HORSE TRADES

This page of the Bulletin is for use of amateurs who have RTTY EQUIPMENT FOR SALE OR TRADE and those looking for equipment to buy or trade. It is a free service and may be the means of getting someone on the air.

FOR SALE: Model 26, $75.00, W6CQO, 309 Palomares, Ventura, Calif.

FOR SALE: Model 26, commercial pallets and keytops, $50.00. W6WOC, 2647 20th Avenue, San Francisco 16, Calif.

FOR SALE: Model 15 perforator kybd, $175.00. Model 15 with stand (Waiver required), $110.00. Model 15, $110.00. Model 14 TD, $100.00. K6DLK, 520 East Mariposa Street, Altadena, California.

FOR SALE: Electrocom FSC-250 Converter, perfect condition, with book and two filters, $230.00. W4IBS, 122 Sarto Avenue, Coral Gables, Florida.

FOR SALE: Estate W5ANW, R390A/URR, 75A4 with filters, KWS-1, all used for Teletype. Also model 28 KSR, converter with crossed line scope tuning, two model 14A taype reperforators and printers. Other miscellaneous teletype convetrers, power supplies, and part. Also, QST 1929-1957 bound and remainder unbound. Write offers to W5EYC, P.O. Box 22594, Houston 27, Texas.

WANTED: Metal table for 15, will swap; prefer eastern amateur. W3LGK, P.O. Box 503 St., Marys, Penna.

FOR SALE: Technical manual for FRR-3A, audio TU type FGC-1, and 3-A receiving equipment, needs cabling and repairs, receivers, intact, all in seven-foot rack. WA6LAI, 2307 Gowan Street, Hollywood 28, Calif.

FOR SALE: Model 14 typing reperf, sync motor and end of line indicator, cover and reel. Come and see it working and then take away. Asking $55.00 if I don't have to ship. Also two Collins 706B2 FSK adapters, and one instruction manual. Will swap for test equipment, or offer. W2ANB, 1623 New Scotland Road, Slingerland, Albany County, N.Y.

FOR SALE: Model 15 with sync motor, cover, crank, steel table. Model 14 TD with cover, base, and sync motor. Model 14 typing reperf with sync motor, cover, keyboard, end-of-line indicator, power supply. Model 14 Narrow strip tape printer with sync motor, cover, power supply. Steel table for Model 14 TD and Reperf. K9MVX, 134 North Varsity Drive, South Bend, Indiana.

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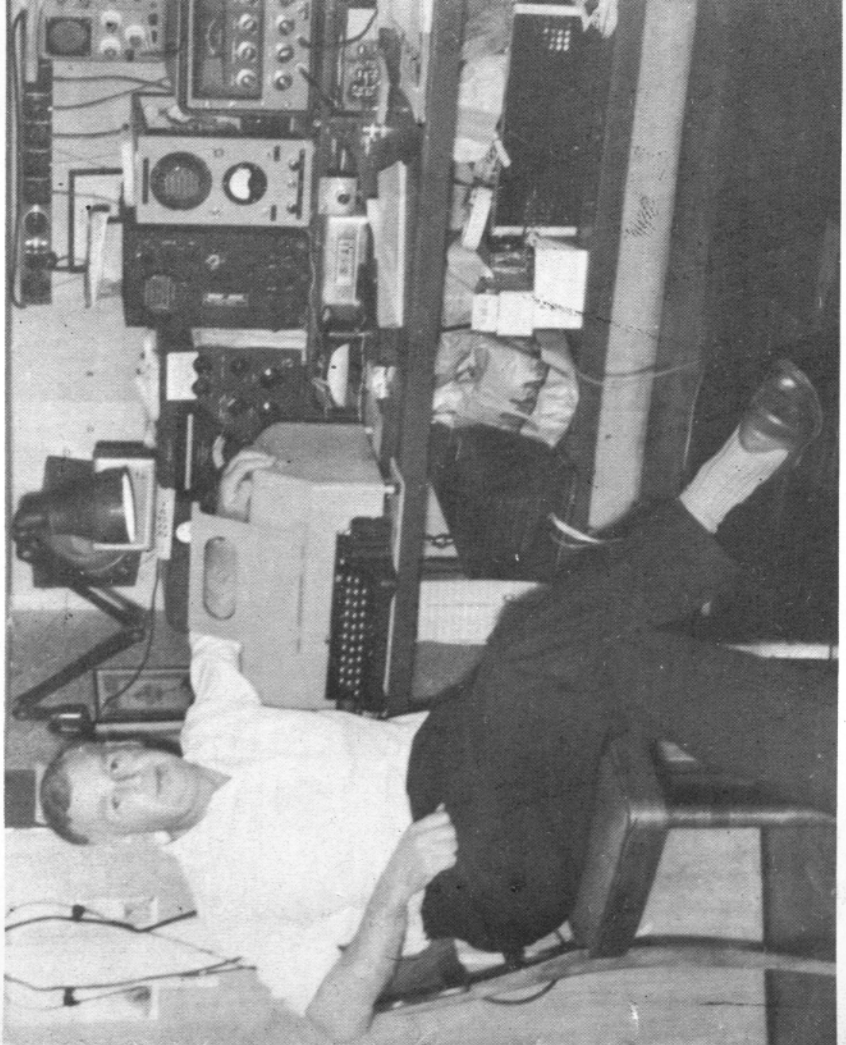
RTTY



