied to an emitter follower via a variable signal attenuation network mr1, mr2. This signal is applied, via mswl-A, to the clamped video line when mswl is turned to the “SCALE” position. When mswl is in this position, the contrast voltage is reduced to near zero by mr6. mr6 limits the discharge current to 20mA maximum when mswl is turned to “SCALE.” A separate “Brightness” voltage, determined by mr7, mr8, is applied to the video clamp line via MSWI-C and pin “V.” It is, therefore, possible to set both the bias level via mr8,
Fig. 1. Modifications to the Robot Research SSTV camera Model 80-A to provide “Grey Scale” generation.

Looking at the photograph, the two trimmer pots are located in the center of the board and the transistor is located in the lower right corner of the board. Notice the new 4-pole rotary switch at the right side of the photo.

Adjustment
With an oscilloscope at test point “T” (Fig. 1) on the clamped video line, adjust mr2 and mr8 for maximum signal such that the positive and negative peaks just begin to show signs of clipping.

Conclusion
The linear circuit is far less expensive, and much easier to implement and adjust than the discrete circuit.

I have adjusted Slow Scan displays using both discrete step and the linear signals with little difference in the end result.

Parts List
mq1 — General purpose NPN silicon 12V transistor “CALECTRO K4-506” ½ watt. Lafayette.
mr1 — 430Ω 1/2 W 10%
mr3 — 1200Ω 1/2 W 10%
mr4 — 2200Ω 1/2 W 10%
mr5 — 1000Ω 1/2 W 10%
mr6 — 2000Ω 1/2 W 10%
mr7 — 2700Ω 1/2W 10%
mr8 — 500Ω 1/10 W 100 V Linear Sub-Min Trimmer CALECTRO B1-642. Lafayette.
msw-1 — 4 pole 3 Position Non-shorting Rotary Switch.

... W2FJT
THE SMART HAMS
ARE CATCHING ON

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**Instant Neutralization**

The following, while intended to apply specifically to a Heath SB-110A, would be equally applicable to other gear containing similar circuitry. The SB-110A final and driver neutralization is a rather long and involved process not so much due to the electronics, but rather to the fact that the screen voltage is removed from the stages to be neutralized by alternately removing two resistors from feedthrough capacitor “AU.” The time and effort involved may be reduced to a fraction of normal if a switch is installed under the chassis. This switch connects either or both of the before-mentioned leads to the feedthrough and allows instant changeover during neutralization.

The switch is mounted in the “driver shield,” immediately below the driver tuning capacitor, with the shaft/knob in line with the shaft of the “mode” switch. The resistor leads involved will reach this point without difficulty and only a very short length of wire is needed from the switch common to the feedthrough.

There are two types of switches which will work in this modification, the most common being a “rear seat speaker switch” of the front-back-both variety. A double pole, three position switch will do as well, but it is a little more expensive.

![Diagram of feedthrough “AU” with double pole three position switch](attachment:image)

**Fig. 1. Feedthrough “AU” with double pole three position switch.**

In the examples, position 1 removes screen voltage from the driver allowing neutralization of that stage. Position two reconnects the driver and removes the final screen voltage for similar purposes. Position three restores the connections and the rig to normal operation.

... **WAØABI**

William P. Turner WAØABI
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73 MAGAZINE
Phoenix Hams
Show How It's Done

Ham radio was on the spot before the eyes of the world out in Arizona in mid-September, and twenty-five Scottsdale area hams from five clubs in the Valley of the Sun opened up the eyes of the world to the possibility of using radio to link together the six hundred members of Sister Cities International in sixty-five foreign countries and the U.S.A. They did it in spite of considerable adversity.

Sister Cities International has been called a “good will people-to-people program” whose aim is to make life better by promoting international peace and understanding through having cities in different parts of the world pair off and work together on each other’s problems.

Hams from the Scottsdale, Phoenix, and Arizona Radio Clubs joined those from the Arizona Repeater Assn. and Bash-Hal-Ne-Ae and accepted a challenge from Sister Cities to rig up a temporary demonstration station at famed Mountain Shadows Resort for nearly five hundred convention delegates. The event was the sixteenth annual international convention, meeting under the banner of “Communicating for World Peace.”

The whole thing got started on Wednesday, September 18, when the five hundred delegates blew into Paradise Valley, just north of Phoenix. Were it not for the sturdy and sumptuous quarters in which they were lodged, they would have been blown right back out again by the niftiest patchwork of intermittent storms to flash through the area in many months. Strong winds drove delegates indoors, while sheets of rain whipped under the covered walkways and jagged lightning walked around the mountain tops.

One puffing delegate from the Midwest said, “My gosh, this is the arid Southwest? Every time I poke my head out of the meeting room, I see ugly clouds, rain and lightning.”

For the hams, things began several days earlier when they wheeled into the hotel parking lot with a pickup truck laden with personal and borrowed gear. Ex-Navy airplane jockey Tom Moore, W7FCQ, was ram-rodding, having taken over from Bill Eccles K7MJC, who had planned the ham end of the project some six months before. It was Tom’s job to set up the equipment and erect two antennas on the roof of Flirtation Walk, leading in from the resort’s tennis court and golf course. He had earlier gotten permission from the FCC to operate with the mysterious call, WH7SCI.

Given his choice of station locations, Tom had the gear set up right outside the door of the elegant Navajo Room, where the delegates would confer. The spot was on the hotel end of Flirtation Walk, under the roof, but protected on the back and sides only by shrubs and a fence. Under normal Arizona conditions, the site would have been superb, but nobody figured on the rain.

“We knew about the bad weather conditions coming,” Tom said, “and we figured that wind would be our biggest problem, so
Sometimes everybody forgets the same thing—in this case an identification sign—so Gene Hubbel W7DI whomped one out on the spot and hung it up for the 500 delegates of the 16th International Convention of Sister Cities to see.

we prepared for that. But it was the rain that nearly got us."

To handle the wind, Tom used new 2000-pound-test nylon ropes on the old style three-element Mosley Jr. beam that the antenna crew hoisted up onto the roof. A Bassett trap inverted V was strung up for 75 and 40 meters, and a portable Hy-Gain Yagi beam was put up under the roof for the little 2-meter rig. All three antennas weathered the coming storm with no trouble.

Jean Murphy, head of the hotel catering service, provided two heavy tables for the rigs. Then she won over all of the hams by covering the tables with linen tablecloths before the rigs were put in place.

"The XYL ought to get a load of this!" said one ham who apparently was having a little trouble at home.

The hams hooked up a Collins 75S-3C, a 32S-3, and a 30S-1 amplifier, all borrowed from Barry Goldwater, and the Scottsdale Radio Club brought a Drake TR4 transceiver. Gene Hubbel W7DI provided a Swan Signet transceiver, and others brought keys, mikes, connectors, and handy lengths of co-axial cable. Everything was carefully and properly hooked up by Tuesday evening, Sept. 17, and with a bevy of curious onlookers gathered around, the big switch was thrown. Nothing happened—at least not in the big rig. Voltages were down 50 per cent and the time delay in the plate circuit wouldn't even come on in the 30S-1.

With several hundred years of combined experience in radio on the spot, no problem remained a mystery for long.

"We just hadn't talked the same language as the hotel engineer," said Tom Moore later. "We had asked for 220 volts, and he gave us just that—with one side grounded. We hadn't told him we had a splitter in the transmitter."

Once the trouble was known, Dean Mendel, the hotel engineer, gave the hams 220 with a common from a box on the lawn, and WH7SCI was on the air testing as K7MJC/7, until their allotted time began on Wednesday. Running barefoot to the east coast, they got a 20 over 9 report from Tom Azzara W2LFB in Nutley, N.J.

But troubles never come singly, and the station was just beginning to get a rhythm to its calls when something happened to the power. It was being drained off as though in a science fiction movie. This problem, too, was quickly located, but it was not solved. Somebody noticed that the hotel swimming pool area was fiercely aglow with lights. A local Cadillac company had rolled in a whole convoy of new cars and spotted them around the swimming pool and on every available flat spot on the lawn for the viewing of a throng of guests that number in the thousands. Each vehicle was brilliantly spotlighted so that gowned ladies and their smartly dressed escorts could view plush interiors and peek under hoods without spilling their martinis.

At 5:40 p.m., somebody decided that WH7SCI was still drawing too much power, and they pulled the plug on the station completely. Nobody minded too much since the convention hadn't yet begun, and forecasters were beginning to say nasty things about the evening weather. On their way home, the hams went past the auto show and bumped into a worried Jean Murphy, the thoughtful cateress.

"I just told the head Cadillac man that it was going to rain and ruin his whole show," she said, looking up at the sky, "and he told me, 'Don't worry, God drives a Cadillac, and He won't let it rain on these.'"

And He didn't.

Back on the air at 5:00 a.m. Wednesday,
the hams found conditions spotty, just as amateur radio publications had predicted they would be. The day had dawned cloudy, and action on the rigs and around the station didn't get heavy until nearly noon, after the delegates to the convention had registered and read the hundreds of brochures about various cities that were spread out on a thirty-foot table in the hotel lobby.

The hotel had suddenly taken on a "poster night" atmosphere like in professional hockey. "See you in Surprising San Jose" in orange day-glo jumped at you from the glass door leading to the pool, and beside it was a varicolored sign inviting you to "Rochester, the Picture City." Posters for other cities clung to the outer walls leading to the convention room.

Foothill College of Los Altos Hills, California, had prepared a fine booklet on ham radio for the convention. Entitled, "Sister Cities and Amateur Radio," the booklet covered everything from "What is Amateur Radio?" to "How to Get Your Own Amateur Station," to "A Sister City-Amateur Radio Network." Thanks to the ARRL, the booklet was illustrated with a great variety of pictures of ham operators all over the world and told of the function and value of the Medical Amateur Radio Council and other radio and emergency networks. The booklet was given to all delegates to the convention, and since Wednesday was a light day in their schedule, many delegates must have read it.

A steady stream of people from all over the world began showing up to watch WH7SCI being operated. As a rule, they hung back and tried to figure the thing out by themselves. Fortunately, there were enough hams on hand to do a little public relations work, and they introduced themselves and told in simple terms how ham radio functioned. Almost all of the delegates, regardless of what point of the globe they hailed from, could speak English, and some of them came back several times, each time adding to their understanding of amateur radio.

A delegate from Cavite in the Phillipines asked Gene Hubbel W7DI if he could put him in touch with his government. But propagation was so poor out of state that Gene had to tell him the job could be done, but it would take a little time.

The station operators had hoped to try some delegate-to-home hookups, but conditions remained so spotty that they hated to build up any delegate's hopes.

About noon, massive clouds that had been hanging around the Valley lumbered in ominously for a convention of their own. As though on signal, lightning began leaping among the clouds and striking out for the higher mountains. Thunder ripped through the Valley, and the sky opened up right over the hotel and its radio station. And then the wind came up, driving every single delegate indoors, and leaving nobody but the determined hams out in the slanting rain.

Bob Johnson W7JTL was on the air when the storm hit, and Tom Moore and Gene Hubbel were talking to delegates. Bob hunched over the radio gear, which was safely back against the wall of the hotel, and Tom and Gene watched in disbelief as the rain poured off the roof.

"What worried us most," said Tom, "was a downspout that somebody had bore-sighted right straight at the lawn box from which we were drawing our power. Water gushed all over that box, and why it didn't blow a circuit breaker, I'll never know."

Tom Moore W7FCQ and his antenna crew drilled a mast hole in a 2 x 4 nailed to a half sheet of plywood, laid it down for the butt end of the mast, and hoisted the Mosley tri-bander into position on the roof of famed Mountain Shadows' Flirtation Walk. Cinched to the cross members of the roof with heavy nylon ropes, the beam easily weathered high winds and torrential rains.

FEBRUARY 1975
Gary Chinn WA6WDC hunts for action on Gene Hubbel's Swan Signet while Bob Johnson W7JTL works the "big rig" borrowed from Barry Goldwater. Hams fought poor propagation and still managed 690 contacts in U.S. and 40 DX during three-day Sister Cities Convention. They missed WAS by one state — Delaware.

To make matters worse, the torrent grew in volume until the drainage system couldn't handle it. Water covered half of the concrete walk, reaching to the chairs on which the operators sat, and it flowed over the lawn and deepened until it was licking at the power box. As long as the engineer left the power on and conditions on the walk were safe, the hams were determined to keep the station on the air.

Gradually the rain stopped, and the water whisked away to lower ground. Curious delegates tip-toed around the puddles on the walk, anxious to get back to see if the hams were still there. They were, as eager and smiling as before. The antennas and all the other gear had come through the storm unscathed, and the operators had been given one more good story to tell.

When the bands fell apart at 9:14 p.m. Phoenix time, Gene Trabor W7GX had written the 208th contact into the log on 20 meters.

Phoenix mayor Tim Barrow delivered the official welcome to the Sister Cities delegates at a mid-morning session on Thursday, and set the theme for the duration of the convention when he said, "The key to resolving problems, be they local or international, is contact—communication—between and among individual human beings." Other speakers tied this idea in with amateur radio, calling attention to its accomplishments and inviting the delegates to visit WH7SCI. As a result, the band of diligent hams out on the sidewalk had a lot of company throughout the remainder of the convention.

The delegates were bussed out to the Western Town of Rawhide north of Scottsdale Thursday evening, and while they were savoring thick, delicious slabs of beef, the
hams continued to fight wind, rain, and poor propagation. A new problem developed when a couple of avid brass pounders decided to go on CW to beat the poor conditions. The big rig borrowed from Barry Goldwater wouldn't key, and it was discovered that somebody had made internal changes that made it function only on voice. Rather than stop communications to work on the transmitter, the operators decided to forego CW.

Gene Hubbel and Rick Olsen WA7CNP tried the little Swan rig on CW but discontinued it when the operators using the mike had been called into special conference by President Ford, thus delaying his departure for Phoenix. He did arrive in time to tell 900 Southwest District Kiwanians why he thinks we should go back on the gold standard, but he missed the Sister Cities Convention altogether.

Arizona Supreme Court Chief Justice Jack D.H. Hayes filled Barry's place on the program. Justice Hayes adjured the delegates to do what amateur radio operators often call out for their club members to do — involve youth in the effort to keep lines of communication open.

"Boy, you really brought 'em out of the woodwork!" kidded his partner. Then the single word "Smile" came clearly over the air...

at their elbow reported annoying key thumps on their receiver.

"Next time we won't hook the inverted-V onto the mast with the tri-band beam," Tom Moore said. "The antennas were just too close together."

But the brass pounders hung in there, picking off a few moments on CW whenever they could, and by the end of the convention, they had rung up a modest score of forty contacts.

Propagation, which had been spotty all day, continued that way through the evening, with conditions varying from impossible to an "everything goes" situation when the operators could make solid contact no matter in which direction they swung the beam. When the bands closed for good Thursday night, WH7SCI had scratched up another 152 contracts to make a total of 360.

Early rising delegates and hams wrinkled their brows Friday morning when they walked out around the hotel pool and cast their wary eyes upon the sky. The clouds were still there, promising rain again, and later delivering it. But it wasn't the rain that disappointed them most — it was the failure of that leaden sky to deliver a featured speaker of the convention, Senator Barry Goldwater K7UGA.

Unfortunately for the convention — and for the hams who had hoped to get the senator behind the mike for a while — Barry
Saturday turned out to be the big day for both the convention delegates and WH7SCI. Delegates were kept busy all day with the annual business meeting, area studies workshops, a Town Affiliation Assn. directors meeting, and a conference reception. But the big event was the annual banquet with presentation of awards by the Reader's Digest Foundation, the sponsoring organization.

Spokane, Washington and Nishinomiya, Japan, got an award for planning and building a Japanese garden in Spokane. Portsmouth, Ohio, and Orizaba, Mexico, got an award for greater awareness and respect for each other's people. Glendale, Arizona and Delicias, Mexico, were given an award for planning, building, and learning to operate a fire truck. Glendale built it and delivered it to Delicias, and then trained the Mexican firemen to operate it. Numerous other awards were given by Kent Rhodes, president of the Reader's Digest Foundation, for such things as dramatic help, cultural exchange, and youth programs.

WH7SCI operators found propagation better than on any of the three previous days, making 279 contacts and running their convention total to 730. Most of the operators had rain paths across the shoulders of their jackets, but there was no major downpour.

A delegate from Mexico came by repeatedly to check on conditions in Hon-duras, where Hurricane Fifi had killed 7000 people. Late in the day, he went away relieved when the hams could tell him that the worst was over and cleanup operations had already begun. His thanks and look of relief told that he had become a believer in ham radio.

The most emphatic convert to the value of ham radio may well have been Dr. Joao Goncalves de Souza, from Brazil. Dr. Goncalves came to the station and asked Rick Olsen if he would call his home town in Brazil. (After all, hadn't the official conference program stated right on top: "The Ham Center will permit conference delegates to call their Sister Cities through amateur radio operated by experts familiar with international telecommunications systems." Why not a call to one's own city?)

