

acc notes

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MAY/JUNE 1984

Dayton '84. This was our third year at the Dayton Hamvention, and our very best one yet! In addition to the products we've been shipping for some time, we showed portions of the new RC-850 controller Version 3 firmware we're working on, including some examples of the computer terminal interface, the new paging formats, and interface to the Heathkit weather instrumentation.

We also introduced ShackMaster, an integrated control system for your home shack, which provides cross-band linking and telephone access to your home equipment, remote home control, an electronic mailbox, a remotely controlled intercom into the home, and a simplex patch. ShackMaster was very well received, and promises to provide a growth path for ACC inside the amateur market, which will benefit all our customers.

We had a user's meeting Saturday afternoon in the (hot) exhibitor's lounge. The most significant result of the meeting was the formation of the User's Group Bulletin Board (see writeup later in this newsletter). Next year we'll try to find a better room, but at the Hamvention, that's hard to do.

It was nice to meet customers that we've talked with over the last year, and to see again those of you that we've met before at Dayton. If you've never been to the Dayton Hamvention, and you call yourself a ham, it's worth going at least once to see what it's all about. See you next year!

Dayton Contest Winners. At the Dayton Hamvention, we donated an RC-85 Repeater Controller as a Hamvention prize, and gave away an RC-850, RC-85, ITC-32, and ShackMaster at a drawing at our booth. The winners were:

Hamvention Drawing

RC-85 Repeater Controller - B. Devitt, Indiana

ACC Drawing

RC-850 Repeater Controller - Jack Olpp, Ohio

RC-85 Repeater Controller - Mort Wolfson, Canada

ITC-32 Control Board - W.G. Eikenberry, Indiana

ShackMaster - Steve Lawis, Arkansas

Mort, who was lucky enough to win an RC-85 controller, has wanted an RC-850 controller for a year and a half. We were happy to apply his RC-85 prize as a credit towards an RC-850 controller. Congratulations to the winners!

HSC Display Paging - What Is It? Paging capabilities are useful on a repeater as a means of selective calling. With a pager, you don't have to listen to all the chatter to be available. Another ham can reach you by activating your pager tuned to your repeater's output frequency. Paging is also perfect for public service groups for alerting users of emergencies.

You may be familiar with two-tone sequential tones (1 second / 3 second or a variation) for activating pocket pagers - your RC-850 or RC-85 controller can generate them on command. There are lots of low cost used surplus two-tone pagers available. Five-tone sequential paging, a more modern format, uses a quick sequence of five tones to address a pager. The tones are selected from a set of ten, allowing up to 100,000 (10^5) pagers to be addressed. The quick tones make five tone sequential more pleasant to listen to on a voice repeater! It also makes available another class of new and used pagers to select from.

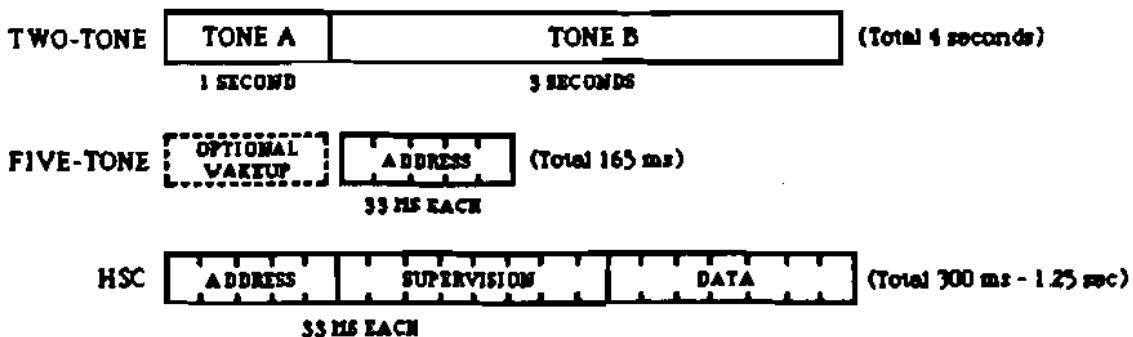
The HSC format is an extension of five-tone sequential. HSC stands for "hexadecimally-sequential coded", and, yes, there are sixteen frequencies which make up the tone set - a superset of the ten frequencies in five tone sequential. What do the extra tones make possible? Display paging!