F. H. (HENRY) FLANTER, ZS1FD

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NEWS OF AMATEUR RTTY

APRIL 1963
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DUAL-DIVERSITY OPERATION IN AMATEUR RADIOTELEPRINTER SERVICE

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One of the little recognized possibilities of improving amateur RTTY capabilities and dependability exists in the use of dual-diversity operation. This method of reception has been in use at W6CQK from 1956 until transferring to Venezuela in January, 1962, and the same equipment is now in use by YV1EM.

To anyone who tries this type of operation, the advantages are instantly obvious. While Bob Weitbrecht was at W9TCJ in Wisconsin, he wrote a very interesting and informative paper on diversity reception. Unfortunately, the paper has not received the wide circulation it merits. Signals that are many times so weak that they are not worth the trouble of copying when using single-channel reception, are 90% to 100% copiable when using dual diversity. True, this does take two receivers, but many hams nowadays do have two receivers. (They don't have to be identical.) And dual receiver tuning is no worse than one receiver.

There are many ways of combining these signals for connection to the printer. Perhaps the most common is to combine the TU outputs at the discriminator output, and let the best signal take over. This will also automatically allow the converter to select the best mark or space signal, during selective fading. The method used by W9TCJ (now W6NRM) was to combine the TU outputs after the detector and feed them into a flip-flop. The method used in the dual-diversity converter here is patterned after the AN/FGC-1 military unit. The best of the two signals is instantaneously selected, whether mark or space, and the best signal controls a d-c amplifier to adjust the screen grid voltage of the relay keyer tubes, thus controlling their plate currents to key a polar relay. Incidentally, in spite of the many developments in converters, the military considers the AN/FGC-1 to still be the best of the lot.

An even simpler method that has been used by Phil Catona, W2JAV, is to just feed the audio outputs of two receivers into one TU and let the limiter in the TU do the combining. He claims no trouble from the beat notes caused by closely spaced audio frequencies.

One may question, "Why all this equipment, when you need an antenna farm to get good diversity reception?" The answer is, *you don't!* As pointed out in Bob's above-mentioned paper, even a regular transmitting antenna, which is usually used for the receiver anyway, fed to one receiver in the usual manner, and a second antenna, nothing more than a piece of wire run around the room, fed to the second receiver, will exhibit worth-while diversity effects.