Rick swung the beam and banged out a CQ. Back came a Brazilian freighter off the coast of South America, PY2BHL/portable mobile marine. The doctor talked for five minutes with the freighter's OM in his native tongue, Portuguese, he would have been very satisfied with that, but when Rick signed with the freighter, on came PY4AKZ in Brazil, forty miles from the doctor's hometown. In short order, PY4AKZ clued him in on everything he wanted to know about home. Ham radio had found another believer and friend.

By the time the last Sister Cities awards were being given out, the bands were getting ragged. The end came when Ed Marple WA7KFA and Rick Olsen worked W6LUV/KV6, Frank, on Canton Island and moments later couldn't get out of town. And that's where the whole thing ended, with Jack, W7J DW, just a few miles away.

"Take her down," said Tom Moore, and fifteen minutes later all the gear except the antennas was in the back of the truck. WH7SCI had sent its mysterious call out for the last time, and hams like Al Schmidt, K9DIN, who typified hundreds of other hams would wonder no more. Al, up in Two Rivers, Wisconsin, had figured out that SCI

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A somewhat puzzled delegate looks over operators' shoulders at WH7SCI and Tom Moore's QSL card bulletin board. Tom framed a sheet of celotex, pinned the cards up, and found that delegates were impressed by the great number of different contacts a ham station can make.

When the photograph arrived, the party was over.

"We weren't about to play games with that lightning," said Tom Moore.

All that remained was for Richard H. Oakland, Associate Director of Sister Cities International, the chief engineer of the convention, to give his appraisal.

Oakland said that the convention had achieved its three main goals: developing stronger ties between international organizations with Sister Cities objectives; finding new ways of communicating with cities throughout the world; and involving more American cities in international programs of America's Bicentennial.

"Amateur radio is an obvious communications factor, frequently ignored until the Phoenix conference," Oakland said.

In his final statement for 73 Magazine, Oakland said, "The amateur radio center operated during the Phoenix conference was highly successful. It started a lot of delegates thinking about amateur radio. The 'Center' will become a permanent fixture at our annual meetings and - as the years go by - will become much more sophisticated."

The hams can take it from there, thanks to Tom Moore and his band of twenty-five volunteers - and the guy who loaned them that heavy equipment.

... K7NZA
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The following is not fiction, but for the sake of all parties involved the call signs have been omitted and the names changed. I personally witnessed the events and checked out the authenticity of the facts, statements, and circumstances which took place.

I had contacted Randy many times prior to the events.

Some years ago, Randy was told by his physicians that he could no longer fulfill his duties in the International Division of a large corporation for which he had served for well over thirty years. He knew it would be quite a blow to suddenly retire from a life that had taken him to 35 different countries throughout the world.

He was a well-thought-of junior executive (back when the dollar was one hundred cents), but his spinal disability had deteriorated beyond hope and Randy was in constant pain. Then he developed angina pectoris that could only add to his misery.

Of course retire he did, and in the first year of retirement he suffered not only physical misery but mental anguish. Randy thought if he were to remain sane he must find something to occupy his active mind. He had come up through the ranks of his company – first a technician, then a sales engineer (methods and systems), then branch manager, and finally export manager at the Washington, D.C. branch. The firm manufactures electronic office equipment; therefore he was bent many years ago toward electronics. Having been a technician and systems sales engineer, Randy had always wanted to be a ham, but now he was almost 60 and wondered if it was too late. However he decided he might be able to make it – even though he was living in his twilight years. Randy remembers that one of the first courses he took before going into sales was the Dale Carnegie course in “How to Win Friends and Influence People.” Thereafter all his training dealt with human behavioral patterns. So, therefore, his friends encouraged him to try amateur radio, even though he had to go through the Novice experience at around age 60, mostly with young people. He liked young people and could bury his pride to accomplish his goal.

Randy bought a radio telegraph key and put together a code oscillator, while spending most of his time in bed – for one month he practiced code while in much pain. In addition to this, and with the help he received from the local radio club, he took the test and received his Novice license. The club straightened him out on proper timing of his self-taught code. He said it was like learning code all over again.

He then set about putting together a rig bought as a kit (Heath DX60 and HR10). He could work only twenty minutes at a time because of his affliction. He states he learned more trying to make the rig work than by putting it together. When it was finished he did many contacts, both domestic and DX.
but during his rest periods Randy tuned in
on W1AW and practiced reading code for
two months. When he thought he was up to
about 14 to 15 words per minute, he asked
his doctor about taking the General Class
exam (even though he had nothing to gain
band-wise), but the doctor did not approve
since it meant sitting for well over his limit.
Therefore he received a certificate of disa-
ability and a director of the local radio club
gave him (the mail) examination for a
Conditional Class.

Well, Randy made it! He doesn’t know
how well he did, but he remembers his
shaking hand more than anything else about
the code test (his spinal injury affects his
entire nervous system).

Randy wasn’t happy with the Condition-
al, because he thought other hams would look
down their noses at him (and some did). So
he went about improving his knowledge. I
counted well over 35 ham books in the
bookcase next to his bed.

He vowed he would go for a General Class
even if they had to take him down in an
ambulance. With 2 to 3 hours of reading
each day (especially SSB), he took the
chance on the one day the FCC would be in
his city (only twice a year). Randy did a
much better job on his General exam than
on the Conditional. He made not a single
mistake in code, and in theory was over 90.
However, the expedition was costly in terms
of the pain caused by going in for the exam.
Now he is studying for the Advanced Class,
but all this is not the moral of this true
story.

A while ago Randy happened to be on
what he thinks was someone’s private fre-
quency?, and so Big John bellowed in on
Randy’s QSO and said Randy was 12 kHz
wide. At the time Randy was receiving and
the other half of his QSO was transmitting.
So Randy asked Big John to please stand by
until his contact had completed transmitting
and then he would discuss his signal with
him. But Big John continued and insisted on
pursuing the subject. Randy finally (his
patience almost gone) said, “It sure is a
mystery to me, if I am really 12 kHz wide
and with SSB, and audio turned down below
the flat topping point and my rig had just
been returned from the factory for general
adjustment.” Just two weeks prior Randy
had his signal checked (on a scope) by a
Navy technician, some 1500 miles away. “It
is difficult” said Randy, “to believe my
one-year-old rig is really 12 kHz wide, that is
so far out.”

Randy’s Navy contact was kind enough
to allow him to adjust his audio gain and
speaking distance from the microphone. He
scratched a mark at the point or the position
that the audio gain was not flat topping and
at that point his signal was not over 3.2 kHz
wide.

“Well,” Big John bellowed, “I’ll get wit-
nesses.” So while Randy was still in QSO
with his original contact, Big John called in a
few nearby ham friends and a discussion
ensued for some time.

Finally it became time for Randy to
transmit to his contact. He mentioned what
Big John had said. Randy’s contact came
back with a quick break, that Big John must
have something wrong with his receiver or
scope, because he measured Randy at 3.5
kHz wide – probably overload in the front
end of his receiver. So after the QSO Randy
apologized to Big John; only for the sake of
peace.

Randy shrugged it off as just one of the
so-called, self-appointed “police” for the
ham bands. However, he vowed he would
have his rig checked by the factory. At this
point Randy had obtained a 550W PEP
input SSB transceiver feeding a classic 33
beam forty feet up. He used mostly 15
meters. So he did send the rig back to the
factory and they gave it a clean bill of
health, including the ACL.

Randy decided maybe his voice did mod-
ulate heavily, so he backed away from the
mike to about 8 or 9 inches with the audio
gain set at a point before flat-topping and
made sure his voice did not modulate the
transmitter more than 150 mils, which is in
accordance with the instruction book.

“One more project,” said Randy, “before
I get to the point where I cannot build any
longer.”

From a kit (IC Board) he put together a
frequency marker that would calibrate 100,
50, 25, 10 and 5 kHz. Then he beat the
marker with WWV three times to make
certain it was correct before the new incentive license change on November 22, 1969. In checking with other hams he found he was never more than a few cycles off (and maybe the other fellow was out) and these checks were with top-notch operators and equipment. He also checked the new marker with his built-in 100 kHz calibrator.

But lo and behold! After talking to a contact who was using the S Line, Big Chicken Little (self-appointed, who did not identify name or call sign) blurted into his QSO, "You are centered out of the band 5 kHz." Randy rechecked his calibration and was within 100 cycles of 21,440; muttering to himself, Randy said, "It is hard to believe," and asked what his anonymous contact was using with which to police him. The voice came back very loud and very wide, "You are 21,450 kHz." Throwing up his hands, Randy said, "Maybe this hobby is not for me, after all." And I think he means it.

I doubt now he will ever take the Advanced Class exam. Yet I believe he has the knowledge and is qualified.

While he was attempting to teach code to some younger, he wondered why Extras insisted on getting exactly on 14,020 kHz, etc. So he wrote the powers in Hartford. You should read the reply from an Extra Class correspondent. Guess the answer.

An eyeball contact with Randy confirmed the following facts:
1. Two American passports with visas to almost 35 countries in every continent in the world.
2. An engraved gold Omega watch, stating he had been with his firm over 30 years.

3. Two patent documents in his name for inventions dating 1945 and 1966, one a medical device and the other an attachment which worked in conjunction with his company’s electronic equipment.

In addition, he has managed to educate three daughters, two with advanced degrees, and the youngest with an electronic engineering degree from a top technical university.

Randy says: "It is not what the big shots say, it’s the way they say it." I agree, and may our over-enthusiastic, self-appointed "police" learn at least the first lesson in human behavior. In spite of their knowledge of ham radio they can be wrong, or can they ...

The other day Randy wrote his will with his lawyer, and among other bequests he ordered carved on his gravestone: "Just How Right One May Imagine Himself To Be, Is No Criteria In The Eyes Of God Or Man."

The big shots could have said, "Randy, when you have finished, may we have a QSO with you?" Then they could have said, "Randy, the QRM is fierce. Let’s check the bandwidth of our signal so we will not be adding inadvertently to the problem."

Randy suggests that because he went to all the trouble to have his rig checked and readjusted is no admission that the “police-men” were right.

The moral to this story is: "If you judge without all the facts, you must stand to be judged by others."

. . . WN7KUD

Any similarity to names and places are purely coincidental and not intended except to those to which this story applies.

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Further Adventures
Of The Bounceless Switch

I have presented several pulsers in past articles that hopefully have been of use to amateurs and others involved in pulse circuit testing ("A Pulse Generator for the Amateur," 73, Nov. 1967, "An IC Pulse Generator for the Amateur Experimenter," 73 Sept. 1971, and "IC Logic Pulser Simplifies Design," Electronic Products Magazine, Aug. 16, 1971). Correspondence from readers indicates there is an additional need for a pulser which puts out only one pulse at a time — each time a manual "pulse" button is pushed.

What good is a single-pulse generator? Well, if one can really depend on obtaining one pulse per push of the manual "pulse" button, such a generator can be of great use in analyzing various count-up, count-down, and shift register circuits. For instance, there are as many different circuits for counting by various integers as there are logic designers. By first resetting an unfamiliar counter (usually by means of its reset input), then inputting one pulse at a time to its clock input, we can make up a truth table. This can be done using only the single-shot pulser and a dc voltmeter. An example of such use will be given later in the text.

It might be thought that a single pulse could easily be created by simply using a battery and a switch as in Fig. 1. However, although this method was workable in older relay logic systems, it has severe troubles in generating a single pulse for modern IC logic systems. The most obvious problem with a battery and switch pulser is that of the lack of ability to control the pulse length. Human response time being what it is, pulses shorter than, say, 100 ms are very difficult to time. The less obvious problem, however, (and actually the worst difficulty) is that nearly all switches exhibit some form of bounce. Bounce is the effect of a switch, on closure, to make and break the circuit several (or many) times before staying closed. In a spring-loaded switch, like a microswitch, the term bounce is quite descriptive; however in other switch types the mechanism of making and breaking is more subtle. The details involve microscopic cold-welding alternating with conductor-oxide insulation — but the result is the same: bounce. Since even the slowest forms of IC logic respond to on and off signals in microsecond times, switch closure bounce can be seen by the IC's as multiple pulse inputs for each apparent switch closure. This, of course, can cause great confusion when trying to understand pulse-counting circuits.

The single-shot pulser in Fig. 2 solves not only the pulse-length problem, but also assures that only one pulse is generated from

Fig. 1. Simplified "one pulse" generator, which does not always put out one pulse per switch actuation, as explained in the text.
each actuation of the push-button switch (even if the switch bounces). The switch debouncer is a pair of TTL gates wired as an R-S flip-flop, sometimes called a latch. The latch puts out a negative going rectangular pulse, whose duration is dependent upon how long the push-button switch is held down. However, the output pulse length is not controlled by the latch output, but by the one-shot multivibrator (IC2) which it triggers. The one-shot is one of the newer TTL types, which are much easier to apply than the older DTL one-shots; it is triggered only by the falling edge of the latch output, as it is wired. IC2 has both Q and Q outputs available; that is, it has both a positive output pulse and its complement. These are available, respectively, at pins 8 and 6 of IC2.

In order to provide as much output drive as possible from the pulser, each of the two outputs are passed through a TTL buffer gate. Since these gates are inverting types, the positive going pulse and its complement exchange output positions. The two buffer gates are contained in IC3.

A simple regulated power supply is used to make the single shot pulser completely self contained. A 6V filament transformer, integrated bridge rectifier, and 500 μF capacitor form the rectifier-filter section. A Fairchild μA7805 integrated circuit regulator provides the regulation. This power IC regulator has only three terminals: input, output, and ground. Reasonably, the ground terminal is also the heat sink tab on the plastic version used (it is the metal case for the TO3 version); and so, no insulating washers are needed for mounting. In order to assure against oscillations (the IC has rather high gain internal circuitry), a 0.22 μF capacitor is placed directly across the input and ground terminals. There are several other similar fixed 5V regulators available which also could be used: the LM309 (National, EEP, Motorola) or the LM335 made by EEP.

A number of simple changes may be made in the circuits to allow for different requirements. As shown, the pulser will provide pulses approximately 1 μsec to 10 μsec long. Increasing the size of C1 to 5100 pF will allow for pulses of 10 μsec to 100 μsec, 0.05 μF will give 100 μsec to 1 msec, 0.5 μF will allow 1 msec to 10 msec pulses. These capacitors must be non-polar types.
such as mica, mylar or polystyrene. If it is desired to use polar capacitors (such as tantalum electrolytics) a modified circuit for

the timing of IC2 (Fig. 3) should be used. This circuit modification also allows the use of timing resistors larger than 50K, and so makes possible really long pulses.

If it is desired to have the single shot pulser drive 50, 75 or 93Ω coax cables, another change can be made. By substituting a Motorola MC3029P for IC3 (with appropriate pin number changes), such coax lines can be driven without ringing and other forms of pulse distortion. Figure 4 shows the several ways in which the MC3029P buffer gates may be wired to drive TTL, 50 to 93Ω coax lines, and 93 to 120Ω coax lines. One may ask why the SN7440N was considered as the buffer in the first place when the MC3029P will provide its function plus the coax drive capability. The reason is that the MC3029P is rather a special case, made only by one firm—the “7440” is much more widely second-sourced.

As to substitutions, there are many sources of the SN7400N, SN7440N, and μL9601. Table I gives a listing for pin-for-pin substitutes that would be satisfactory in this circuit. In fact, one could even use DTL units for the latch and buffer gate IC’s (IC1 and IC3). A μL946 (or MC846P) would directly substitute for the SN7400N, and a μL932 (MC832P) would directly substitute for the SN7440N.

An example of how the single shot pulser can be used is shown in Fig. 5. The pulser output is connected to the clock input of an SN7492N divide-by-twelve counter IC to ascertain what its truth table is (assuming we did not know it). We first actuate S1 to the “1” position, which resets all the four flip-flops to zero. Then S1 is set to “0” in order to count. The outputs Q0, Q1, Q2, and Q3 are each measured with a dc voltmeter (say a 20,000Ω/V V.O.M.). Now input one clock pulse by pushing the pulse pushbutton on the single shot pulser, and again measure the states of Q0, Q1, Q2, and

---

**Table 1**

<table>
<thead>
<tr>
<th>UIC 1 = SN7400N (Texas Inst.)</th>
<th>IC2 = μL9601 (Fairchild)</th>
<th>IC3 = SN7440N (Texas Inst.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC7400P</td>
<td>MC601P</td>
<td>MC7440P (Motorola)</td>
</tr>
<tr>
<td>USN7400A</td>
<td>SN74122N (Texas Inst.)</td>
<td>USN7440A</td>
</tr>
<tr>
<td>N7400A</td>
<td>N74122A (Signetics)</td>
<td>N7440A (Signetics)</td>
</tr>
<tr>
<td>U6A740059X</td>
<td>AM2601 (Adv. Micro.)</td>
<td>U6A740059X (Fairchild)</td>
</tr>
<tr>
<td>SG7400N</td>
<td>AM9601 (Adv. Micro.)</td>
<td>SG7440N (Sylvania*)</td>
</tr>
<tr>
<td>HSC7400D</td>
<td>RF8601 (Raytheon)</td>
<td>HSC7440D (Hughes)</td>
</tr>
<tr>
<td>DM7400</td>
<td>DM7850 (National)</td>
<td>DM7440 (National)</td>
</tr>
<tr>
<td>TG-7440N</td>
<td>SW9601 (Stewart-Warner)</td>
<td>TG7440N (Transitron)</td>
</tr>
<tr>
<td>C3000</td>
<td>C3803 (Motorola-HEP)</td>
<td>C3040 (Motorola-HEP)</td>
</tr>
</tbody>
</table>

*Discontinued, but often available as surplus stocks.