The HSC format, because it uses tones, is compatible with any repeater transmitter without modification. That isn't true of digital paging formats, which can be completely incompatible with some transmitters, or require modifications to the modulator at best. And if you've ever heard digital paging on a scanner, you probably wouldn't want that awful-sounding stuff on your repeater anyway!

The RC-850 controller Version 3 firmware supports five-tone and HSC paging formats. HSC numeric display paging capabilities allow you to leave a phone number, or a time and a frequency, or any other numeric message in a friend's pager. The repeater is also capable of originating display pages from any programmable message, including the alarms.

Standard Communications offers a brand new HSC tone, tone and voice, and tone and display pager - the PG-50, adaptable to 2M and 440MHz. You may see it advertised in magazines including Personal Communications. It can display and store six 12 digit messages (72 characters), as well as provide tone and voice and tone only signalling. When we release Version 3 firmware, we'll see if there's enough interest for ACC to offer the PG-50 pager. It costs about as much as an HT, so it isn't for everyone, but with the RC-850 controller, it brings state-of-the-art selective calling technology to amateur radio.

PAGING FORMATS



User's Group Bulletin Board. A computer bulletin board service is now available to RC-850 and RC-85 controller owners. Ed Feins, WA2ZDN has added a SIG (Special Interest Group) to his Computer Forum of New Jersey bulletin board as a means for controller owners to exchange ideas, information, and even computer programs relating to repeaters. Share with everyone your ideas on courtesy tones, messages, metering applications, etc. We'll try to supply information which may be of interest to owners, as well, from time to time. We check in occasionally, so you can leave us a message or ask us questions.

Ed's hardware consists of a TRS-80 Model 4 with over 12 megabytes of online storage, and accepts 300 or 1200 baud users. The TBBS software is outstanding. Ed's system is popular, though, so try to access it during odd hours to avoid busy signals.

Access is limited to '850 and '85 owners, and the phone number is (201) 486-2956. To qualify, check in once to provide your information for verification, and write to Ed with an SASE to Box 115, Union, NJ 07083. Or call him before 10:30 p.m. eastern time to accomplish the same - get his voice number from BELL NJ Information (address OK in the callbook). We won't publish his voice number here to avoid mixups and middle of the night calls!

Thanks to Ed Feins for making his system available. It's time to break out the modems and get ready for when you'll be able to talk with your '850 as well, using your home computer!

Automatic Repeater ID as a Beacon is Illegal. From "Westlink Report" of June 15, 1984. Carol Fox Foelak of the FCC wrote in response to a question, that repeaters which identify themselves when not retransmitting signals violate Section 97.113 rules on broadcasting. It isn't clear if that means that the repeater can't "clean up" (ID) several minutes after a QSO. The only alternative would be to ID at the end of every transmission during a QSO, since the repeater can't know when users will be finished.

It also isn't clear to us how a periodic repeater ID relates to broadcasting, given the definition of broadcasting in 97.113 - "dissemination of radio communications intended to be received by the public...". If the periodic ID were considered a beacon, 97.61(e) would apply, which limits beacon operation to certain frequency bands, which generally don't include repeater output frequencies. But a periodic ID isn't really a beacon either, in that it isn't used for "observation of propagation or transmission phenomena" or other activities defined in 97.3 (1).

It might seem reasonable to consider a periodic repeater ID, when the repeater is not otherwise in use, to be an information bulletin consisting of subject matter of direct interest to the amateur radio service, i.e. "There's a repeater on this frequency and you're welcome to use it!". This type of one-way communication might specifically be permitted by 97.91. In no case would it be defensible for such an ID to intentionally interfere with co-channel repeater users, though.

We feel obligated to make you aware of the FCC's letter, and Westlink Report's comments that citations will be issued against operators whose repeaters "beacon ID". (The RC-850 controller offers a selectable "Beacon ID" mode.) We specifically disclaim any responsibility for improper use of your equipment - it can be operated properly under virtually any interpretation of the rules. This discussion is intended only as food for thought. As always, read the rules and understand them, then follow common sense. An excellent reference is The FCC Rule Book from the ARRL. And as we've heard before, it's best not to ask the FCC!

Adjusting Audio Levels. Time was that a repeater just retransmitted the audio coming into the receiver, plus perhaps a cw ID tone. With repeater controllers, it's a little more complex, since there are a variety of audio sources which are to be transmitted.