In a series of articles by Mr. Irvin M. Hoff, presently appearing in RTTY, he states in the January 1963 issue that "Often these antennas were separated by great physical distances—the theory being that a fade on one antenna might place a surge on the other." The commonly accepted explanation is that the signal usually does not fade in two locations at the same time, even in areas separated as little as one or two wave lengths. Also, due to polarization rotation caused by travel through the ionosphere, very noticeable differences in signal amplitude occur, even when vertical and horizontal antennas are both in use at the same location. There is no way that a fade at one point can place a "surge" at another.

A very interesting and convincing proof of diversity effect can be had by connecting the output of one receiver to the horizontal plates of an oscilloscope, and the output of another receiver to the vertical plates. Tune both receivers to the same signal (using the "diversity" antenna arrangement, of course), and adjust the oscilloscope traces to form a square. There will be times, when the signal fades, that the trace will decrease to a line, but unless the signal is extremely poor, it will always be visible on the screen from one receivre or the other.

A very ingenious antenna for dual diversity (no originality claimed) is shown in Figure 1. The method used at W6CQK for a number of years is shown in Figure 2. The diversity method used at YV1EM is nothing more luxurious than a pair of doublets, made from plastic-covered twisted-pair wire, at a height of 15 feet, and separated about 45 feet. They are roughly in line, and facing broadside toward the U. S.

Dual-diversity operation is not as complicated as it may appear on the surface, and is well worth the time and effort required, for the utmost reliability and performance for the serious RTTY'er. Quite a few hams have been worked who have tried and are now enjoying the benefits of diversity operation. As more and more RTTY'ers realize the benefits to be gained, they too will incorporate dual diversity.

No attempt has been made here to detail the methods to be used in integrating dual-diversity into the receiving equipment. There are perhaps as many methods as there are hams interested in RTTY. The motto of "RTTY'ers build" is still true, at least for the time being. However, with the increased number of converters appearing on the market, we are approaching the lamentable state of SSB, where the ham knows only how to turn it on, and not what makes it work. Let us hope that this trend does not increase.

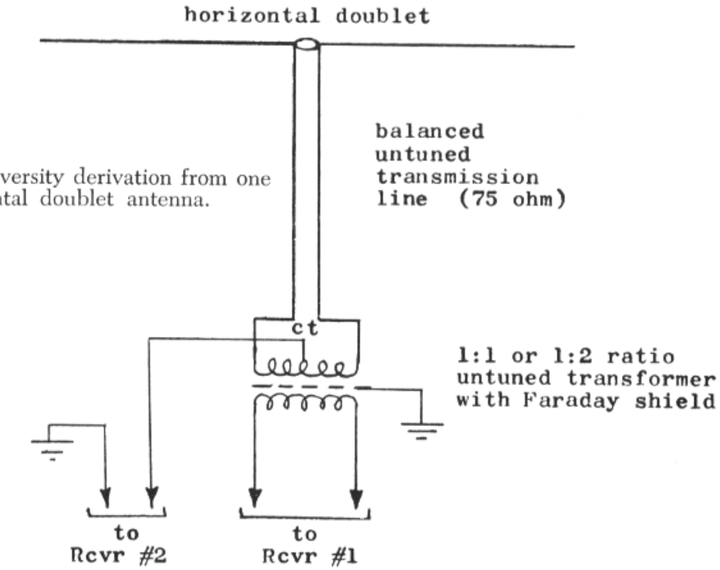

Figure 1. Diversity derivation from one horizontal doublet antenna.