---

**Fig. 3.** Modification to allow use of polar capacitor (c) in one-shot timing circuit, and timing resistor (R) larger than 50K. Q1 = 2N3565 (Fairchild) or HEP55 (Motorola).

**Fig. 4A.** For T.T.L. outputs.
For SO to 93 coax outputs,

\[ \begin{array}{c}
\text{Fig. 4B. For SO to 93 coax outputs. }
\end{array} \]

- For 50 to 93 coax outputs
  \[ \begin{array}{c}
  \text{Fig. 4B. For 50 to 93 coax outputs.}
  \end{array} \]

\[ \begin{array}{c}
\text{FOR 50 TO 93 COAX OUTPUTS}
\end{array} \]

\[ \begin{array}{c}
\text{FOR 93 TO 120 COAX OUTPUTS}
\end{array} \]

\[ \begin{array}{c}
\text{Fig. 4C. For 93 to 120 coax outputs.}
\end{array} \]

\[ \begin{array}{c}
\text{Fig. 4D. For 93 to 120 coax outputs.}
\end{array} \]

Q3. Input another pulse, etc. In twelve pushes of the pulse button we can build up a truth table as shown. Note that this counter has a relatively unusual sequence; it counts up from 0 to 5 then skips to 8 and counts on through 13. There are still a total of 12 steps; so it is truly a divide-by-twelve counter, but the count sequence is somewhat unusual.

This example is one that needn't have been done, since the truth table of the SN7429N is well known, and published in the data sheets of its numerous manufacturers. However, there are plenty of nutty counters around made up of combinations of individual flip-flops and gates that are tedious to analyze. Running through a count sequence, as above, can quickly shed some light on their inner workings.

\[ \begin{array}{c}
\text{Fig. 5. Example of using single shot pulser to ascertain truth table of a counter IC.}
\end{array} \]


\[ \begin{array}{c}
\text{DRAKE DRAKE DRAKE}
\end{array} \]

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\text{Slep Electronics Co.}
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... W6GXN
Is Automated CW Possible?

Many hams who are CW operators are awakening to the fact that the use of a tape recorder in conjunction with their ham stations can take a lot of the work out of transmitting, especially during contests. An article in QST September 1962, Magnetic-Tape Second Operator, gave W3GKP's sending system with a tape recorder, but it appeared more complicated than it actually was, and this may have scared off some possible users of the technique. The following article will describe the simplest possible circuit for using automated CW transmitting.

In July 1962, my article "A Simple Electronic Keyer" appeared. An equally simple modification was made to this keyer to add the capability of sending pre-recorded magnetic tape messages. Figure 1 shows the circuit, and this may have scared off some possible users of the technique. The following article will describe the simplest possible circuit for using automated CW transmitting.

Fig. 1. The original keyer circuit.
original keyer circuit, and Fig. 2 shows the changes necessary. Referring to Fig. 2, the audio from the tape recorder is rectified by the silicon diode and filtered by the audio bypass capacitor. The resultant voltage actuates the plate-sensitive relay which was already used in the keyer circuit. The keyer operation is unchanged after this modification.

If you accidentally connect the diode with the wrong polarity, the keyer will not operate. This is because the polarity of the diode will be such that the current through V1b will follow the path of least resistance, through the diode and the tape recorder af output transformer to ground, and not enough to actuate the plate relay will flow through it. So if your keyer doesn't work after this modification, check the polarity of the diode. If it is in fact correct, then check to see if you have the keyer line cord plugged in. Further trouble shooting is beyond the scope of this article.

![AF INPUT](image)

**Fig. 2. Modified version of the keyer.**

In case you don't use a keyer with a negative dc supply (with respect to ground), or want to build this second operator independent of the keyer, just use the circuit as shown in Fig. 3. It can be built into a small minibox, with no power requirement, or it could be built into the tape recorder becoming an on-off keyed circuit. Various other possibilities will suggest themselves to match the individual ham station.

It should be mentioned that the parts specified in this article are junk box values and represent simply what was on hand at the time the idea was tried out. Any diode which will handle a few mils will do for the rectifier, and any af bypass condenser value from 0.1 to 1.0 µF will be OK.

So that's all there is to the construction of the gadget. What could be simpler! It has been convenient in my station to place the recorder on a small shelf beside the operating table and permanently connect it with patch cords to both the electronic keyer and the receiver (more on this later). Now let's consider some of the possibilities with the set-up.

As W3GKP suggested in his article, it is possible to buy an older model recorder in fair condition at a reasonable price. For this application, you don't need anything approaching hi-fi, so you may be able to pick up a recorder still in good mechanical condition simply because its audio quality is not up to modern hi-fi standards. However, if you want to use the family recorder rather than buying one just for the ham station, this circuit is ideal, since no modifications need be made to the recorder to use it.

If you do buy an older recorder, something that's worth looking for is one with two playback heads. This type of recorder will play with the tape moving in either direction, rather than having to manually swap the two reels to reverse the tape direction. I managed to get hold of a good old Webcor which has this feature, so that two different messages can be recorded on the two tape tracks, and either track played back simply by selecting the appropriate tape direction by the selector switch.

Thus, in an ARRL Communications Department Party (in which the transmitted half of the contest exchange is always the same for any given station), a tape loop was prepared with a "CQ CD" call on one side of the tape, and an "ORS WPA" report on the other track. The actual texts of the two messages were chosen so they were of the same duration, and recorded with the same index point on the loop. Then it was a
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simple matter of starting the tape to call CQ until it had had time to attract some attention, then stop the loop at the index, sign “K” with the keyer, and listen for a reply. If a reply was produced, the station’s call sign was signed by keyer (manually) and the second tape track started. This gave the contest exchange for my station (K3KMO) while the log was filled out. Then when the tape loop had run, the tape was stopped and the incoming half of the exchange copied, with all log-keeping up to date and ready for a new contact when the transmission was receipted for.

However, woe be unto him who falls asleep with his automated station calling CQ, for his call sign shall be eternally remembered...

It is surprising how much of the work of a contest can be eliminated by such automated sending taking care of the repetitious transmissions for you. When the contest is hot, it helps the operator keep his logging caught up. When the contest begins to thin out, the operator can turn on the endless loop and call CQ until he rounds up the last few strays, and he can sit back and relax a little. However, woe be unto him who falls asleep with his automated station calling CQ, for his call sign shall be eternally remembered, his fame shall be known far and wide, and his name shall be mud forevermore!

W3GKGP mentions in his article that he records his tape loops by taking the af output from his receiver while monitoring his transmitter (with the final turned off, naturally). This is a very easy technique. Also you can use your normal station monitor to do the same things. However, W3GKGP failed to mention something regarding the recording of his own signal in his receiver that should be fairly obvious – the same thing can be done with any incoming signal. Thus, you can record another ham’s signal and play his first back to him through your keying unit to show him what his sending is like. With careful adjustment of the receiver audio note and i-f bandpass characteristics, it is possible to eliminate most interference and get a good quality recording of any average signal. A little experimentation will show you the best tuning technique to use with this trick.

Also, recording and playback through the keying unit can be used to pass traffic on the CW nets – that is, if you are not ashamed of sending the other fellow’s fist over your call sign! If this is done, the traffic should always be copied by hand simultaneously with the tape recording, to insure that you have a solid copy.

Another good trick is to use a two-speed recorder to either double or halve the transmitting speed. It is fun to use this technique at both ends, and make all the kids on your block think you and your contact are real speed merchants. However, you may attract the attention of an honest-to-goodness speed merchant, and be embarrassed. So be careful.

Numerous stations are helping to supplement W1AW’s code practice transmissions nowadays by re-transmitting their material on six and two meter MCW or CW to help the Technicians over the code hurdle. This can be done quite easily with this tape-transmitter. Also, this gives you the capability of feeding the receiver audio output right into the keyer af input, so you can re-transmit directly. A switching arrangement can be used to kill the automatic relay when W1AW is signing its call, so you can take the opportunity to sign your own station call sign.

The possibilities of a recorder-operated station are almost limitless. You can add many more uses than those mentioned in this article. For instance, you too can have a CW phone patch such as I once had. Or you could help a physically-handicapped person with a unit for him to send CW by speaking “di-dahs” into a microphone. You can supply many more uses of your own.

I have played around with completely pre-recorded chatter for an entire contact, so that all he needed to do was to start the recorder calling CQ, then after receiving a reply, sign the call sign of the calling station and then let the recorder take over. If the tape-recorded QSO trend catches on, it may end up with two hams’ recorders talking to each other while the two operators go out and have a beer. 

... DJØHZ
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In between working one hundred countries on slow scan, Gene has done one of the better jobs of putting together a console for his station. Take a look at it ... it took him over five months to whip this up. Take a peek at the front cover and you'll see that Gene has left little out. Digital clock (local time) - dummy load indicator - antenna indicator - antenna control and main power control - temperature indicator, in and out (Heath) - frequency display (Heath SB-650) - tape recorder - tower lights - 75S 0 325 - dummy load - slow scan unit - tower up and down - digital clock on GNT - SSTV monitor - elapsed time meters - antenna height indicator. Antique addicts may be horrified to learn that the base of the console is a 90 year old roll top desk made of solid oak. The front panel is made of white leather finish Formica while the top and ends are oak Formica to match the desk. The back of the console is enclosed with 1/4" (6.35 mm ... he) Plexiglas. How Gene was able to build this beautiful and neat console and still keep his car in there to be the first to work 100 countries on slow scan is a mystery. Either chore would seem enough for any energetic amateur to accomplish.

COVER
Gene Kundert W8YEk
735 E. 5th St.
Delphos OH 45833

W8YEk Works

100 Countries on SSTV

I have 91 countries confirmed. Here's a list of the 100 countries I worked 2XSSTV. Also a list of the ones that did not OSL so far. Some were recent contacts.

EA68Q was country #100.

Gene also had a way with T12GSW and no OSL from him. I did hear that EP2FB sold out, so that card is lost. I may have to work 115 countries to get 100 cards.

I worked Faisal (HZ1SH) several times and did not know who he was so I thought maybe the poor guy was hard up. I enclosed IRC's and still I received no card. So I did it again, IRC's and all. Then I picked up a newspaper one day and there it was - Faisal puts oil embargo on USA.

Gene operates 10 to 12 hours a day, 7 days a week in the winter and in the summer 2 to 4 hours a day. I find that if you work 'em you have to be on the air a lot. If I receive any OSL's from the above 91 I will drop a note to 73.

... W8YEk
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Once you have a good tape deck you will probably want to use it for music, so hi-fi is important. This deck is capable of superb fidelity recording and playback.

LOW PRICE
You want the lowest priced deck that is capable of meeting your requirements, with slow scan being an important application. This is one of the few decks on the market which provides good quality recording without going to extremes such as the Dolby noise reduction circuit, automatic reverse, CrO2 bias, and things like that. Lower priced decks don't make it for you because their tape drive systems are too cheaply made and they have unacceptable flutter and wow as far as hi-fi is concerned. Most cassette decks today are running in the $250 to $350 range.

STEREO OR MONO RECORDING
When you put nearly $100 into a tape deck you want it to be usable for a music system...and that means stereo today. This is also handy for slow scan where you put the picture on one channel and accompanying audio on the other, each to be transmitted on separate sidebands. Slide shows can have commentary on one channel and slide projector signals on the other. This recorder has a switch in the back to provide stereo or mono action...few decks have this, even in the $400 models.

DB METERING FOR BOTH CHANNELS
This deck has illuminated meters so you can set your levels right and keep an eye on them. Tape has a rather narrow range of recording level so good meters...ones that are easy to read...are very important. If your levels are too low the sound is down in the tape hiss...if they are too high you get distortion. You get the best dynamic range from your tape when you have good meters for setting your levels.

MANUAL VOLUME CONTROL
Not one of the lower priced cassette decks has a manual volume control for recording. This means that there is no possible way for you to do an adequate job of recording good music for the automatic gain controls they use raise and lower the gain for you and ruin the normal dynamic range of the music. They are handy for recording lectures where you can't keep an eye on the meters, but manual is best. Try recording Morse code on an AGC recorder!

PAUSE CONTROL
Another function found only on expensive recorders...the pause control allows you to stop the tape instantly so you can edit as you record...starts instantly too. You can't do without this for slow scan. The pause control permits you to turn on the deck and set your levels before starting the tape.

AUTOMATIC STOP
What do you think it does to a captain when it keeps going at the end of a tape. It doesn't do anything any good. It wears rapidly, thus changing the speed of your tape in the future...it quickly wears out the tape so it can break, etc. The more expensive decks stop at the end of the tape, automatically. You want this.

HEADPHONE OUTPUT
There are many times when you want to be able to monitor as you record, so you want some sort of headphone output. You may want to use the deck without any power amplifier...just plug in your headphones. Have you heard stereo with headphones? It beats speakers in every way...the results are incredible and suddenly you realize how fantastic stereo can really be.

AC POWER
Battery operated tape decks are fine, but they start at $350 for any with quality recording and the batteries wear out very quickly. Around the ham shack and home you want ac powered gear.

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The price on this deck is so astounding that it deserves mention twice...while everything else is going up in 10% leaps, Panasonic has reduced the price on this deck from $110 to $89.95

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How do you get your kicks in ham radio? Depending on the individual there are many ways. Some spend their time strictly on CW, some on phone, some are rag chewers. Some spend all their time on the nets, some chase DX, and some do nothing but build new gear. There are those that spend their time mobilizing. And some think QRP is the only way to fly, while others have to have stacked yagis 100 feet high with the legal limit of power. Still others find overseas phone patching is their thing. Choose your own poison.

We get our kicks from portable operation of the temporary one or two night stop. We have hammed from camp locations by the hundred and to some extent from motels, beach cottages, mountain cabins and other permanent structures. We have alluded to this in several articles previously which will be noted as we go along. The purpose of this article is to relate a few of our adventures in the world of hamming while traveling, but not mobile. We hope a few more will join the fun.

Just setting up camp, cooking your meals, hiking and fishing can be a lot of fun. But eventually you run into some time that you don't know what to do with. The fish quit biting or you are tired of walking around and then it is time to set up the portable ham gear and enjoy a little hamming. You can get quite a kick out of just telling the guy who is sweltering in 100° heat how nice and cool it is up in the mountains. Or maybe you have need to get a message back home and you are 50 miles from a telephone. Either way hamming is a mighty fine adjunct to camping. It can be fun whether you camp in a tent, a trailer, a camper or a 20 kilobuck motor home.
What Type of Rig Do You Need?

Generally, if you are going camping, you are not likely to have an ac line. So it is highly desirable to have a rig that will operate from a storage battery. A number of the Swan family have dc modules available, but most are hard on an outboard storage battery. A Swan 350 will go through a heavy duty storage battery in less than 5 hours. This is OK if you are going to be out for no more than a couple of days and expect to do more fishing than hamming. The new solid state Swans should do much better. The SBE33 and 34 are excellent for battery drain. We presently have an FT-101 which has never run our heavy duty battery clear dead. We believe it will run for 12 hours. And 12 hours is a lot of hamming before you get to the next place that you can charge the battery. Obviously any of the solid state QRP rigs will run for days from a big storage battery. If you are traveling to motels or with a motor home with built in ac power, anything portable with less than a Mack truck is fine for portable operation.

Power Supplies

As mentioned above we would regard a heavy duty storage battery as a prime source of power. Now, none of the aforementioned rigs will actually deliver full rated power from a battery. In general, they are designed for mobile use with the car generator charging at all times. This means about 14V. We have an extra cell for our battery, making 14V. You still don't have full power but you have more. Caution: Read your instruction book before adding an extra 2V! The only other power possibility, aside from a possible ac line being available, is a portable gasoline generator. We have a Zeus capable of furnishing all of the power we could possibly want but we very seldom use it. It is driven by a cheap lawnmower type engine which is noisy. If you are camped within 91.44m (100 yards) of a neighbor camper you will be about as popular as a small kid riding a motor bike all around camp. The problem is not exhaust, its the motor itself. Even with a good muffler you still have the clank of a cheap engine. The Honda company makes the quietest portable gas gener-
Antennas

By and large the simplest antenna to get going is the dipole. A forty meter dipole will work on 40 and 15 m. Once measured the correct length it will get by regardless of the height. In the good old days Amphenol and others made 72Ω ribbon that was smaller than zip cord and all you had to do was zip out 33 feet and tie a knot in it, the remaining length being feeders (60 feet each side if you are interested in 75 meters). This writer would be most happy to buy a couple hundred feet of 72Ω receiving twin lead if anyone has some back in the attic or down in the basement, because it is simply not available any more. However, ordinary twin lead rubber zip cord is not bad. Zq is about 95Ω. Losses are unknown. But we have had many 40 and 15 m contacts, including some DX ones, using 10.06 meters (33') of zip cord each side of a knot.