Every once in a while a controller owner will have difficulty setting audio levels through the system. We'd like to make a few points about how and where levels should be set, based on the design of our controllers and the nature of FM equipment. The most important point is to (1) adjust audio levels on the controller for high level audio - 4 volts peak-to-peak, at the transmitter audio output of the controller, then (2) make adjustments at the transmitter as necessary for proper deviation and peak limiting, independent of controller adjustments.

The repeater controller is an audio mixer for the transmitter, with audio mixed from the receiver, link receivers, speech synthesizer, tone generator, and phone line. The first step to good audio is to balance the levels of the various sources out of the controller in a way that is pleasant to the ear. The best way to monitor the levels is with a scope, looking at "average" peak levels, ignoring unusually high peaks. Never attempt to adjust audio levels using an ac meter, either analog or digital. The controllers should provide 4 volts p-p of receiver audio, about the same for the speech synthesizer and phone audio, and somewhat less for tone audio. Remember that peak-to-peak means the total excursion from the most positive to the most negative voltage. It's different than rms or average ac voltage.

Attempting to adjust levels by monitoring transmitter deviation can be tricky for several reasons. First, the transmitter may actually be driven into clipping, so that adjustments may not result in meaningful changes in deviation. Second, instantaneous deviation in an FM system is a function of both the audio level, and the frequency components of the audio. FM transmitters pre-emphasize the audio - that is, higher frequency audio components drive the transmitter's modulator harder than lower frequency components of the same level. De-emphasis in the FM receiver on the other end restores a flat frequency response, and at the same time reduces the high frequency noise in the audio, improving the overall signal-to-noise ratio of the system. The point, though, is that deviation is not always proportional to audio level.

Our controllers are designed to provide fixed, high level, low impedance audio outputs to the transmitter. Most transmitters have an audio level, and a deviation adjustment. Depending on the sensitivity of the transmitter audio input stage, and especially if your transmitter doesn't have a level control, it may be desirable to knock down the audio through a resistor divider, or to reduce the gain of the transmitter audio input stage. Attempting to lower the levels of the audio sources inside the controller to match its output to the transmitter requirements will result in degraded signal-to-noise ratio throughout the controller. Our circuitry is designed to work internally with high level audio.

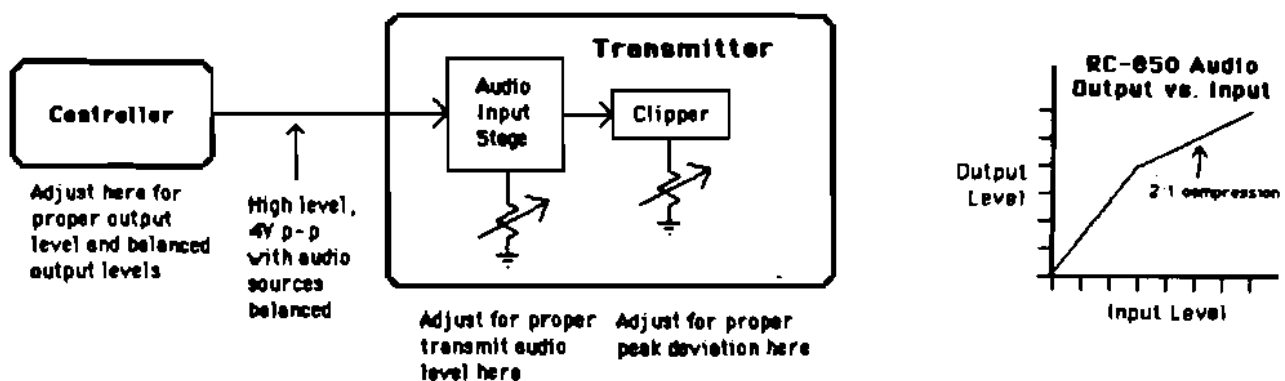
No interface circuitry is necessary or desirable between the controller audio output and the transmitter audio input (except perhaps an attenuator pad or resistor voltage divider). If you have any buffers, amplifiers, or transformers in the line, and you're not happy with your audio, take them out. Even a transmitter balanced audio input may be driven by the controller's unbalanced signal output and analog ground.

Controller specific hints:

The RC-850 includes audio processing (predictive effect etc) which reduces the transmitted level variations for different received levels. Don't try to get a linear "x kHz out for x kHz in" relationship with a deviation meter - the transfer function is shown below. Also be sure to make the proper internal adjustment for optimum level through the audio delay line.