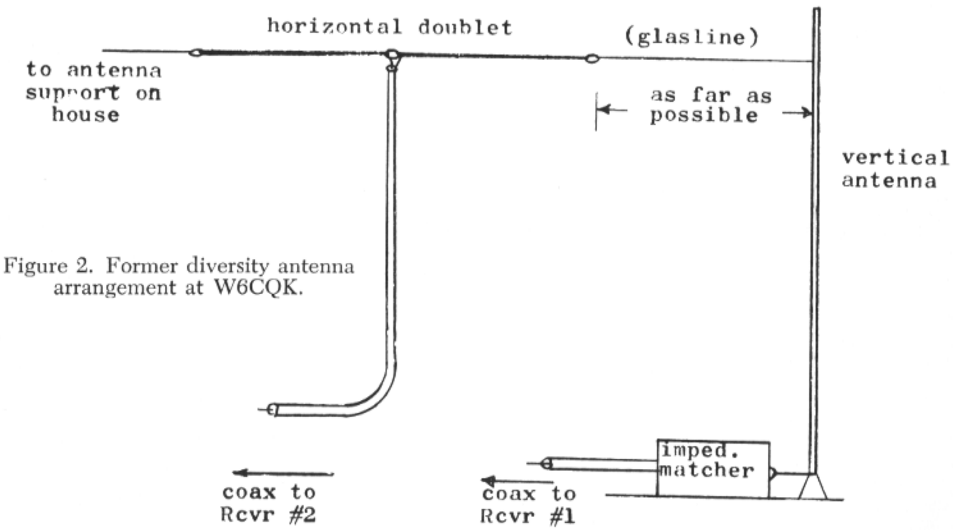

Figure 2. Former diversity antenna arrangement at W6CQK.

"WB6ABF Reviews . . ."

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I. "Optimum Parameters for FSK Radio Teleprinter Systems in the Presence of Thermal Noise."
George B. Gibson 19 September 1951
NRL Report 3861 ASTIA ATI 118 081

This report, written in 1951, was declassified only last year. Gibson undertook experiments using various values of shift and various filter combinations to determine the optimum combination. The output of an FSK generator was mixed with white noise and detected in a modified Navy FRF converter, which is an IF type limiter-discriminator device performing detection at 29.3 kc after conversion from 429 kc. He first determined that a converter input bandwidth equal to 1.67 times the frequency shift is optimum in the presence of white noise for all shifts from 100 cps to 920 cps. He then, maintaining this ratio, tried various values of shift to determine the noise performance of each. He found that for shifts exceeding 300 cps, increasing shift has little influence on performance; while narrower shifts cause performance to improve rapidly as shift is reduced. He then determined that a sharp cutoff multisection m-derived post-detection filter is superior to a simpler filter, and that 80 cps is the optimum cutoff frequency. (A filter with 40 cps cutoff gave somewhat better performance at high error rates, but introduced more telegraph distortion.) Gibson chose 35 percent telegraph distortion as a limiting value, and measured the signal/noise ratio at which this performance was achieved.

It is unfortunate that he did not use some other means of determining S/N performance, as other writers have tended to use either character error rate or bit error probability. Thus his performance figures cannot be compared directly with those stated by other writers. Nevertheless, the general trends which Gibson has established are at least interesting and somewhat useful. First let's consider the relationship between shift and performance in noise. There are two facts of primary interest; the improvement which occurs when shift is reduced below 300 cps, and the relatively small change in performance when shift is increased above 300 cps. The 300 cps "magic number" corresponds to a modulation index of about 6. As was noted in my November article, FSK signals of large modulation index occupy a limited bandwidth which is almost independent of shift, in that the portion of the spectrum between the marking and spacing frequencies contains little signal energy and thus does not contribute to bandwidth occupancy. Further, with a limiter-discriminator type of detector, noise at frequencies between the marking and spacing frequencies has little effect on the signal (if the signal is consistently above threshold) because the discriminator output is proportional to the difference between the input frequency and the center frequency. On the other hand, as modulation index is reduced the signal becomes increasingly effective in occupying the entire bandwidth between the marking and spacing frequencies. Thus the rapid improvement in performance as modulation index is reduced seems to be explainable in terms of the relatively better fit of the filter bandpass characteristic to the signal spectrum envelope which is obtained with signals of small modulation index. Gibson does not attach much importance to the actual improvement attained; he seems to feel that the 3.9 db improvement gained by reducing shift from a large value to 100 cps is too small to be worth worrying about. 3.9 db, however, does represent a power ratio of almost 2.5, which is the difference between a 100 watt transmitter and a 250 watt transmitter. Thus in amateur work a 3.9 db improvement might be well worth the effort. Gibson does point out entirely correctly that performance in white noise on a laboratory circuit is not the only consideration in actual radio working, so that there are other factors which must be considered in evaluating the relative merits of wide vs. narrow shift operation. Among these factors are selective fading, discrete-frequency interference, and transmitter and receiver frequency stability problems. We can safely conclude that when white noise is the principal noise present, when modern high stability equipment is in use, and when selective fading is not troublesome, narrow shift operation offers definite advantages over wide shift when limiter-discriminator receivers are being used in either case. As for Gibson's observations concerning the relationship between filter bandwidth and shift, I can only comment that these results seem quite reasonable and in line with current practice. These findings of course did not include consideration of the use of a comb type filter for signals of large modulation index.