Now as to getting the antenna up in the air. Naturally the higher you can get it the better, but it will work even if tied between two picnic tables. We worked VK land with a dipole draped on blackberry bushes less than 8 feet from the ground, from an Oregon beach campground. But our favorite method is to shoot a two ounce fishing sinker attached to the spinning rod, over a tree limb, with a sling shot. We then reel the fish line back in with nylon cord attached and hoist up our antenna. If you are a baseball pitcher maybe you can throw a weight over the limb or spin a weight around and around releasing it at the proper time. In any event you need a spool of nylon cord.

Next to the dipole the ½λ ground plane would be most important, especially if you are interested in working the higher frequencies. We presently have a portable

ground plane made of telescoped aluminum tubing which will telescope from 2.44 m — 4.87 m (8' — 16'), thus covering 10, 15 and 20 m. Cost for two of these was less than $12. We use the roof of a Ford van for the ground plane. However, the vertical element may be a wire secured to a limb overhead or even a pole wrapped with kitchen aluminum foil. And the ground plane may be random wires on the ground. The main trouble with a ground plane in camp is the radial wires being where people trip over them. This could be alleviated by making the bottom of the vertical element and the ground plane 2.44 m (8') from the ground. This usually presents construction problems though.

Last but not least comes the quarter wave Marconi antenna. This is especially good for 40 or 80 m and the motel traveler. Again, once you get the length established you can expect to stay under an SWR of 2:1 for nearly all cases. Measure out a quarter wave length of wire. (From the standpoint of public relations the smaller the wire the better, and erecting after dark is not a bad idea either.) Use 50Ω coax (NOT 72Ω) and hook the wire to the hot lead. Connect the
you have to be pretty good terms
So we fired up the FT-101 and
least 200 miles on 75 meters. We were
2:1 coax to the roof
was the trees.
Kiwi was and and a night on 15m. His direction was directly
home with the same power
Land, draped about 60
mote l practically in the center of
as in Korea. This
fiber glass can at a
shield to anything that looks like a ground.
The ground can be a vent pipe on the motel,
an eave trough, a steel railing on the upstairs
tier, even an aluminum screen door. The
closer to perpendicular to the assumed
ground that you can go with the wire the
better, although even practically parallel will
work. In the latter case you might have to
adjust the length of the wire by a foot or
two to get under 2:1 SWR. A dipole is fine
for a motel also, but difficult to attain with
the feeders at your apartment. Needless to
say you have to be on pretty good terms
with the motel manager to put up a 75m
dipole across the front wings of the motel.
So we used the quarter wave wire in 30 or
40 motels all over ZL land where they
usually have metal roofs for the substitute
ground.3

Some Examples of What You Can Do
Operating Wise:

Much has been speculated about the
effects of trees on radiation. Our observa-
tions at least in the summer time, is that
trees don't really affect things that much.
On the lower frequencies you can work as
far as you can at home with the same power
with or without trees. We have made WAC
several times in a forest so thick you
couldn't see through and with the antenna
half as high as the trees.

If you have need for a low frequency
antenna don't assume the one you have up is
useless: it may work. A 40m dipole will not
work on 80 the good book says. If you have
a short haul situation to get back home go
ahead and load it up to something less than
rated power. You can work 100 miles or so
with no difficulty. You may have a 3:1 SWR
but at half power it won't hurt for a few
minutes. You can break a net and get your
message through. By the same token a 40m
dipole won't work on 20 either. We had one
up about 50 feet recently and didn't want to
get out the ground plane for 20 so we
checked the SWR which turned out to be
1.5:1. So we fired up the FT-101 and
worked Florida on the first contact.

The worst antenna we ever had worked
for at least 200 miles on 75 meters. We were
in a motel practically in the center of
Dunedin, New Zealand, on a main traffic
lane. There was absolutely no place to hang
an antenna. We clipped the shield of the
50Ω coax to the roof and draped about 60
feet of wire on rose bushes less than three
feet high around the end of the building in
the shape of a "U." We did have to adjust
the length of the wire to get less than a 2:1
SWR but we worked several stations and
even got invited out to dinner. I suppose
the best antenna was a 100 foot water tower in
Merrill, Oregon, which we shunt fed.

While in ZL land we occupied ZL1KN's
beach cottage in Whangamata, New Zealand,
for about 10 days where we mounted our
whip antenna on top of a rotary clothes line
and, using the clothes line for a ground plane
we tuned up our SB 34 on 20 meters. A
neighboring boat builder and his wife came
over to visit one evening and he wanted to
see how ham radio worked. We turned the
rig on and a CR4 in the Cape Verde Islands
was calling CQ. He answered and gave us a 5
by 6 report. Sometimes things work when
you want to show them off!

Several years ago we stayed at a motel at
Shasta Lake in California on the second
deck. We laid our 40 meter dipole on the
wooden railing and the first station we
worked on 15 meters was in Korea. This was
with the SB 34. Another time we were
camped in Colorado near the Air Force
Academy. Our camp was at the foot of an
earth filled dam 50 feet high. We were less
than 50 feet from the face of the dam on the
south side. With a Swan 350 and a fiber glass
fishing pole wrapped with wire we worked a
Russian in the Ural mountains at 10 o'clock
at night on 15m. His direction was directly
into the face of the dam. Maybe it came the
long path, I don't know. Anyhow, you can
have a lot of fun operating from strange and
different remote locations. Give it a try.

1. Antenna Matching Systems, W7CSD, July 1973,
    Ham Radio
2. The Poor Man's Occasional Antenna, W7CSD,
    Feb. 1967, 73
3. An Oregon Yankee in Kiwi Land, W7CSD/ZL1BHC, June 1972, Break In
4. Ready Made Emergency Antenna, W7CSD, July
    1961, 73
DV-21

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

TPL brings you the finest amateur RF amplifiers for VHF FM available today. Only state-of-the-art techniques in circuit and semiconductor technology make an amplifier of this quality possible. The amplifying transistors are of the balanced emitter silicon power type. Each one is individually checked for power output and reliability during mismatch conditions. They are operated well within the factory's suggested limitations for added reliability and life. Most circuitry is of micro-strip technique for stability and broadband characteristics. Antenna switching is accomplished through the use of a specially selected RF relay ... activated by only one watt of RF power through an RF sensing circuit. During receive, the antenna by-passes the amplifier and is fed through the relay to the transceiver. Also of note is a reverse voltage protection diode which protects the power transistors from destruction in the event the amplifier is connected to the wrong polarity. TPL amplifiers are simple to install and fool-proof to operate. With proper care, they will provide a lifetime of dependable service.

DID YOU KNOW...

TPL is the largest manufacturer of accessory solid state RF power amplifiers in the world. TPL commercial amplifiers are used and recommended by every major manufacturer of commercial communication equipment. TPL’s engineering staff contributed to the development of RF power transistors from their earliest inception. TPL offers the broadest selection of RF power amplifiers. TPL offers the highest quality RF power amplifier available. TPL guarantees its amplifiers against defective parts and workmanship for a full year. TPL power amplifiers and repeater amplifiers are now available at your local dealer.
have a high enough peak-reverse-voltage rating in order not to fail. Make sure the key-up voltage across the key terminals is less than the p.i.v. rating of this diode. Here again a low leakage diode should be used.

opening relay K1 and the transmitter power circuits.

Once the key is closed, however, the voltage across C1 decreases to YN, causing zener diode D2 to not conduct. This will in effect cause Q3 to conduct, turning on the relay as well as the transmitter. Once the key is up, charge is allowed to build up on C1, and when the voltage reaches 6V, the relay opens. Thus, a delay of R1C1 will occur after each key-up.

Transistor Q1 should be a high gain NPN. I used a 2N3565, but any small signal type should work equally well. Transistor Q3 should be able to handle the current of the relay. I used a 2N4401 which is able to switch about 500mA. Q2 is also non-critical. Diode D3 is used as transient protection for Q3 and must be installed correctly. Damage could result to Q3 otherwise. Zener diode D2 should have low leakage current. I used a power from the circuit. This allowed me to operate in the normal mode, i.e., with the quasi-break-in out of the circuit. Since the relay contacts parallel the main transmitter control switch, either switch or relay may be used to put the transmitter in the transmit mode. An extra set of contacts on the relay allows the receiver to be disabled during key-down periods.

As mentioned previously, the amount of time delay after sending code is determined by the R1C1 time constant. With the values shown, a delay range of ½ to 5 seconds was measured. More or less delay may be made by respectively increasing or decreasing the values of R1.

I have used this type of quasi-break-in for several months and have noted an increase in operating efficiency and pleasure. It is very convenient to be able to just tap on the key in order to transmit during a QSO. This circuit can be adapted to your transmitter at little expenditure of time or money. In fact, even Wayne probably has time between editorials to build it!

...WAS5KPG
KOX for CW

Something like VOX

VOX was invented for the lazy phone operator. Probably by a lazy operator. Phone operators have been using VOX systems since the advent of SSB. The manufacturers of ham gear have carried this over to the application of VOX during the CW mode of operation. Though this greatly simplifies the operation of the station, everyone who operates a commercially bought rig will admit that the CW features in today's SSB designs are not meant for ardent CW men.

I was trying to modify a friend's transmitter to the quasi-break-in system because it is cheap and easy. In their enthusiasm to simplify CW operation, the operators have devised the most complicated break-in systems. What ever happened to the simplified system, the ones you can throw together, adapt to any rig, have worked every time, and that don't take a week to build or install?

I came up with a simple design that would open and close the voltages to the transmitter when the operator wished to send CW.

Familiar to most, quasi-break-in is a system where the station stays in the receive mode until the operator desires to send the code via a key or keyer. Any tapping on the key causes the transmitter to switch into the transmit mode, and stay there a defined period after the last character is sent. This period of delay, before the transmitter is de-energized, is usually adjustable by the operator.

Since the quasi-break-in does not allow the operator to hear the other stations between his character sending, this is not a true break-in system. However, since the automatic transfer of power does occur with the first character sent via key, operation is speeded up. This is very desirable in operating a CW station. Quasi-break-in is a simple circuit and may be added to existing transmitters or designed into new ones. Since a power relay handles all of the high voltages in the transmitter it is safe to operate. Of course, the relay may be used also as an auxiliary switch for other relays.

Operation

Basically, the circuit works as follows: Diode D1 is used to protect the circuit from high voltages which may occur during key-up situations. D1 is reversed biased when the key is up. This allows capacitor C1 to become charged through resistor R1. This R1C1 time constant determines the variable delay of the circuit. This is the reason a variable resistor is connected in series with R1. Transistor Q1 is a voltage follower which isolates the charge on C1 from the rest of the circuit. Once the voltage on C1 reaches six volts, diode D2 is allowed to conduct. D2 is a 6V zener diode. No conduction takes place until at least 6V are across D2. The firing of D2 allows Q2 to turn on as current flows through D2 and the base of Q2. This causes Q3 to turn off,

![Fig. 1. Schematic of Quasi-Break-In system for use with cathode keyed transmitters.](image-url)
SHAME ON W5JJ!!

W5JJ ought to have an FCC monitor permanently assigned on his lawn for such a travesty of an article appearing in your June 1974 (p. 33) issue.

Most of us have thought about such schemes, but who in his right mind would publish it for all newcomers and old timers alike to fabricate from scratch?

At least a small diagram so newcomers would stay in the band! Assorted oscillators will appear with regenerative tones modulating, sliding back and forth across commercial circuits, WWV and naturally TV. W5JJ proposes more power than hams with pride would use QRP!

K1CLL is a man after my heart with his thrown together circuits — deliver us from W5JJ, unfit for April CO Magazine.

Shades of 1931, light bulbs coupled to an oscillating tank circuit! Please allow me to expose that which HF, VHF and UHF commercial folks have been using for years — the simple RHO ‘tector as sold by Telonic, Texascan and Wiltron companies, to name a few.

![Fig. 1](image)

**PARTS LIST**

3 ea. 50Ω ¼ w (5%)
2 ea. 100pf ceramic capacitor
2 ea. 1000Ω ¼ w
1 ea diode IN34, 82 etc.
1 ea Ref 50Ω (¼w) 5%
1 ea. ≈ 100 Microamp meter

The circuit is a bridge — a 50Ω (or any pair of equal loads) on the unknown terminal will balance the 50Ω Ref load and the meter reads zero. Make other Ref loads of 100Ω, 150Ω etc., for VSWR check points of 2:1, 3:1 etc. Leave the unknown terminal unconnected and put in enough rf to read full scale on the meter; connect a 2:1 or 3:1 Ref load and note the meter reading — a complex VSWR of same value will read at the same point.

Couple into the bridge with a grid-dip meter and move the dial slowly through the band of interest — band edges can be found quickly.

![Fig. 2](image)

The Ref 50Ω can be built into the box with the other parts and save a connector and having to build a resistor into a mating connector. Built in meter makes it compact.

![Fig. 3](image)

For those with a sweep generator — Heath TV alignment, B&K Precision, or other types sweeping over a wide range with a saturable reactor, are pretty good and available used — a ‘scope gives a spectrum VSWR response.

Expanded scale measurements can be made if a standard mismatch (100Ω, 150Ω, 200Ω for 2:1, 3:1, 4:1) is used on the unknown terminal and the G.D.O. or signal generator is applied with enough voltage to give a full scale reading — then full scale is that ratio of the known (Ref) to the standard mismatch on the unknown terminal, i.e., 33Ω on Ref and 100Ω on unknown gives VSWR of 3:1 when set to full scale.

Write for data sheets from Texascan and an application note from Wiltron. Their devices for sale are in machined stainless steel with precision connections, but we homebrewers can live with phono connector, binding posts, BNC or other easy to connect devices. For BNC mount 3 of the chassis type UG-625 or UG-290 in a tight triangle to keep lead lengths to a minimum — the meter connector can be on an edge of the box. Photos of several homebrew versions on request.

Now, don’t you think this is better than W5JJ suggesting that any available tube (813, 4PR60A etc.) be pressed into slotted together oscillator service?

Paul H. Sellers ex-K31EW
Norfolk VA

REPLY

Thanks for forwarding the comment on my article! It’s both amusing and enlightening to note the attitudes of persons when views or practices are voiced that do not coincide with their narrow preconceived concepts.

Please excuse my delay in commenting. As I’d told you, I’d planned to spend the summer and fall in Europe. But fate intervened. Instead, I went to a hospital for an operation on my spine and am just now getting able to sit in front of a typewriter. . .with my neck in a brace!

How does this chap ex-K31EW know what power I used on my Hartley oscillator? (And why is he ex? Did he have a Lazy Liars License and get called in by the FCC to pass a real examination. . .and flunk?)

As a matter of fact, the power used was just slightly greater than that of the Measurements Corp. “Megacyclemeter” (a superior form of griddip meter sold for laboratory use) which had been used in some of the preliminary stages of the series of antenna experiments. The power radiated probably was within a dB of that of the “Megacyclemeter.”

Also, I had used an “Antenna Noise Bridge” furnished to me by Ted Hart, the man who invented it and who holds the patents on it.

Both of these conventional devices functioned quite well until the stage of experimentation at which so much resistance was coupled into the antenna that neither could furnish a dependable indication. Then I dug out
the “Shades of 1931” that horrified ex-K31EW. You know, Wayne, just because a technique has been known or available for many years is not an infallible indication of the utter worthlessness of the technique!

So it proved in this instance. The Hartley oscillator (built in 1929 . . . not 1931) plus a simple lamp indicator performed what “state of the art” devices had failed to do: Indicate resonance on an antenna with high induced resistance.

As for the amazing techniques outlined as prime information by ex-K31EW, are they in any manner different than those employed in common use by those who are aware of their sharp limitations? Not to mention by a much larger number of persons who are not aware of such limitations. It’s the later group that comes up with some of the wild and totally baseless ideas about the performance of antennas and transmission lines.

In his bombastic effort to establish his omniscience, ex-K31EW completely overlooked (or ignored) the one simple, basic principle: Keep it simple. An amateur who doesn’t have access to a stack of laboratory equipment (or, in my case, even one who does) can make effective use of equipment on hand (or that can be built from any hellbox) to perform evaluative measurements.

Thank you, Wayne, for listening to my explanations.

Carl C. Drumeller W5JJ

ADS

Just a short note to say keep up the good work. I’m solidly behind you on your editorials and the format of 73 Magazine. One thing I would not like to see is a magazine cluttered with advertising like CQ and QST. In 73’s case, I would rather pay a higher sub cost in the future than see more advertising in its pages.

WB0FGO

MODEST PROPOSAL

While reading the letters in a back issue of 73 on the sree of .... ah incentives given us by the ARRL, I think I’ve come up with a fantastic solution.

Here goes: First, find a capable and responsible person to take over the publishing of 73 and retire (temporarily). Now, since there are some 280,000 amateurs in the U.S., and only about 80,000 belong to the ARRL, I’m sure at least 160,000 must be left to support you. So all 160,000 of us join the ARRL! Horrors! But wait, with 2/3 of the membership backing you, we can fire Huntoon and elect you as General Manager of the ARRL.