The RC-85 doesn't have any agc, but the speech synthesizer and tone levels are at fixed output levels. Adjust R1 to set the receiver audio output the same as the speech level. Don't do this with a deviation meter - do it with a scope, then adjust the transmitter.

Interfacing audio really is easy - it just may be necessary to forget some of the techniques you've used in the past.



1200 MHz Update. We've interfaced our ICOM RP-1210 repeater with an RC-85 controller - it really is easy! The RC-85 and RC-850 controllers are perfect companions to ICOM's 1200 MHz and 440 MHz repeaters.

if you're getting power from the repeater, be careful about its no-load voltage - above about 14 volts is too high for the RC-85 - try dropping the voltage through a silicon diode if necessary. We also found that it was best to reduce the gain of the transmitter's audio input stage - paralleling a 100K resistor around the op amp's feedback resistor brought the transmitter out of heavy clipping (as it comes from the factory it seems to clip heavily). By moving the wire to its local audio amp from the receiver audio output to the transmitter audio input (controller output), you can monitor the repeater's output audio in the local speaker (rather than just the receiver audio).

There is now one active 1200 MHz repeater here in the Bay Area, with ours to go up soon. The Bay Area is repeater heaven, with a densely populated valley surrounded on almost all sides by "repeater sites". Virtually all repeaters are line of site from the valley. On 1200, it seems that antennas ranging from a clip lead to outside quarter waves will work, but propagation seems to change even on line of site paths. It doesn't pay to skimp on the antenna. It seems that simplex is rough in any case. We don't know how well the band will work out in rolling hill terrain, but if you're line of site to the repeater, 1200 should work well. We'll keep you up to date with what we learn here, and if you have any experience with 1200 MHz FM, let us know and we'll share it.

Lightning Protection for Your Repeater. We're heading into lightning season again, so it's time to make sure your equipment is protected as well as it can be. By their very nature, repeater sites are prime targets for lightning hits of tens of thousands of amperes. Lightning protection is a system level problem - all the equipment at your site should be protected from large transients on the power line, phone line, and from the antennas and tower.

The first line of defense is good system grounding. Getting a good ground on a mountaintop isn't easy, but it's essential to provide a non-destructive discharge path to ground for lightning currents (rather than through your equipment). Multiple ground stakes may be necessary, and even bare wire radials may be required to achieve an effective ground. All equipment grounds should be bonded (interconnected) with heavy braid, so that they're all at the same potential.

Doug Zestrow, WBOUPJ recommends from his own experience surge suppressors from Lightning Elimination Associates, for use on the phone line and the ac power line. He's used the TET-200-100 device on the phone line for some time with excellent results, and is adding an SE-115-10-BF device on the power line. They're under \$100 each. Lightning Elimination Associates, Inc., 12516 Lakeland Rd., Santa Fe Springs, CA 90670, (213) 944-0916.

Other companies manufacture arrestors for use in-line with the coax to the antenna. In addition to LEA, PolyPhaser offers a family of coaxial impulse suppressors, which are intended to be mounted at the grounded tower leg (they're also about to offer a phone line protector). Ask for their publication "Impulse Protection", and their data sheets. PolyPhaser Corporation, 1420 Industrial Way, P.O. Box 1237, Gardnerville, NV, 89410, (702) 782-2511.

Decibel Products, Inc. offers coaxial suppressors, and a publication "About Lightning". 3184 Quebec, Dallas, TX 75247, (214) 631-0310.

Finally, "All-Risk" Ham Radio Equipment Insurance is available from the ARRL for members at a very reasonable cost. The coverage includes lightning damage, and is available for repeater installations. Insurance isn't a substitute for good site engineering, but nothing can protect against the worst hits. If you're not already an ARRL member, their insurance service may be a good reason to join. Contact the ARRL.

Control Your Intermod. Intermod Control, a book from the publishers of Mobile Radio Technology magazine, is excellent reading for anyone involved in designing and maintaining repeater systems. The book combines theory and practical information, and offers good discussions about antennas, cavities, circulators, combiners, and multicouplers. It shows examples of intermod problems and how to clean them up. The price is \$8 postpaid, available from Wiesner Publishing Co., 5594 So. Prince St., Littleton, CO 80120. While you're at it, request a subscription qualification card for MRT magazine - it's an excellent technical magazine with lots of articles of interest to repeater owners.