Gibson found that a post-detection filter having a sharp cutoff of 80 cps is usually to be preferred to a similar filter with a cutoff frequency of 40 cps, or with a cutoff frequency greater than 80 cps. The 40 cps filter did give a lower error rate under poor signal conditions where the error rate is rather large anyway; while it was no better than the 80 cps filter at more reasonable error rates. The most important conclusion to be gleaned from the post-detection filtering experiments is that a multisection filter is markedly superior to the simpler filters usually to be seen in amateur designs. Something which would probably be better yet is a filter designed primarily for good phase response at the expense of sharp cutoff.

II. "Comparative Performance of Digital Data Transmission Systems in the Presence of CW Interference"
Frank G. Splitt

IRE-PGCS Transactions, June 1962

Splitt's paper, while based on theoretical work rather than on-the-air experiments, is of considerable importance in amateur work because of the high incidence of CW interference in amateur operation in the USA.

Splitt considered on-off amplitude keying (AK), frequency shift keying (FSK), phase shift keying (PSK), differentially-coherent phase shift keying (delta-PSK), and time shift keying (TSK). TSK is perhaps unfamiliar to many of our readers. In this system, a unit-length marking pulse might be transmitted as a marking pulse followed by a spacing pulse, each pulse being of half unit length. A spacing pulse would similarly be transmitted as a half-length spacing pulse followed by a half-length marking pulse. Thus each pulse of the original information is transmitted containing a transition, and the nature of this transition is determined by the type of information pulse to be transmitted. Since there is at least one transition during each unit interval of time, the resultant TSK waveform contains no energy at zero frequency even if the information signal remains continuously spacing or continuously marking. The spectrum of the TSK signal appears approximately the same as that of the original information signal with all components doubled in frequency. If only the fundamental keying frequency is considered, the TSK waveform occupies no more bandwidth than the information signal; but if higher-order components are considered the TSK waveform occupies somewhat more bandwidth because of the increased frequency spacing between components which results from the frequency doubling process. The TSK waveform can be transmitted by any of the usual modulation means, but in Splitt's analysis, AK was assumed.

Splitt concluded that with input S/N greater than 0 db, the error rate for FSK can be arbitrarily small, while for all lesser values of S/N the error probability is exactly 0.5, which is the figure of maximum uncertainty (If error probability exceeds 0.5, then the error rate can be reduced by arbitrarily converting mark to space and vice versa at the receiver. An error probability of unity can thereby be converted to a probability of zero, since in such a case it is certain at the receiver that all marks should be spaces and vice versa.) For above-threshold signals, he concluded TSK to be 3 db inferior to FSK and AK to be about 6.8 db inferior. PSK was concluded to vary from as-good-as-FSK to 0.8 db superior, depending on whether the difference between signal and interference freqeuncies is zero or $\frac{1.3}{T}$, respectively, where T is the bit duration. For the same variation in interference frequencies, delta-PSK shows a performance variation in the opposite direction, being equal to PSK with identical signal and noise frequencies and 2.3 db inferior with these frequencies differing by the aforementioned factor. For below-threshold signals, FSK and delta-PSK were found to produce a constant 0.5 error probability, while all other modulation schemes were very slightly better (error probability around 0.1 to 0.4).