Once you have become supreme dictator, ah, general manager, you can get some things done that amateur radio vitally needs such as:

1. Establish a Washington lobby! In this day and age of politics it is insanity not to have one.

2. With the Washington lobby to pressure, that is make suggestions to the, FCC, establish a hobby class license for 220 with a basic theory and regulations exam but no code.

3. Shake QST loose and make it a competitive, and then maybe progressive magazine.

4. Restructure the ARRL into a more responsible, more representative, progressive organization able to reflect the needs of present day amateur radio.

Now that you’ve advanced amateur radio and the ARRL fifty years, you can step down and return to 73 and publishing one hell of a fine magazine. Or maybe stay and run QST, whichever, you can count on me for vote #1.

Kevin L. Johnson WB0FGO

The incredible intelligence of our readers never ceases to amaze me...Wayne.

DOUBLE STUB TUNING SYSTEM

WA6CPP's double-stub tuning system (November 74) can be simplified by bringing the 180° of transmission line around into a circle and using only one sliding short. This may sound weird, but the short reflects any wave that reaches it (because it's a perfect mismatch) so no energy can travel past it. The sections on each side of the short form independent shorted stubs. Naturally, a low-resistance connection is important, so the joints should be either soldered or clamped tightly and protected from corrosion.

Doing that much gets rid of the "ganged" adjustment, making the matching procedure much easier, with no walking back and forth. However, it has also been pointed out in the past that a couple of wavelengths of high swr line between the antenna and the matching device cause no particular harm. The reflected energy just bounces back and forth in the mismatched section until most of it radiates. This means that enough half-wavelengths of line can be placed between the antenna and the first stub to place the short point at the bottom of the support structure, making the adjustment possible from the ground, or at most, a step ladder. Radiation from the extra open line can be minimized by twisting the line with a fairly short pitch.

John A. Carroll
Great Gift Idea!

Now you can build up your ham library for next to nothing!

PACKAGE A
25 different issues (of our choice) for ONLY $5.00. That's just 20¢ an issue — it costs us more than that to print them! Choose from three different categories:

- Vintage: 1962-1965
- Recent: 1966-1969
- Very Recent: 1970-1973

PACKAGE B
A complete set of 12 issues for a particular year for only $3.95. At only 33¢ an issue, you're still saving a bundle. Choose any year(s) from 1969-1973. Should we run out of a particular issue, you will receive a 50¢ credit.

BACK ISSUE OFFERS

*Please enclose $1.50 postage for each package ordered. (domestic)

PACKAGE A ($5.00 EACH)
- Recent: 1966 – 1969
- Very Recent 1970 – 1973

PACKAGE B ($3.95/year)
- year(s) ________
- with binders ($7.75 each) _____

Postage ________
Total Enclosed $ ________

HURRY WHILE OUR SUPPLY LASTS. ALL ORDERS ON A FIRST COME, FIRST SERVED BASIS.

Name ____________________________ Call ____________________________

Address ____________________________

City ____________________________ State ________ Zip ____________________________
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 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-caps 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 . . .

PORTSMOUTH RADIO CLUB requests help for Everett Reese WA8WIV completely burned out restaurant, home, all personal belongings. $60,000.00 loss and little insurance. Any financial help will be very much appreciated. Send all contributions to Portsmouth Radio Club c/o Trust Department, The Portsmouth Banking Company, P.O. Box 1151, Portsmouth, Ohio 45662.

STANDARD FM Equipment — Special huge discounts, 2M FM; 10 watt base/mobile SR-C 826MA $335 ppd. 2 watt handle talkie, SR-C 146A, crystals for 2 channels, $240. All brand new. Order now, write for catalog. Larger discounts on units of 3 or more. Bercom Electronics, P.O. Box 237, Bergenfield, NJ 07621.

WANTED: Make model and serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma Washington 98466.

COLLECTOR is interested in books, autographs and other information on early radio telephone pioneers. Ronald Phillips, 1926 Baltimore, Kansas City, Missouri 64108. (816) 842-9009.

AMSAT/OSCAR 6-7 SLIDES — set of 5, $1.25 Lift-off and equipment Proceeds AMSAT. KBPGX P.O. Box 463, Pasadena, CA 91102.

WANTED: Hallicrafters SX-88 for parts, any condition considered. K8MIN, 4805 Sullivan, Wichita, Kansas 67204.

STANDARD 146A — 3 months old, with 94/94, 34/94, 73/73, 25/85, 16/76, nicads, charger, rubber ducky and 2 whip antennas, external mike, 2 leather cases, $300.00. Mike Arseni, WA2WCB, 30-91 Crescent St., Astoria, New York 11102. (212) 626-7817, after 1800.

YOUR SWAP-N-SELL ads run free in RADIO, a public service publication of Wichita Amateur Radio Society, Box 4391 Wichita Falls TX 76308.

FROM UNIVERSITY-Sound 4 C 15 W Wofflers in unopened cartons. Retail $169 each. Will sell at $1.00 each. Write Certificate Headquarters, P.O. Box 482, Jaffrey, N.H.

NOW PAYING: $2000.00 and up for ARC-94/618T, ARC-102/618T. $1200.00 and up for ARC-51BX. $1500.00 and up for 490T-1 antenna couplers. We also need these control boxes — C-6287/ARC-51BX, C-6476/ARC-51BX, C-714E2. We also need R-1051 receivers, RT-662/Grc-106 transceivers. We buy all late aircraft and ground radio equipment. Also pack radios. We are buyers not talkers. Bring your equipment in, you are paid on the spot. Ship it in, you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment, call us. Call collect if you have and want to sell or trade. We also sell. What do you need? Electronics, R.D. 1 Box 56, Milton PA 17847. Phone 717-742-4604. 9:00 AM-9:00 PM.

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding, literature Estes Engineering, 543-A West 184 Street, Garden City, NY 10028.

FOR SALE: Drake TR4, AC4, DC 4 $495.00. Knud E. M. Keller, Rt 12A, Surry NH 03431.


GE-VOICE Commander II with crystals on 94, charger, battery, case, book, excellent cond. $55 each (2), K. Bassett 1124 Woodrow, Waynesboro, VA 22980.

FREE: 12 Extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Yaesu, Kenwood, Swan, Atlas, Standard, Clegg, Icon, Hallicrafters, Tempo, Ten-Tec, Venus, Alpha, Hy-Gain, CushCraft, Mosley and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. (812) 894-2397.

WANTED: Tapetone converters for Model 345 Skysew. Also NC 300 receiver. Bob Harmon, P.O. Box 751, Deming, New Mexico 88030.

GE PROGRESS Line portable on 94, internal charger, less battery, with book, $40. K. Bassett, 1124 Woodrow Waynesboro, VA 22980.

FREE: 12 Extra Crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Collins, Kenwood, Icom, Ten-Tec, Swan, Atlas, Alpha, Standard, Clegg, Genave, Tempo, Midland, Hy-Gain, Mosley, CushCraft, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812) 694-2397.


SIGNAL GENERATOR (measurements model 80) $200.00, also AC VTVM $20.00. Call 914-297-0557.

SALE: 6M Gonset IV with approx. 12 dozen xtal. Excellent condition, $65.00. Utica 650 A 6M xcvr with VFO, includes mike. Excellent condition $50.00. Will consider trade for a low power SSB xcvr (or icm) or higher powered AM unit or will sell both for $100.00. John T. Carrigan, 601 Valley Ave., Apt. 105, Bihum, Ala 35202, 205 870-5068.

TWO-METER FM ANTENNAS, 1/4; 5/8 W "Cartop"; and Fixed Station, Unique designs. Send for literature. Marsh Devices, P.O. Box 154, Old Greenwich, Connecticut 06870.

HELP Urgently needed Schematic for a custom frequency touch tone pad encoder for repeater use. Pete K. Hons, 614 Main, Portage, Pennsylvania 15948 B14 495-4601.

TEST EQUIPMENT, receivers and builders items. R11 A $4.00, R-15 $6.00 plus shipping, MX-2840-URR for R390A-$10.00 PPD. SASE for list. Lisaious, 116 Orton, Caldwell, New Jersey 07006.


SSTV, CRT's, 70 dog, yokes and focus magnets SASE to LOTZ, W5HCO, 750 Florida Blvd., New Orleans LA 70124.


CALCULATOR OWNERS: Use your + x calculator to compute square roots, cube roots, trigonometric functions, logarithms, exponentials, and more! Quickly, accurately, easily! Send today for the IMPROVED AND EXPANDED EDITION of the First and best calculator manual - now in use throughout the world...still only $2.00 postpaid with unconditional money back guarantee! Mallmann Optics and Electronics, Dept. E7, 836 South 113, West Allis, Wisconsin 53214.

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

SELL UNIQUE WIRE TUNER like new $45 Box 8352 Savannah, Georgia 31402.

... W2NSD from Page 3 stations, on television and in the newspapers - talking it up on CB and at CB clubs.

5. Get all the publicity you can for amateur radio via club activities such as providing communications for walkathons, car rallies, parades - and be sure your club PR man has the story and pictures for the media. If a club member does anything outstanding in amateur radio be sure the story is written up for the papers and mention the club meetings.

6. Organize club events and make sure every scrap of publicity is gained from them. Hamfests, picnics, auctions, banquets, Field Day, VHF Contest group effort, other contest efforts by the club - all are good for publicity, which is the name of the game.

7. Improve meetings so newcomers will continue to come. Ruthlessly eliminate business meetings and have them run by the executive committee with nothing more than a short report. Eliminate the unnecessary trivia such as treasurer's report, other reports that can be done without. Get right down to an interesting speaker - into a short tech talk - show and tell on some gear built by a member - slides of a DXpedition - QSL card showing of some rare ones - demo of RTTY - of slow scan - Fax - talk on Oscar - 160m action - DX news - moonbounce - VHF SSB action - be sure every club member who has done anything of note gets an opportunity to brag about it.

8. Keep the club newspaper or bulletin lively. Start controversy at meetings and ask anyone interested to comment in writing to the club bulletin. Have the editor get the Hotline and thus have some hot news for each issue of your bulletin. Keep members up to date on DX scores of your serious DXers - DX scores of SSTVers - or RTTYers - certificate count of certificate hunters - etc. Put all that bragging into print to encourage others to compete - and more fun will be had by all. The club paper can help organize club contest efforts.

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

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send SASE showing make and model number. Joseph C. Crockett K3KUL, 762 S. Gulph Road, King of Prussia PA 19406.

MOTOROLA PORTABLES - Expert repairs, reasonable prices, fast turnaround time. More details and flat rate catalog FREE. Ideal Technical Services, 6663 Industrial Loop, Greenville, Ohio 45401.

TWO PLASTIC HOLDERS FRAME and display 40 QSL's for $1.00 or 7 holders enhance 140 cards for $3.00 - from your Dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin, Tennessee 37066.

DAYTON HAMVENTION at HARA Arena April 25, 26, 27, 1975. Program brochures mailed March 10th. Write for information if you have not attended the last two years to HAMVENTION, P.O. Box 44, Dayton, Ohio 45401.

9. Since one of the factors which is considered important by the FCC as justification for amateur radio is emergency service, it is prudent for clubs to do what can be done to organize the members to be ready for emergencies. Repeater clubs have an advantage in this since they have such outstanding communications between members. Clubs should appoint Emergency Liaison Officers who will be in charge when needed. These men should have at their fingertips everything they might need to do their job such as phone numbers of all other radio services in their community (police, fire, sheriff, CAP, highway, doctors, trucks, public service, etc.). They would do well to be licensed in as many of these services as possible and be able to intercommunicate with them for emergency purposes. They should have an inventory of emergency equipment such as generators, HTs, portable repeaters, available club members with mobile rigs, etc.
CAN ARRL BE PRODDED?

The fact is that your club can get some action from the ARRL. They may be insensitive to individuals, but you may be sure that they listen when a club has something to say.

1. Get to know your ARRL director. Get him to your club and don't just listen to him talk, but insist on answers to problems, local, national and international. He is your representative and he must know the answers. Make sure your director is informed of the will of your club and insist on getting an answer back from him as HQ's response to this.

2. Your club can do a lot to initiate PR on a local level, but national PR is needed too and this means the ARRL since there are no other organizations to do this. Your club can be very insistent that ARRL does something concrete about this such as working up a series of television spots which hams at TV stations can use management to run as often as possible. Some of these can be keyed to local clubs. Some can offer a pamphlet put out by your club. The League has vast resources to get national publicity.

3. Your club should discuss all FCC dockets and rules you want changed - and see that members send in comments - that the club sends in its own comments - with copies to your director and feedback later from him as to HQ action in the matter. All club members should be well informed on all aspects of rules changes and should know where the ARRL stands on these items.

4. Since amateur radio hinges entirely on the International Telecommunications Union (ITU) in Geneva your club should know exactly what is being done by the ARRL to prepare for the proposed 1979 ITU Conference. You should insist on knowing what the League is doing with the $100,000 fund the directors set up to fight for amateur frequencies - and what they have done with it in the past - accept no double talk. Your money is involved and you have a right to know exactly what it has been, is, and will be used for. Obviously the results of the ITU Conference hinge on the attitude toward amateur radio of the so-called Third World nations. This means that your director should be reporting on the actions of HQ in contacting these countries and the results of these meetings. Perhaps your club can help with things like this by setting up a liaison with some small country and sending surplus equipment - call-books - ham magazines and books. The League can set up these liaisons through your director. Be sure your club gets reports on what ITU nations are proposing for changes in the amateur bands - these proposals are made many months to years before the conference so delegations will be able to coordinate with each other. U.S. amateurs should be informed on what Germany, England, Australia, India and other countries are proposing to do with the amateur bands.

5. Since it is difficult for everyone to keep in touch with what is going on with the ARRL it might be prudent to have someone in your club appointed as an official liaison between the director and the club - someone who will take the time to read the fine print in QST - get the official bulletins - keep track of what the League is doing on various FCC dockets - of what they are doing with the ITU and contacts with other countries preparatory to the ITU conference - keep track of the quality of the representation of your division ARRL director - keep track of ARRL elections - and report at each club meeting what is going on - who is running for office and what their qualifications are - what has been or has not been happening at HQ - what response he has had from the director on club positions on dockets and other amateur matters - etc. This liaison should get the various ham newsletters, the ham magazines, and all mailings from the ARRL, including director letters.

Continued from Page 160

if they don't pay, just to prove that they can.

Since the editorial asked at the end if members want QST to continue with this practice, there is some suspicion that they might use a response from the readers as an excuse to change this policy.

One prominent mail order advertiser who claims that his QST ads have not pulled well at all was particularly furious. He wrote a blistering letter to us (he advertises very successfully in 73) pointing out that on page 166 of that very same issue of QST they ran an ad for Dycomm, so who did they think they were fooling with their sanctimonious act? He enclosed a review of the Dycomm amplifier from the Mid-Oklahoma Repeater Newsletter which said, "It has generally been conceded that the Dycomm Super D amplifier should be categorized as a Super Dud. In addition, you should learn to attempt to tune a Dycomm amplifier. One of the brightest technicians who works on commercial equipment every day undertook such an effort with the consequences that the final transistors blew out. This has been known to happen even if you weren't tuning the amplifier! Also, Dycomm must get their power ratings for their amplifiers from a Captain Marvel Comic book because they border in the realm of science fiction. A problem this editor had with a Dycomm amplifier ended with a couple of nice letters to the manufacturer explaining the problem over what apparently had been a mistake between the dealer that the amplifier was purchased from and the manufacturer. The amplifier was repaired (at a cost) and returned and a small note included saying that the problem was in the private dealings between me and the amateur I bought it from. Apparently Dycomm dealers are not dealers, but just people who pass this garbage to an unsuspecting amateur population and your only remedy would be to sue your friendly dealer. Objectively, some people have had success with this equipment and had few problems, but I have yet to see one that meets the power specifications advertised. You would do much better to buy a KLM or TPL or other. A threat of legal action brought a response from Jim Penhy (who seems to be the president, engineer, technician and shipping clerk) saying that he would exchange the amplifier for another for only $50 more! Should I throw good money after bad?'

Just recently we received a good comment on a Dycomm repeater, so all is not a total loss. Our experience with Dycomm repeaters was extremely bad at 73 - and many of the repeater groups we talked with who had tried them were very disillusioned. It seems unlikely that QST has not had at least some of the letters of complaint on the Dycomm amplifiers - many have been received at 73 - yet QST continues to carry the Dycomm ads. Odd. But then they continue with the Trigger ads too, even after CQ published quite a terrible letter about Trigger.

...Wayne
Very small capacitors made from twisted hook-up wire are often not stable enough; one has to snip away until he hits the right capacity — he hopes. This gimmick uses a double fluted plastic coffee stirrer, into which #14 wire fits snugly to form the plates of a capacitor. When checked out on a General Radio Q-meter, it was found to be linear throughout: 1 pF per inch. Need a 3 pF capacitor? Just cut off 2" from one end!
INTRODUCTION TO RTTY

In this book the world of radio-teletype is explained in an easily understood manner for the beginner. The last part of this book contains a bibliography of everything published about RTTY since 1952.