Front End Crystal Filtering for Greater Selectivity. In very high rf environments, your receiver may need more help than duplexers or cavities can provide. Stan Schreier should know - his 2M repeater is near the World Trade Center in New York City, perhaps the wildest rf zoo in the world. The rf is so high, he can work simplex for only a few feet because of desense.

Stan points out availability of crystal filters at the repeater input frequency. With minimal loss, a front end crystal filter can provide narrow bandwidth and steep skirts. Just plan ahead - the lead time is 20 weeks. For info, contact Piezo Technology, POB 7859, Orlando FL 32854.

New Product Status. With Dayton out of the way, we're back down to solid work on our new products which we've promised. The RC-85 upgrade is done, and we used the opportunity to totally rewrite and reorganize the manual. If the manual "works" as well as we think it will, the RC-850 Version 3 manual will be in the same mold. Now we're getting ShackMaster ready to ship, and we've snuck our Digital Voice Recorder into pc layout. Next up will be completion of Version 3 software and manual for the RC-850, and the DVR. The voter will follow release of the DVR. Thanks for your patience on our new products. We appreciate your interest, but time spent on the phone answering questions about them takes valuable time away from our working on them. We'll be releasing more information about Version 3, the DVR and the voter later this summer - probably in the next ACC Notes.

FC-1 Frequency Control Board Available. The FC-1 control board provides the shift registers and logic to interface any of our products to the ICOM IC2A, IC3A, or IC4A handhelds as remote base transceivers. It can also recover the 32 expanded User Function remote control logic outputs from the RC-850, and the eight expanded outputs from the RC-85. With ShackMaster, it controls the ICOM IC-751 HF transceiver as well.

Remember that connecting to the internal points of the ICOM handhelds is delicate work, and at the very least you need good tools, such as a Weller solder station or other good iron.

There is currently a limited number of boards in stock for \$39.95 plus \$5 shipping and handling. We'll have more later in July. Request "Repeater and Remote Base Applications of the FC-1 Frequency Control Board" for more info.

Literature Available From ACC. The following literature is available on request. Please write to request any of the no-charge material.

- n/c RC-850 Repeater Controller flier ("Third Wave")
- \$30 RC-850 Repeater Controller Technical Manual (Version 2)
- n/c Getting Started With Your RC-850 Repeater Controller (owners only)
- n/c Getting to Know Your '850 Scheduler (owners only)
- n/c 73 Magazine Review of RC-850 Repeater Controller (January, 1982)
- n/c QST Magazine Review of RC-850 Repeater Controller (February, 1983)

- n/c RC-85 Repeater Controller flier
- \$20 RC-85 Repeater Controller Technical Manual (new - Version 2)

- n/c ITC-32 Intelligent Touch-Tone Control Board flier
- \$10 ITC-32 Intelligent Touch-Tone Control Board Owner's Manual

- n/c ShackMaster flier
- n/c ShackMaster and the Rules

- n/c Repeater / Remote Base Applications of the FC-1 Frequency Control Board
- n/c Standard Communications PG-50 Pager flier
- n/c ACC Notes - back issues
- n/c Price List and Order Form

RC-850 Controller Price Reduced, Warranty Increased. We've reduced the price of the RC-850 repeater controller for the summer by about 12%. The VR-2 Voice Response Telemetry option is reduced from \$595 to \$495, and the MX-1 Memory Expansion Board (\$150) is now included at no charge. The price of the '850 will never be lower, since many of the costs associated with producing it continue to slowly rise. Now that you've had a couple of years to see what others have to offer, it's never been a better time for your group to upgrade with our equipment!

We've also increased the RC-850's warranty from one year to two years, reflecting its proven reliability in the field. Offhand, we don't know of any amateur equipment with warranties as long as two years - the typical period is only 90 days.

New Employees. ACC welcomes Tim Malm to our customer service department. Tim isn't a ham (yet) but he's learning about our products quickly. Tim can help you with literature or ordering, and with some questions about the products. Of course, if he can't answer your question he'll get you to someone who can. We also welcome Dave Schultheis, WB6KHP to customer service on a part-time basis. Dave is in on Mondays, and he knows our products about as well as anyone. Dave is better about correspondence than yours truly, so if you would like to write or call about questions, he'll help you. Of course, Steve and Ed are available as well whenever you need us.

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WR6COP Repeater