The type of detector assumed is of course quite important to these data. For AK, a simple filter and envelope detector was assumed. The FSK detector was a non-limiting two-filter type using envelope detectors. The TSK detector was similar to the AK detector, since AK transmission of the TSK waveform was assumed. The differentially-coherent PSK and coherent PSK systems used the peculiar detector types required with these modulation schemes. Synchronous operation was apparently assumed in all cases. For delta PSK and PSK, the interference frequency was assumed related to the signal frequency by the two factors previously mentioned. For AK and TSK-AK, the interference frequency was made equal to the signal frequency. For FSK the interference frequency was assumed to fall at either the marking or spacing frequency, but not at both simultaneously.

Splitt's most significant conclusion is that with CW interference all of the modulation schemes considered exhibit thresholds, which is in marked contrast to white-noise performance. Below threshold, all systems considered are almost uniformly crummy. With the interference frequency equal to the signal frequency, FSK is as good as the more difficult-to-instrument PSK and delta-PSK. AK is much worse than might be expected at first glance (6.8 db vs. 3 db).

In comparing the performance of AK and TSK, I considered the relative transmitter powers and bandwidths applied to the Hartley-Shannon law, which is totally inapplicable to CW interference. The results agreed remarkably with Splitt's. Someone wiser will have to tell us whether this agreement means something or whether it is purely accidental.

W6NRM has just sent me a couple of papers which appeared in British publications. I plan to review these in the near future. Perhaps some of the BARTG fellows will then bring other British papers of note to our attention. It appears that a lot of interesting work has been done on the other side of the pond which has received little notice in this country.

GETTING STARTER ON RADIOTELETYPE

VI. THE MAINLINE FSK SYSTEM

(Including Narrow Shift CW ID)

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Ann Arbor, Michigan

The biggest problem in satisfactory operation of RTTY has been setting the proper frequency shift on the transmitter and then keeping this correct shift.

Even old-timers are frequent offenders of incorrect shift. Although we have never so far heard of anyone receiving a citation for shifts exceeding the legal limit of 900 cps, one should not make the assumption that a shift that "looks fine to me" is accurate or legal.

One of the biggest offenders of frequent over-shift is one of the country's foremost RTTY operators. When informed of his amount of shift, he is quite embarrassed and sets it correctly. As he often changes his shift on purpose to experiment with narrow shift, etc., he is just about that often in error once again.

Thus we cannot emphasize too strongly the problems one runs into if a somewhat permanent shift system is not used.

It follows, then that a system which would automatically give a "permanent" 850-cycle shift that would not need further setting over a period of weeks and years would certainly be an advantage to most RTTY enthusiasts. (As well as giving "peace of mind" knowing that your shift was optimum and legal at all times!)

When amateurs first got started on RTTY on the lower frequencies, FSK was not possible. Thanks to the efforts of W6AEE; W6ZH (now President of the ARRL); W6NRM (ex-W9TCJ); W3PYW; WØBP and others, FSK was authorized.

Since most transmitters at that time were using AM or CW type circuits, using multipliers, the VFO (where the FSK is usually introduced) offered the problem of a shift that needed to be changed from band to band.

Thus the shift pot circuit was born; this system utilizing the partial conduction concept—this requiring voltages that were quite stable and well regulated.

Although the current trend is now to SSB transmitters*, (even for RTTY) few FSK circuits have been presented which take advantage of the unique heterodyning feature of their VFO's.

With this type of transmitter, no change in shift is needed as one goes from band to band. Therefore, the old shift pot circuit with its many disadvantages and limitations can now be discarded in favor of a much more versatile system that gives a permanent shift that will not vary more than a few cycles for months at a time. In fact, once the "Mainline FSK System" is installed and properly adjusted, one need never again be concerned with the amount of shift until the transmitter is sold or dismantled!