RTTY HANDBOOK

A comprehensive book covering all areas of radio teletype, from getting started with the basic principles, what equipment to procure and how to make it work.

FM REPEATER CIRCUITS MANUAL

Contains almost every conceivable circuit that might be needed for use with a repeater. All circuits explained in detail. All aspects covered, from the operator to the antenna.

DIGITAL CONTROL OF REPEATERS

Here's a book for the FMer who wants to design and build a digital repeater control system. Contains sections on repeaters, basic logic functions, logic circuit design, control systems, support circuits, mobile installations, touch-tone, plus a special section on a "mini" repeater control system.

4 STUDY GUIDES

FCC exams got you scared? Frustrated by theory fundamentals? There's no need to worry. 73's four License Study Guides will help you breeze through any of the four tough exams! They are the ONLY guides which cover ALL the material you will have to know. Many amateurs find that one quick reading through our guides is enough to get them through with no sweat.

DIODE CIRCUITS HANDBOOK

115 diode circuits including power supply application, regulators, ac meter applications, receiver detectors for AM-FM-SSB, noise limiters, squelch, AGC, varicap tuning, audio clippers.

73 USEFUL TRANSISTOR CIRCUITS

Useful transistor circuits for audio, receivers, transmitters and test equipment. 47 chapters with circuit diagrams for each, complete with component values, etc.
TRANSISTOR PROJECTS $3
Crammed full of home construction projects, from receivers to transmitters and all in between. Chapters include such articles as zener diodes, how they work, how to use, test and buy them; integrated circuits; how to design transistor amplifiers; and many more.

SOLID STATE PROJECTS $4
More than 60 projects of interest to anyone in electronics. The devices range from a simple transistor tester to a ham TV receiver. This collection will help you become more intimately acquainted with zeners, ICs and varactors, etc.

VHF PROJECTS FOR AMATEUR AND EXPERIMENTER $5
A must for the VHF op. Opening chapters on operating practices and getting started in VHF, both AM and FM, followed by 58 chapters on building useful test equipment, modifying existing and surplus gear.

SOLID STATE PROJECTS
More than 60 projects of interest to anyone in electronics. The devices range from a simple transistor tester to a ham TV receiver. This collection will help you become more intimately acquainted with zeners, ICs and varactors, etc.

VHF ANTENNA HANDBOOK $3
Would you believe that the secret to success in VHF/UHF is in the antenna system? This is no earth-shaking discovery, but it's true. A complete, detailed book with descriptions, dimensions, tuning data, diagrams and photos.

DX HANDBOOK with MAP $3
How to work DX, how to get QSLs, country lists, award lists, QSL bureaus, maps of the world, great circle maps centered on major U.S. cities. Wall size DX map of the world included.

SLOW SCAN TELEVISION HANDBOOK
hardbound $7
softbound $5
This excellent book tells all about it, from its history and basics to the present state-of-the-art techniques. Contains chapters on circuits, monitors, cameras, color SSTV, test equipment and much more.

COAX HANDBOOK $3
All about coaxial cables, connectors and applications. It's all here—pictures, part numbers and specifications for all types. Includes lengths for different types for quarter, half and full wave feedlines.

FASCINATING WORLD OF RADIO COMMUNICATIONS $4
All about broadcast band DXing, tuning the tropical DX bands, DXing radio amateurs, antennas for short-wave, radio licenses, pioneers in electricity and radio, commercial broadcast stations, WWV, etc.

TVI $1.50
Discusses all types of interference problems in great detail with recommended steps to cure these problems. Good for both the amateur and citizens band operator. Try this cure and suffer no longer.
73 CERTIFICATES
WAAS $1
Worked Almost All States - Proof of your having worked 49 of the 50 states.

ALL MODE DXDC $1
An award for 2-way communications with 10 countries using CW-SSB-RTTY-SSTV modes.

DXDC $1
Available for those who present proof of contact (copy of log) with 10 different countries.

SSTV-DXCC $1
For 2-way Slow Scan Television communications with 10 countries.

LAPEL BADGES $1
Name and call identifies you at club meetings, ham fests, busted pot parties. Hand engraved by skilled New Hampshire craftsman with loving care.

RTTY-DXDC $1
All operating award for those who have submitted proof of 2-way teletype communications with 10 countries.

CUSTOMIZED DX BEARING CHART $4
An amateur who works for a big computer company has a program which permits him to plug in your location and have it print out the bearings of all the countries of the world from your shack.

73 BINDERS $5
These binders are a gorgeous red and come with the nicest set of year stickers you've ever seen. The perfect thing for storing your issues of 73 so that they won't get lost or split on, or into the hands of the Jr. Op. Dress up your shack with these binders.

WORLD DX MAP $2
This is the same wall-sized DX map that is included with the DX Handbook except it comes to you rolled up instead of folded. This is so you can put it on the wall or have it framed.

CALL LETTER DESK PLATE $2
How about dressing up your operating table with a desk plate showing your first name and call? These embossed desk plates are nice and inexpensive. No zero available, sorry. There is room for twenty letters and spaces total.

U.S. MAPS $1
These wall sized maps show the states and call area. They are specially designed for coloring to show your progress toward the Worked All States award of ARRL. They come in groups of four.

---

73 gift gallery
73 Magazine, Peterborough NH 03458

NAME ____________________________________________
ADDRESS ________________________________________
CITY ___ STATE ___ ZIP ___

SEND ME: _________________________________________
__________________________________________________
__________________________________________________
__________________________________________________

SIGNATURE _______________________________________
CARD # ________________
EXPIRATION DATE ____________ TOTAL ______

☐ Diners charge ☐ Mastercard ☐ American Express ☐ Diners club ☐ CHECK

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HOW TO SAVE $20 in one easy lesson

Wouldn't you like to save yourself $20.00? Of course you would! Want to know how to do it? Here's the plan.

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- TWICE as many feature articles
- TWICE as many construction projects
- 50% MORE ads
- 50% MORE shopper's bargains
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73 gives you MORE of everything you buy a ham magazine for. And by subscribing, you save $20 — and that's a whopping 56% SAVINGS over the newsstand cost!

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Mail today to 73 Magazine, Peterborough NH 03458.
INTERNATIONAL ELECTRONICS UNLIMITED

MICROPROCESSORS

IEU is making available for the first time anywhere an extremely versatile 16 bit microprocessor kit. The basic kit includes all necessary components to build a 16 bit microprocessor. Optional memory boards are available allowing possible expansion of the basic system to microcomputer or minicomputer proportions.

Basic Kit Includes:

A. Printed circuit boards (compatible with 22 pin edge connectors - not supplied)
B. Microprocessor chip set
C. Gates, interface elements, clock drivers, etc.
D. Transistors, diodes, capacitors
E. A page data package which includes an introduction to microprocessors, all necessary data sheets and extensive data on the workings and applications of microprocessor chips

Available Options

1. Power supply component pkg.
2. Memory board #1 (employs 1101 rams)
3. Memory board #2 (employs 1011 rams and 520 erasible PROMS)

Available separately:

Refundable with purchase of basic kit $5.00

FEBRUARY SPECIALS

8008 8 bit C.P.U. - prime quality factory marked & guaranteed $64.50
2102 N-channel 1024 Bit Static RAM $7.95
930 Dual 4 input gate w/exp $10.00
936 Hex inverter $1.00
937 Hex inverter $1.00
938 Half peri output comp $10.00
324 Prec. timer. Operates on unreg supply 4.5-4.9 V $1.60
709 Op amp $1.25
739 Dual half per output op amp $1.99
40411 Audio per amp $3.40
40594 Audio driver $1.33
40595 Audio driver $1.49
2N2219A Audio-UHF amp/sw $89.99
50012 12 bit calculator chip $3.39
5312 4 digit clock chip $5.25
7404 Hex inverter $1.18
7410 Triple 3 input NAND gate 16 $1.79
7429 Dual 4 input NAND gate 16 $1.80
7437 Quad 2 input NAND buffer $2.99
7446 Dual 4 input buffer $17.00
7445 BCD-dec/dodr-driver $9.00
7483 6 Bit RAM $3.25
7490 Decade counter $69.00
7415V 4-6 line decoder $1.19
74181 Arithmetic logic unit 2.95
74L00 Quad 2 input gate (i.p.) $2.75
74L74 Dual D flip flop (i.p.) $0.49
MAN17 Red 7 seg LED $1.29
MCT2 Opto iso trans $0.59

ALL DUAL-IN-LINE

MEMORIES

1101 256 bit RAM MOS $1.75
1103 1024 bit RAM MOS $4.95
52023 2048 bit BRAM $24.95
52024 2048 bit low power $3.95
8694 8 bit RAM TTL $2.75
8664 8 bit RAM BRAM $3.95
52200 16 bit RAM tri-state 7.95

LEDS AND OPTO ISOLATORS

MV108 Red 10 V $2.25 ea.
MV50 Axial leads .20
MV5020 Jumbo visible red .33
ME40 Infra red diff. dome .60
MAN1 Red 7 seg .270 $2.50
MAN2 Red alpha num. .39
MAN3a Red 7 seg .127 $2.79
MAN3b 7 seg .127" $2.79
MAN4 Red 7 seg .190 $2.15
MAN5 Green 7 seg. .270 $2.95
MAN6 Red 7 seg .270+ $2.15
MAN8 Yellow 7 seg .270 $3.95
MAN86 60" high dir. view $6.45
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**BRAND NEW QSLs**

- **two styles**
- **QSO info back**
- **two colors**
- **LOW PRICES**

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While the cost of everything continues to skyrocket, 73 has STILL kept the price of these beautiful QSLs at absolute rock bottom. When we started selling our top quality QSLs two years ago at a PENNY-A-PIECE it was a great deal (postpaid no less!). When we held that price firm last year against all obstacles, it became a fantastic opportunity. Now, this year we're STILL HOLDING DOWN THE PRICES and it's the next best thing to having your very own oil well! And with two brand new designs too!

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<tr>
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<tbody>
<tr>
<td>250 . . . . . . $6 (2.5¢ ea)</td>
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<tr>
<td>500 . . . . . . $10 (2¢ ea)</td>
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<tr>
<td>1000 . . . . . $15 (1.5¢ ea)</td>
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<tr>
<td>2000 . . . . . $20 (1¢ ea)</td>
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These QSLs are printed on Fine Quality Glossy Card Stock and are as good or better than cards sold elsewhere for several times the price. We can offer this fantastic low price, because we “gang print” orders between other jobs in our own print shop which keeps the costs way down and we pass the savings on to you. If you haven't been QSLing as much as you'd like to because of the cost of cards, do you really have an excuse anymore? Get some cards and help improve the image of U.S. Amateurs.

Name ____________________________ Call ____________________
(First and last name is most friendly)

Address ____________________________
(as brief as possible and still get through the mail)

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(a must) (if desired on the card)

Awards to be listed on card

☐ 250 ☐ 500 ☐ 1000 ☐ 2000 cards (if desired)

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| 250 — $1.75 |
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| 500 — $2.25 |
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Check local Post Office for air rates . .

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NEW extended hours
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ERICKSON SPECIAL!
SRC-146A with

- Charger
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Inoue's New
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- All modular construction
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- AVAILABLE NOW! ... only $489.00

TEMPO SOLID-STATE POWER AMPS

<table>
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<th>MODEL</th>
<th>DRIVE POWER</th>
<th>OUTPUT POWER</th>
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<td>100-135 watts</td>
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<td>1202B</td>
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<td>120-130 watts</td>
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<td>152</td>
<td>1 watt</td>
<td>15 watts</td>
<td>$59</td>
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SEND QSL FOR COMPLETE SPECIFICATIONS

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Plays on any cassette player so you can practice anywhere anytime!

- 5 WPM This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people - including kids of ten - are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

- 14 WPM Code groups again, at a brisk 14 per so you will be at ease when you sit down in front of the steely eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test you'll thank heavens you had this back breaking tape.

- 6 WPM This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly - under pressure - faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five. Practice this one during lunch, while in the car, anywhere and you'll be more than prepared for the easy FCC exam.

- 21 WPM Code is what gets you when you go for the Extra Class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape. No one who can copy these tapes can possibly fail the FCC test. Remove all fear of the code forever with these tapes.

ONLY $3.95! 73 is in the publishing business, not tapes, so these are priced much lower than anyone else could sell them. Have you ever seen one hour cassettes for under $6?

ORDER NOW!

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<tr>
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☐ 5 WPM 1 hr cassette $3.95  ☐ 14 WPM 1 hr cassette $3.95
☐ 6 WPM 1 hr cassette $3.95  ☐ 21 WPM 1 hr cassette $3.95
☐ all four cassettes $13.95

73 Magazine - Peterborough NH - 03458
MOTOROLA
MOTRACS: U43HHT 152-172 mc, 30 watts output, solid state receiver. With accessories.
   Single frequency                        $240.00
   Two frequency (if available) Tx        $260.00
U63HHT 152-172 mc, 80 watts output, solid state receiver. With accessories. Two
   frequency                              $350.00
(Motrac quantities are limited, first come, first served.)

MOTORCYCLE RADIOS: D33AAT 152-172 mc, 10 watts output, solid state power
   supply. Front mount, less mike          $40.00
   T33AAT 152-172 mc, 10 watts output, solid state power supply, rear mount with
   head and cables                         $45.00
PORTABLES: H21AAC-1½ W output, dry battery supply (less battery) 30 to 50 mc 25.00
   P31AAC 5 watts output, dry battery supply (less battery) 30 to 50 mc     $30.00

GENERAL ELECTRIC
TPL's (TRANSISTORIZED PROGRESS LINE). All TPL's have solid state receiver and
   exciter and have 3 or 4 tubes in the transmitter.
   100 watts output in the 30 to 50 mc band, two frequency, with a NOISE
   BLANKER. Less accessories. RE72JB3        $300.00
   Accessories for above                    $35.00
   100 watts output in the 30 to 50 mc band, less accessories, TE72JA3        $225.00
   Accessories for above                    $35.00
   80 watts output in the 152-173 mc band, less accessories                      $200.00
   Accessories for above                    $35.00

PROGRESS LINES: 6/12 volt vibrator supply.
   MA/E 13N 30 watts output in 30 to 50 mc band, with accessories for trunk
   mount, FULLY NARROWBANDED                $65.00
   FA/E 16N 60 watts output in 30 to 50 mc band, with accessories for front
   mount, FULLY NARROWBANDED                $85.00
   MA/E16 60 W output in 30 to 50 mc band, w/accessories for trunk mount$190.00
   MA/E 33 30 W output in 152-172 mc band, w/accessories for trunk mount$75.00

PROGRESS LINES: 12 volt transistor power supply
   MT-42N 15 watts output in 450-470 mc band, with accessories for trunk mount (narrowbanded) $60.00
   MT-13N 30 watts output in 30 to 50 mc band, with accessories for trunk mount,
   FULLY NARROWBANDED                      $100.00
   MT-16N 60 watts output in 30 to 50 mc band, with accessories for trunk mount,
   FULLY NARROWBANDED                      $130.00

Quantities are limited on some items so send your check or money order today to

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Winter Specials — Radar sentry police radar receiver... locates police radar speed traps. Sold nationally for $45 now $29.95

Norelco video tape recorder LDL-1000. One hour on 7" reel of 2400' 1/2" video tape. Record your favorite programs for later enjoyment. 40DB video S/N ratio. Records sound and video. All transistor. 26 pounds. Push button operation. Standard CCTV connectors added by us. Demo units checked out and working $299 no warranty

TV camera kit. All transistor, small light TV camera. Excellent picture fidelity. More than 400 lines resolution, internal sync., video or rf output. Standard C mount. Complete with 1" vidicon and lens. Easy manual all parts and nice case. Brand new full warranty. $169.95

Color video recorders from $425. Wow

Many other items in our stores. Ask about our Clegg FM27X modifications... super!

Video tape. High energy high quality 2400' 1/2" (1 hour) reel in nice box $17 each.

VIDEO and FM COMMUNICATIONS SALES and SERVICE
COMMUNICATIONS UNLIMITED
9519 MAIN STREET P.O. BOX 463
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Store hours, noon to 6PM, Tuesday thru Saturday. (313-449-4367)
Noxpoop

A reader, who unfortunately did not give either his name or his call on his correspondence, has made the following excellent suggestions for additions to the content of 73:

A "This Happened to Me" series which could include humorous or serious stories of first contacts, unusual QSOs, weird experiences with equipment, both home brew and commercial, etc.

An updated listing of nets operating daily in the states and abroad.

An updated listing of VIP stations; amateurs famous in fields other than amateur radio as well as those considered "professional amateurs."

A simply written column covering new concepts and components.

Guest editorials by VIPS.

Anyone out there feel like taking on any of these projects? Remember, 73 pays for publishable material.

I like the magazine as is, but you won't be able to please everyone. Hi! WA6MBK. (Boy, are you right on that one!...ed.) I would like to see more SSVT construction projects. The W0LMD converter article was excellent; continue along this line of quality — W7OHI. (We will, we will...ed.) Keep up the off-beat articles like "Lightning in a bottle."
The digital stuff is great too. Maybe an article someday on testing complex ICs such as RAMs, ROMs — Dallas. You have a lot of good articles — keep sending them. Include more things a Novice can use in 73 — Tommy Richardson. Less articles on slow scan — W6NKB. (Henry, you're sure swimming against the tide!...ed.)