Before proceeding, we should like to point out that due to the very nature of this process that it will not be suitable for AM or CW transmitters using the "multiplying VFO", unless (1) single-band optimum operation is desired; or (2) a separate keyer is built for each band contemplated.

A second problem which causes much consternation among the members has been how to obtain "local copy" so that while typing you could see what you were printing —when to hit the carriage return and line feed, etc.

With the "shift pot" system it was not possible to place the keyboard and printer together for local copy without using a polar relay. (W6NRM in his Mark IV series converter does quite cleverly get around this by using a special clamper tube.)

As polar relays are a potential trouble source and frequently get out of adjustment (besides often presenting RF interference problems due to arcing of the relay contacts) most amateurs have attempted to discard polar relays from transmitting circuits as well as from receiving converters. In fact all but a few of the leading authorities (including Teletype Corporation themselves) have discarded all polar relays for RTTY operation.

With the "Mainline FSK System" no polar relays are needed, since the system uses a "super-saturated diode" to key the transmitter. This system requires no voltage regulation and allows for great latitude in design—which enables one to drive it directly from the converter's own output loop supply; thus keeping all keyboards and printers in series for both receive and transmit. Thus with no relays, etc., one could have three or four printers in series at once, with an operator keying the transmitter from each printer, if desired.

*Heterodyne Type Exciters

Another feature that is often nice to have available is "retransmit" which allows you to key several transmitters at the same time automatically from either the keyboard or the converter.

With "retransmit" circuits, you can use the same simple method to key either a low frequency transmitter for 80-10; and also key the VHF transmitter, as an example. With this circuit, one can also receive from a second receiver and feed this into the converter which can then transmit directly off the air.

As an example one evening while talking to W6NRM on 40m he was copying W6AEE on 80m on a second receiver-antenna and let me "eaves-drop" on Merrill's conversation, which was not loud enough in Michigan to copy directly from 80m.

Thus the "standard" Mainline driver circuit will offer retransmit.

The standard driver will put the printer at about 15-20 volts potential with respect to ground during mark. Should you prefer to ground one side of the printer, you can then use the alternate driver, but will sacrifice the retransmit feature.

Thus we will now list the advantages of the super-saturated diode method used in the "Mainline FSK System":

1. A "permanent" shift that will stay correct at 850 cycles over a period of months and years.
2. Allows all keyboards; printers; reperforators; tape readers, etc., to remain in series for transmit as well as for receive.
3. Uses no polar relays.
4. Uses no shift pots to worry about properly setting.
5. Has narrow shift CW ID with normally open key.
6. Requires no separate voltages other than the regular supply in the converter.
7. Requires no shielding or shielded wires.
8. Utilizes reverse cut-off bias for optimum square-wave generation and frequency stability.
9. Is easily constructed and adapts readily to nearly any type of transmitter.
10. Was designed especially for SSB transmitters using the usual heterodyning VFO.
11. Requires no alteration or modification to existing transmitters.
12. Does not affect normal voice transmission of either upper or lower sideband as no adjustments on the transmitter need be made.
13. Does not require the transmitter to be removed from the cabinet.
14. Regulated voltages not required, needed nor particularly desired.
15. Offers retransmit in standard circuit with printer at nearly ground potential.

THE MAINLINE KEYER

Some transmitters, such as the Collins, heterodyne in such a manner that it is necessary to have conduction on mark rather than on space (which is standard). Some, such as the HT-32 series Hallicrafters and the Viking Invader must have a system where you can have conduction on mark on some bands and during space on others. As an example, the HT-32 needs conduction during 10, 15 and 20 on space, and during mark on 80 and 40.

So it is necessary to have three separate basic keyers in order to simplify circuit design. In the November issue an "universal" keyer was presented, and this shall be retained for those needing it, but since this used several extra components that would not be necessary for the majority of transmitters, all three keyers will be illustrated and one of these will be correct for nearly any transmitter.