More digital please — Chris Leach. First thing read are NSD editorials. Tell OM to keep up the stomp ing...stomp on the ones who need it...stir up the things that need stirring up. Ham radio needs more NSDs — K7OYN. (Troublemaker...ed.) More VHF-UHF projects. Regular column of hints for improving commercial equipment. More nude covers, they're great! — KB8BJ. (Another troub lemaker...ed.)

Too much IRS and not enough ham radio — WA6UGH/3. (Okay, you help get rid of the IRS and no one will have to write about the bastards...ed.) Would like to see a 2m dual synthesized IC constructed portable transceiver...if possible — Bill Hampton, W3HPX's Moskey is beautiful, gonna build one pronto. CMOS logic is definitely the way to build to conserve power, and prices are dropping on CMOS ICs WA4MRE/0. On balance Wayne, the magazine is pretty good — you'll never be able to publish enough technical articles to suit me, but you're doing a fair job now. Keep up those editorials — W9EG. More digital information and construction projects — when you put a project in it should be checked thoroughly to make sure all the information is given — WA1CRI. (Oh, we try, we try...all articles are proofread by the authors now...two recent editors tried to skip that important part of the process and both are now looking for work in less exacting fields...ed.) You ought to include more 6m gear in the line of FM construction articles — WA8BLL/4. (Love to...has anyone built anything like this recently?...ed.) Better yet, just double it. Two issues (one dollarette each) each month — R. Thomas. (We've been thinking of that, but don't know how many would want it...ed.)

How about a series on digital logic fundamentals to run for an indefinite period? This could be helpful to many hams so they can make use of contemporary construction articles — W1MKF. (Fine idea... any takers?) It's disappointed me that you do not give details about contests in 73 — C. Junck. (We've been looking all over for a good contest editor, but haven't come up with anyone interested yet... pity...ed.)

More 6m FM articles please — WB8OKR. (Hey, is anyone on 6 these days?...ed.) Please — more construction projects and circuits on ATV (fast scan) — K3VUD. (We're trying to get as much into print as we can...any more articles available out there?...ed.) Congratulations — keep the construction projects coming — XE2OZ. Include a regular column on antennas and one on a critical review of new equipment — WN2VGM. How about something on the care and feeding of FEDs? DAAAU. (Like ground glass or cyanide?...ed.)

Like "Solid State" news approach as done by KBD1Z — WB8NJ. I feel you should be more consistent with your covers. Although I do like Schlitz, the December 73 cover was much more thrilling. Also, the more solid state the better — WB4ZQX. I think you have a nice mix of articles and projects — WA7JLL/5. The best ham magazine on the market today. Pricewise also. Have been asked by many where I get some of my information and I tell them "in 73 Magazine." I give them a subscription blank if it doesn't ruin an article in the magazine. I don't like to get magazines with insers every 16 pages. I still have all copies of 73 back to '65 and they'll still be making it in good age — WA6OUK. I don't like those cards either, but they sure pay for a lot more pages in a magazine, if you happen to like a fat magazine...

Wayne) Would like to see more articles on counters, computers. The ICs become obsolete before articles reach print. I'm still trying to keep up with the 7400 series, which is impossible. Keep up the good work — WAGKS. Fire Wayne Green. He is a loud mouthed jerk who writes first and researches later on — WA6SLN. (tsk, tsk...Wayne) Vote for KBD1Z Solid State, and push for CW on HF for Techs — WA7DTJ. (I have a petition with the FCC for just that — been there for years...Wayne) For some reason you seem to have forgotten the six meter band — Russell, Ohio. (While not much is doing on 6m of real news, you may have missed the 50 MHz column? Any readers want to push 6m? Be our guest...Wayne) Use larger type, esp for repeater update. Cut space used by Green to one page. See Jim Fisk page — WA3VYS. (Buy some glasses like I did and you'll read the fine print. If I had as little to say as Fisk I'd use no space at all. Oh, Fisk knows there are things he should write about, but I doubt if his publisher will let him — terror of being controversial...Wayne) (The editorials should be much longer — W1DF.

(For fifteen years Ken has been an unflagging source of erudite and puckishly good humored letters, cards and articles — what a delight a reader like Ken Cole is to an editor with a mailbox full of gripes about ARRL sluggishness, DXCC rules, FCC insensitivity, subscriptions gone awry, and the other trivia which adds up to much of the usual day's work. Bless Ken and the few others like him who spread their happiness...Wayne) I wouldn't like more articles on results of new ICs for HF through 2m FM, plus test equipment such as an impedance meter — WSSQJ. (Excellent, any takers? We'll print 'em...Wayne) I like Circuits! and IC articles, especially CMOS — WB6KGD. How about 6m SSB news? Maybe repeater news by call area — WB4XMG. More 6m equipment, SSB xmitters cvrs, converters, linears, etc. Also would like to see construction articles monitor scopes for SSB, CW and RTTY. Let's get more 6m articles so we don't lose that band WA4AGD. (We agree...Wayne) How about special columns for antennas, QRP, and perhaps articles on the fundamentals of RTTY and SSTV? — W8OUG. (We're books out on the RTTY and SSTV fundamentals, plus thorough coverage in the past. Any interest in a monthly ORP report?...Wayne) I think we are all with you re IRS rip-off. Bureaucratic power fears speech, so you must be careful ORP! Let's do a series of "The Movement." Good luck — W2RI. (Thanks, Al, there is much in what you say...Wayne).
1975 CATALOG

Since Verada 214 expanded its mail order division with the publication of its 1975 catalog in the January issue of "73" Magazine, our family of satisfied customers has grown tremendously. Below, you will find additional products, most of which are made in our own shop. Add this page to the previous seven and look for more pages in future issues of "73." Thank you from Verada 214.

VERADA 214 CABINET KITS

All cabinets are cut from walnut-grained, vinyl-covered particle board. The two larger ones are built from extra heavy stock to reduce resonance and give clear, low bass response at high listening levels. These two larger cabinets are sealed acoustic suspension units with removable grille cloth panels. All kits include fiberglass acoustic insulator and complete assembly instructions. Speakers and grille cloth to complete these cabinets are available from Verada 214 and their prices are listed separately in this catalog.

A) BOOKSHELF CABINET KIT. Dimensions - 9-1/2"W x 14-1/2"H x 5-3/4"D. Stock sizes - Sides, 3/8" thick. Front & back, masonite. Order #CKBS (with blank front panel). Order #CK62 (cut out for 6" woofer and 3" tweeter. Price $6.75 each (CKBS or CK62).

B) BASIC ACOUSTIC SUSPENSION ENCLOSURE KIT. Dimensions - 12-3/4"W x 23-5/8"H x 11-7/8"D. Stock sizes - 3/4" thick front, back and sides. Order #CKBE (with blank front panel). Order #CK1053 (front cut out to accommodate our "Good Listening" system on page 3. (10" woofer, 5" midrange, and 3" tweeter) Price - #CKBE or CK1053 $19.50 each.

C) DELUXE ACOUSTIC SUSPENSION ENCLOSURE KIT. Dimensions - 15-1/2"W x 25-1/2"H x 11-1/2"D. Stock sizes - 3/4" thick front, back and sides. Order #CKDE (with blank front panel). Order #CKHP (front cut out to accommodate our "High Power" system on page 3. (10" woofer, two 5" midrange, 3" tweeter.) #CKHP also includes materials for sealed acoustic chamber for midrange speakers. Price - #CKDE $24.50; #CKHP $28.50.

GRILLE CLOTH

Many of you have requested smaller pieces of grille cloth, so here we offer two standard sizes. Because of the wide range of colors and patterns in stock, including beautiful tapestries, as well as standard black and brown, we offer a set of samples for $1.00, from which you can make your choice. Remember, the $1.00 can be deducted from any future order, or is refundable when the sample packet is returned.

Standard sizes: 18" x 30" - $1.50
24" x 36" - $3.00
36" x 60" or wider, $6.00/linear yard.
Multiple yard orders shipped in one piece.
Choose from: Black #GCBK - Silver #GCSR - Dark Brown #GDB - Light Brown #GCLB or order sample kit #GCSK - $1.00 (refundable)

SPEAKER WIRE

The world's only truly multi-colored cable, #24 mini-zip speaker twinlead that changes color every five feet. We don't know why they made it and we're not sure they do either. Good quality wire under the strange coloring.

50 ft. roll - #50RW - $1.00
100 ft. roll - #100RW - $1.75

Standard #24 mini-zip speaker wire with clear insulation. 50 ft. roll - #50CW - $1.50
100 ft. roll - #100CW - $2.50

Minimum Order - $2.00
On orders of $25.00 or more we ship FREE

Important - Personal checks must be cleared before merchandise is sent and only delay orders. All cash and COD orders are handled within 48 hours. Other correspondence should be written on a separate piece of paper.

COMING, IN THE MARCH ISSUE OF "73, A FULL PAGE OF SEMICONDUCTORS. BE SURE TO LOOK FOR IT!!!
IF YOU CAN SOLDER, YOU CAN BUILD YOUR OWN
Clock/Calendar

SOLID STATE SYSTEMS, INC. has available a CLOCK/CALENDAR kit containing over 120 separate electrical components.

The clear, simplified instructions include step by step construction procedures and ample illustrations which will quickly take you through construction of this versatile Clock/Calendar.

THE KIT FEATURES:

* DISPLAY OF DATE WITH MONTH AND DAY - displays month and day automatically, through year, except for February 29.

* DISPLAY OF TIME ON 12 HOUR CYCLE - hours and minutes displayed with A.M. and P.M. indicators.

* A 24 HOUR ALARM OPTION - this also includes a snooze button which delays alarm an additional 10 minutes.

* A 9 HOUR 59 MINUTE TIMING OPTION - this allows operation of any pluggable 600 watt, 120 volt, 5 amp, 60 Hz electrical device such as a radio, room light, stereo or coffee pot.

* EASILY VISIBLE SPERRY® DISPLAY - this display is highly visible in a well lighted room.

An attractive case may be fabricated of wood, plexiglas, metal or whatever you feel would make an appropriate show-case for your finished kit.

TO ORDER:

Order Number 01-12241 - BASIC CLOCK - This kit does not include the 24 hour alarm option or the 9 hour 59 minute appliance timer option. Price.................................$49.95.

Order Number 02-12241 - COMPLETE CLOCK - This kit includes all available options. Price .............$65.00.

SEND YOUR ORDERS TO:
SOLID STATE SYTEMS, INC.
P. O. BOX 617
COLUMBIA, MISSOURI  65201

OR PHONE (TOLL FREE)
800-325-2981 – 800-325-2983

FEBRUARY 1975
MITS has always been noted for the quality parts used in its calculators, test equipment, and computer terminals. Now, for the first time ever, MITS is opening its stockroom doors to offer you all new, quality American-made electronic parts at wholesale and near wholesale prices. Resistors. Integrated Circuits including calculator chips. Transistors. Electrolytic and ceramic capacitors. 10AAR displays. LED's. PC boards. Assembly manuals. Keyboards. Transformers.

Just fill out the coupon below and we will send you a free, complete parts and price list. Don’t miss out on this one-time, post Christmas bargain.

SG 1900 — The Audio Sweep Generator provides the capabilities of both a fixed frequency (CW) and a sweep generator in a laboratory quality instrument. Modes include CW, linear sweep, and log sweep with a sweep time of 10 milliseconds to 100 seconds. Waveforms are sine, square, and triangle. The range is from 1 Hz to 100 KHz. The output has fixed attenuation levels of 0, 20, and 40 dB ±1 dB, as well as continuously variable attenuation.

**COMPARE and SAVE!**
SG 1900 full assembled, still $149.95
OR if you really want to save, buy the SG 1900 in kit form, with easy-to-follow assembly manual for just $119.95
### 7-Segment Readout
12-PIN DIP

- Three digits with right-hand decimal plugs into DIP sockets.
- Similar to (LITROMIX) DL337
- Magnified digit approximately 1".

**CTU1 Special**

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<td>Complementary Transistor Logic.</td>
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<td>This logic family is unique in that both NPN and PNP transistors are</td>
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**MOS**

- 3500 Read Emitting
- 40-MA @ 2V

- **7400 Series**
- 12-PIN DIP

**25K Trimmer**

- PRINTED CIRCUIT BOARD TYPE
- EACH $1.20
- 10 FOR $1.50

### Rectifiers

**VARO FULL-WAVER BRIDGES**

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**MR810 Rectifier**

| 50V | 1A | $.10 |

### Special 811: Hex Inverter

**TTL DIP Hex Inverter**

- Pin interchangeable with SN 7404.
- Parts are brand new and branded Signetics and marked "11111110".
- EACH $0.30

- **DIP**
- **Supply**
- **10 FOR**
- **.25 EA**

### CD-2 Counter Kit

- This kit provides a highly sophisticated display section module for clocks, counters, or other numerical display needs. It accepts inputs up to 10 digits (with 10 interconnects); there is also a lamp test, causing all 17 segments to light. Kit includes a 2-sided (with plated thru holes) glass printed circuit board, a 7400, a 7474, a 4050, a D2010 RCA Monitor display tube, complete instructions, and enough NOLEX pins for the ICs. Note: boards can be supplied in a single panel of up to 10 digits (with 13 interconnects); therefore, when ordering, please specify whether you want them in single panels or in one multiple digit board. Not specifying will result in shipped delay.

### High Quality PCB Mounting IC Sockets

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### 5001 Calculator


### Babyfon Electronics

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<td>$11.00</td>
</tr>
</tbody>
</table>

**Money Back Guarantee on all Goods:** Send for FREE FLYER LISTING 100's of MONEY-SAVING BARGAINS!

**February 1975**

153
CALL FREE

DIAL-A-DEAL

HAM RADIO CENTER

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(Continental 48 States)
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MO CUSTOMERS CALL 314-993-6060 COLLECT

TRADE ON NEW

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TRADE ON USED

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- DRAKE
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- REGENCY

We carry all major brands and a large stock of used reconditioned equipment

HAM RADIO CENTER INC.
8342 OLIVE BL.
PO. BOX 28271
ST. LOUIS MO 63132
008A MICROCOMPUTER KIT
8008 CPU, 1024 x 8 memory; memory is expandable. Kit includes manual with schematic, programming instructions and suggestions; all ICs and parts supplied except cabinet, fuses & hardware. Includes p.c. board.
$375.00
MANUAL ONLY, $25.00

008A-K ASCII KEYBOARD INPUT KIT
Includes keys, p.c. board, all ICs, power supply, instructions, schematic. Intended to interface ONLY with the RGS Electronics 008A Microcomputer.
$50.00

"THE CUBE" Fully assembled subaudible tone generator for small handheld or portable FM radios. 9-16 volts; no moving parts; set anywhere between 98 & 240 Hz with a trim resistor.
.5" x .6" x .7" $19.95
Set on frequency by the factory, $5.00 extra

PS 5–1 5v 1a regulated power supply kit with p.c. board & instructions. Board measures 2" x 5", completed kit is 2" high. Transformer has internal r.f. shield.
$8.00

PS 25–1 0 to 25v 1a lab type power supply with adjustable current limiting; remote sensing & remote programming for voltage & current. Instructions included. All parts except chassis, meter(s), p.c. board.
Kit of parts with schematics $14.95
P.C. boards available, No. 007 $3.00 ea

★ We have brand new 8038 function generators ★ $5.25 ea

BRAND NEW ALUM. ELECTROLYTIC CAPS, RADIAL LEAD

<table>
<thead>
<tr>
<th>Value</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>10 μF</td>
<td>$ 0.10</td>
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<tr>
<td>22 μF</td>
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<tr>
<td>56 μF</td>
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</tr>
<tr>
<td>100 μF</td>
<td>$ 0.16</td>
</tr>
<tr>
<td>330 μF</td>
<td>$ 0.20</td>
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<tr>
<td>500 μF</td>
<td>$ 0.24</td>
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<tr>
<td>1000 μF</td>
<td>$ 0.15</td>
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TRANSISTORS

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<tr>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>2N2222</td>
<td>NPN TO-18</td>
<td>$ 0.25</td>
</tr>
<tr>
<td>2N2907</td>
<td>PNP TO-18</td>
<td>$ 0.25</td>
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</table>

TO–92 general purpose NPN & PNP transistors, beta > 100,
breakdown > 40v $ .08 each $5.95/100

JUNCTION FETs, TO–18

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>NF10</td>
<td>2N4416, MPF102</td>
<td>$ 3.00</td>
</tr>
<tr>
<td>NF11</td>
<td>2N4091–93</td>
<td>$ 4.00</td>
</tr>
<tr>
<td>NF12</td>
<td>2N4338–41</td>
<td>$ 4.00</td>
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<tr>
<td>NF13</td>
<td>2N3089</td>
<td>$ 3.00</td>
</tr>
<tr>
<td>NF14</td>
<td>2N4221–22</td>
<td>$ 4.00</td>
</tr>
<tr>
<td>PJF11</td>
<td>2N3382–86</td>
<td>$ 4.00</td>
</tr>
<tr>
<td>PJF14</td>
<td>2N2608</td>
<td>$ 4.00</td>
</tr>
</tbody>
</table>

All FETs come with data sheets.

RGS ELECTRONICS
3650 Charles St., Suite K • Santa Clara, CA 95050 • (408) 247–0158

We sell many ICs and components not listed in this ad. Send a stamp for our free flyer. TERMS OF SALE:
All orders prepaid; we pay postage. $1.00 handling charge on orders under $10.00. California residents please
include sales tax. Please include name, address and zip code on all orders and flyer requests. Prices subject to
change without notice.

DISCOUNTS: 10% OFF ORDERS OVER $25.00; 20% OFF ORDERS OVER $250.00.
CLOSE-OUT! DIGITAL CLOCK KIT $23.73

Full Six Digit LED Display – 12/24 HR – 50/60 Hz operation!
Handsome anodized aluminum case approximately 2” x 5” x 1½”. All components, PC board, with instructions for easy assembly.

8008 Computer Special includes: 1 – 8008 8 bit CPU, 8 – G2102/2602 1 X 1024 NMOS status RAMs, 1 – G5203 8 X 256 bit MOS EROM $130.00

READOUT RIOT

<table>
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<tr>
<th>Part Number</th>
<th>Description</th>
<th>Price</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>DL 704</td>
<td>.3” Common Cathode</td>
<td>$1.25</td>
<td>4/3.95</td>
</tr>
<tr>
<td>DL 707</td>
<td>.3” Common Anode</td>
<td>1.50</td>
<td>4/4.95</td>
</tr>
<tr>
<td>MAN 1</td>
<td>.27” Common Anode</td>
<td>1.95</td>
<td>4/7.50</td>
</tr>
<tr>
<td>MAN 74</td>
<td>.27” Red Common Cathode</td>
<td>1.50</td>
<td>4/5.25</td>
</tr>
<tr>
<td>MAN 401</td>
<td>.27” Red Common Anode</td>
<td>1.50</td>
<td>4/5.25</td>
</tr>
<tr>
<td>MAN 84</td>
<td>.27” Yellow Common Cathode</td>
<td>1.95</td>
<td>4/7.50</td>
</tr>
<tr>
<td>DL 33-1</td>
<td>.1” Red 2 digit w/minus in DIP</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>OR 33</td>
<td>.1” Red 3 digit in DIP</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>MV 1050 min1</td>
<td>Discrete LED (bottom leads)</td>
<td>10/1.00</td>
<td></td>
</tr>
<tr>
<td>MV 50 min1</td>
<td>Discrete LED (side leads)</td>
<td>10/1.00</td>
<td></td>
</tr>
</tbody>
</table>

EXPERIMENTER’S SPECIALS

Over 500 1/4W resistors with leads cut and formed for PC insertion, good mix of values 3.95

Mini reed relays SPST n.o. Form A contacts 3000 ohm coil 8-15V 2/1.00

6 assorted photo resistors 6/1.95

10 assorted thermistors 10/1.95

20 key calculator keyboard w/on-off switch mounted in mini calculator case (no bottoms), print supplied 1.95

PC mount inductors – no mystery values – 1 to 680 microhenries 20/1.95

Microswitch keyboard – type 53RW4-1 – 53 key full alphanumeric brand new factory pack 19.95

8038 Function generator square-triangle-sine 4.50

ALL ITEMS IN STOCK and will be shipped within 24 working hours of receipt of order! Include 50¢ postage and handling on orders under $10.00

Sorry, NO C.O.D. s. CALIFORNIA RESIDENTS ADD sales tax.
<table>
<thead>
<tr>
<th><strong>RC OSCILLATORS</strong></th>
<th><strong>COLUMBIA 4 CHANNEL SQ</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>16 pin IC chip contains 4 RC osc. Ideal for touch tone encoder. TCA 430</td>
<td>Solid state SQ 4 channel adapter, 2 amps built in. Decodes 4 channel or synthesizes 4 channel.</td>
</tr>
<tr>
<td>$5.00</td>
<td>$35.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>8 CHAN MULTIPLEX SWITCH</strong></th>
<th><strong>LED READOUTS 5/$1.00!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid state 16 pin IC MOS. 8 channel w/output enable control &amp; one-of-eight decoder in chip. With data. Fairchild 3705</td>
<td>The price is not a mistake. We have some hobby variety with some segments out. Ukinbuyem for as low as</td>
</tr>
<tr>
<td>$5.00</td>
<td>5 for $1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LOGIC SUPPLY</strong></th>
<th><strong>DUAL 16 BIT MEMORY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>New, made by Computer Products, Fla. High voltage 170V and 5V logic output. Solid state, highly regulated &amp; filtered. #PM 728</td>
<td>Dual 16 bit memory, serial MOS by Philco TO-5 case, brand new with 2 page specs. #PLR 532</td>
</tr>
<tr>
<td>$5.00</td>
<td>$1.00 each</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th><strong>MEMORY SYSTEM $125.00</strong></th>
<th><strong>AM–FM RADIO</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1024 core memory system, 1024 words memory, 8, 9 or 10 bits/word. Random access, with all logic, register, timing, control, core select and sense functions in one package. New, with 60 page booklet includes schematics. Measures only 9x4x1 inches. Good start for mini-computer.</td>
<td>For console installation, w/face plate, no knobs. Stereo amplifiers for tape or turntable playback. Pair of matching speakers w/xfmr's for above</td>
</tr>
<tr>
<td>$20.00</td>
<td>$5.00</td>
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<tr>
<th><strong>TONE GEN. BOARD</strong></th>
<th><strong>CALCULATOR CHASSIS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Octave tone gen. board from Magnus Organ. Unused and tested, with instructions &amp; amp.</td>
<td>Fully assembled pocket calculator chassis with calculator chip. Uses LED readouts not included.</td>
</tr>
<tr>
<td>$14.95 two for $25.00</td>
<td>$5.00</td>
</tr>
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<table>
<thead>
<tr>
<th><strong>PIANO KEYBOARD $9.95</strong></th>
<th><strong>ELECTRIC SIREN $10.00</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>For use with above organ or synthesizer, etc.</td>
<td>Brand new, operate 6 or 12 volts dc. Just the thing to protect car or boat. Used also as burglar or fire alarm in house &amp; camp.</td>
</tr>
<tr>
<td>$9.95</td>
<td>Kinda scarce, but we found some. While they last</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MULTI-USE XFMR $8.95</strong></th>
<th><strong>SOLAR ENERGY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output 18 V @ 6 amp; 17V @ 6 amps; 10V @ 10 amp. Brand new. $8.95 ea, 2 for $15; 10 for $50</td>
<td>Electricity for free from the sun. An exciting experimental device. Instructions included show how to make a solar energy bank for higher voltages and/or current, also how to make a solar operated radio receiver.</td>
</tr>
<tr>
<td>$8.95</td>
<td>Giant cell 2” diameter – $1.50</td>
</tr>
</tbody>
</table>

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<tr>
<th><strong>PHOTO-STROBE</strong></th>
<th><strong>BOOKSHELF SPEAKERS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Made for Instamatic but useful on any camera with instructions provided. Info also on trick uses, automotive strobe, slave strobe, automotive strobe, Psychadelic repetitive strobe, etc. Complete with charger &amp; Nickel Cadmium batteries.</td>
<td>Completey finished, 9 x 12 x 5 inches. 16 ohm, with extension cord.</td>
</tr>
<tr>
<td>$9.95 or 3 for $25.00</td>
<td>$15 a pair</td>
</tr>
</tbody>
</table>

**FREE catalog.**

MESHPHA PO Bx 62 E. Lynn Mass. 01904

Please add shipping cost on above.

FEBRUARY 1975
**MICROPROCESSORS by Poly Paks!**

**8008**

**"THE COMPUTER ON THE CHIP"**

*$79.95*

16-BIT MICRO PROCESSOR BASIC SYSTEM

The lowest-priced 16-bit system! Outperforms the 8008.

The CPU (Central Processing Unit) includes 4-MHz 8000, called RALU, and one MM7551 CROM. RALU — called Register and Arithmetic Logic Unit — is a 16-bit control bus, and the CROM is a 16-bit Read-Only Memory. The four RALUs in parallel form a 16-bit arithmetic and logic unit that is controlled by micro-instructions, stored in the CROM. With spec sheets.

**2102 1000-bit "static" Ram package...**$9.95

**SIMPLEST! FINEST! SMALLEST!**

6-FUNCTION AC-DC CALCULATOR KIT!

- Lightweight, pocket size
- Extra large display
- 6 functions plus, minus, times, percentage, constant
- Floating decimal
- Chain and Mix calculations
- True credit calculation
- Simplified indexing
- Mark up and Mark down
- Constant multiplication and division
- S/A converter jack

**ALL LED MONTOSANTO READOUTS**

- Refreshable memory (RAM, ROM, SR)
- 8-bit readout
- 8-bit address
- 8-bit system
- 8-bit input
- 8-bit memory

**"ALL LED" MONTOSANTO READOUTS**

- H6U case
- 2103 16-bit RAM, 12 or 24 hour
- 2102 1000-bit memory

**ALL LED MONTOSANTO READOUTS**

- H6U case
- 2103 16-bit RAM, 12 or 24 hour
- 2102 1000-bit memory

**MINI CALCULATOR BASICS**

**CT5031**

- Includes mini case
- Model MM5316
- 1 2 or 24 hour
- 2103 16-bit RAM, 12 or 24 hour
- 2102 1000-bit memory

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- Includes mini case
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**CT5031**

- Includes mini case
- Model MM5316
- 1 2 or 24 hour
- 2103 16-bit RAM, 12 or 24 hour
- 2102 1000-bit memory
EMP! Are You Prepared?

The answer to that is a resounding NO! EMP... Electromagnetic Pulse generation by the explosion of a nuclear device (also known as an atom bomb) has not been given much publicity... and that is unfair, because it presents some problems almost as serious as the bomb itself. Why have only one worry if you can have two, right?

Since the nuclear tests were made several years ago, back when they were using tubes... before the advent of solid state electronic equipment, the seriousness of the EMP problem was not realized. Tubes, as you may recall if you are over thirty, can stand an awful lot of zap on their input with no long range bad effects. Transistors go to hell immediately when zapped.

It seems that when a nuclear bomb goes off in the atmosphere a lot of gamma rays are generated and interact with the air to generate a substantial magnetic field... something on the order of 10,000,000 volts per meter. This magnetic field is so strong that there is probably no feasible way of shielding electronic equipment against it. It will burn out any semiconductor, confuse logic circuits and wipe out core memories. Think what that will do to telephone service to amateurs and electronic equipment against it. It will burn out any semiconductor, confuse logic circuits and wipe out core memories. Think what that will do to telephone service to amateurs and electronic equipment.

George Grammar was right a few years back when he advised us to forget about transistors and stick to tubes. The thought of all that stuff going blip and turning into monodes approaches the unthinkable.

But how much energy are we talking about here? Perhaps we can button up our gear a bit and keep it secure. Energy in this case is measured in Watt-seconds... the quantity is the Joule, which is one Watt consumed for one second. It takes about 0.0001 Joule to ruin most semiconductors and a memory erasure can take as little as 0.000000001 Joule! Okay? Now how about a thermonuclear bomb? How many Joules are we starting with? The book says we get about 1,000,000,000,000 Joules. Now how are we going to go about keeping out that kind of zonker? If you like powers of ten, you're trying to figure out how to cut 10^12 Joules down to less than 10^-3 Joules... a factor of 10^15. By the time you got something shielded enough and by-passed enough to keep out that order of magnitude you'd never get anything you wanted into it to use it.

Say, come to think of it, the Russians are still using tubes for most things. Let's hope they modernize quickly... we'll all feel better. Are the Chinese using tubes?

If we elect someone who thinks that a war will be the best solution to a recession, let's hope he picks on some small unaligned country. Come to think of it, after failing so miserably in trying to beat North Vietnam, perhaps we'd do well to try some other solution to our economic woes... like cutting expenditures.

MORSE CODE TAPES?

Sure enough, an immigrant has come along with code cassettes... it was to be expected. In this case it is not an improvement.

If you don't mind a little sarcasm, you might consider the other code cassettes if you are really into learning the code and want to take a long time to do it. The system of teaching used on the other cassette is right out of the 1930's and guaranteed to take you from five to ten times as long to get up to speed as the 73 code course.

What is the difference? The 73 cassettes have two main things going for them... firstly, in one hour the average person can master the entire alphabet, the ten numerals and the needed punctuation with the 5 WPM beginners tape. This starts right out teaching the letters as words, using them, so you are able to copy code almost immediately. Secondly, and of extreme importance to anyone who wants to save a few dozen hours of practice getting over that cursed ten words per minute hump that other code courses set you up for... the 73 tapes start you right out with all characters being sent at 13 WPM... just the spacing is for 6 WPM. Thus you don't have to learn the code characters at 5 WPM, then again at 6, at 7, and so on as you do with all of the graduated speed code tapes. You learn each character just once and you've got it.

And what kind of code course takes you to 18 WPM when the Extra requires 20 WPM? The 73 cassettes run you at 21 WPM, giving you a good margin for error and panic. And they give you cypher instead of plain language, an added margin for error... so you can't memorize the tapes.

Which do you want... 1930's code or 1970's? Remember that the 73 code courses are advertised ONLY in 73.

OST EDITORIAL

The November OST had an editorial that really got quite a few manufacturers uptight. The gist of it was that OST refuses to carry advertising for firms which put out shoddy merchandise and so, if you don't see an ad in OST, you'd better watch out. Some manufacturers got mad about this because quite a few of them have tried OST and been disappointed in the advertising results and now run their ads elsewhere — yet they feel that OST is putting on the screws and forcing them to run ads in QST, even

Continued on page 136
Not just another 2 meter FM transceiver

A total coverage, synthesized transceiver for the FM enthusiast

SIGMASIZER 200R

- 200 channel coverage of 146-148 MHz.
- Simplex or repeater operation.
- 10 watt or 1 watt power output.
- Automatic high or low 600 KHz repeater offset (146-147 low; 147-148 high).
- Priority channel for instant selection of your favorite frequency.
- "Performance plus" receiver utilizing front-end selective resonators for optimum intermodulation rejection and both HI and LO IF filters for maximum selectivity.
- Built-in tone burst.
- Plus many more exciting features.

Specifications subject to change without notice.

Visit your dealer for details or write for our new catalog.
All Yaesu products warranted by the selling dealer. Complete after-warranty service available in Paramount, Calif.
MINI-CATALOG 1975

THE WORLD'S MOST COMPLETE LINE
OF
VHF—FM KITS AND EQUIPMENT

CD1 Kit 10 channel receive xtal deck w/diode switching $ 6.95
CD2 Kit 10 channel xmit xtal deck w/switch and trimmers $14.95
COR2 Kit complete COR with 3 second and 3 minute timers $19.95
SC2 Kit 10 channel auto-scan adapter for RX $19.95
TX144 Kit exciter—1 watt—2 meters $29.95
TX220 Kit exciter—1 watt—220 MHz $29.95
TX432 Kit exciter—NEW—432 MHz coming soon
RX144/220 F Kit 140-170 or 210-240 MHz rcvr w/8 pole cer 455 filter $65.95
RX144/220 C Kit 140-170 or 210-240 MHz rcvr w/2 pole 10.7 xtal filter $69.95
RX432 C Kit NEW—432 MHz receiver coming soon
HT144 B Kit 2 meter—2w—4 channel—hand held xcvr $129.95
PA1501H Kit 2 meter pwr amp—15w—compl. kit w/SS switching $49.95
PA2501H Kit similar to above—24w $59.95
PA144/15 Kit similar to PA1501H less case, connectors and switching $39.95
PA144/25 Kit similar to above—25w $49.95
PA220/15 Kit similar to PA144/15 for 220 MHz $39.95
PA432/10 NEW—similar to PA144/15 except 10w and 432 MHz coming soon
PA4010H Kit 10w in—40w out—relay switching $59.95
PA110/10 10w in—110w out 2 meter amp factory wired $179.95
PA110/30 30w in—110w out 2 meter amp factory wired $149.95
PS3 Kit power supply regulator card $ 8.95
PS12C Kit 12 amp—12 volt regulated power supply w/case $69.95
PS24C Kit 24 amp—12 volt regulated power supply w/case $99.95
RPT144 NEW—15 watt—2 meter repeater factory wired $595.95
RPT220 NEW—15 watt—220 MHz repeater factory wired $595.95
RPT432 NEW—10 watt—432 MHz repeater coming soon

Repeaters are available in kit form—write for prices

ORDER FORM

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART #</th>
<th>DESCRIPTION</th>
<th>PRICE</th>
<th>EXTENSION</th>
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NAME _______________ TOTAL __________________
ADDRESS _______________ SHIPPING _______________
CITY _______________ NYS RESIDENTS-SALES TAX _______________
STATE _______________ ZIP _______________

TOTAL ENCLOSED __________________