Figure 1 shows the "Mainline FSK Keyer A"; which requires positive voltage at point *X* for conduction. Figure 2 shows the "Mainline FSK Keyer B"; which again requires positive voltage at point *X* for conduction, but will be used with a particular driver circuit for those transmitters requiring reverse operation on some bands.

Figure 3 shows the "Mainline FSK Keyer C" which requires negative voltage at point *X* for conduction. This keyer will rarely need to be used, except for certain Collins items such as the "S-line", etc.

Most small germanium diodes have a dark ring of color around one end – this is the cathode or "bar" end. The opposite end is the annode or plate, represented by the triangle in the diagram. To the right of each keyer will be seen the "picture" of the diode showing proper installation.

At this point we suggest that should you have access to the November 1962 RTTY* where we previously discussed voltage-reversing circuits (under the SSB section of the discussion), as it will better help understand the standard and alternate systems which we now present.

The following table represents the voltages that would be gotten during mark and then during space (open keyboard) from the various taps when set approximately at the positions shown in Figure 4 on the standard Mainline FSK Driver:

TABLE A

TAP	MARK	SPACE	KEYER
A	– 30	115	A
B	– 75	70	B
C	–115	30	C

You will then note from Table A that we get voltage reversal from any tap, and that properly selecting the tap-keyer combination we can have conduction on mark; on space; or on either—of course For point *B*, a switch (DPDT) will be needed to reverse the shift.

Next we illustrate the Alternate Mainline FSK Driver circuit:

*Now out of print

TABLE B

TAP	MARK	SPACE	KEYER
A	115	– 30	A
B	70	– 75	B
C	25	–120	C

An interesting comparison shows that although tap *A* takes keyer A in both Figure 4 and Figure 5, that in one case you conduct on mark and the other case you conduct on space.

So you can now see that one of these six combinations will fit nearly every transmitter under nearly any circumstance.

These Tables and Figures will be used in the next six or seven articles to show the method by which various transmitters may be used for FSK in conjunction with the Mainline FSK System.

Article VII in the series will use Point *D* of Table A for Collins S-line transmitters; Article VIII will utilize point *C* in either Table for Hallicrafters and Johnson equipment.

Even transmitters such as the 100-V; 200-V; and Heath HX-10 Marauder (all having a built-in FSK system) can achieve superior results by use of the Mainline FSK System. However, they need not add any of the keyers, since these are previously installed at the factory. Subsequent articles will deal with adapting this system to those transmitters.

ADAPTING TO ELECTROCOM FSC-250

Many other possible circuits may be and have been worked out, but they have all been consolidated into the final systems shown in Figures 4 and 5 for simplicity.

The illustrations shown adapt immediately to the Mainline Converter described in the January 1963 RTTY. They adapt immediately to the Electrocom FSC-250, and indeed to any converter using a separate power supply for the keyer tube. In the event your converter has no separate power supply, you can still utilize Figs. 4 or 5 by plugging into the present keyer jack with a power supply such as is shown in Fig. 4 in this manner:

In Figure 6, R-4 would be rendered inoperative when plug P-1 was inserted into jack J-2 on the converter, and R-3 would then be used to regulate the loop current.

Since many converters continue to use polar relays, Figures 4 or 5 adapt very easily to circuit of this nature, also. Merely ground the bottom of Jack 1 and eliminate the keyer tube entirely. Then use this circuit (abbreviated) shown in Figure 7:

This system offers the advantage that the loop voltage only appears on the printer for a fleet moment as the polar relay commences to close. Unlike most circuits, then, there is no constant high voltage on the printer during the entire space signal.

The Mainline FSK System will adapt to the vast majority of converters, then, and offer the advantage of not requiring the printer or keyboard to be switched back and forth from the converter to some special transmit loop supply.

DISADVANTAGES OF THE SYSTEM

The disadvantages are inherent in a "permanent" system when used in certain types of transmitters, and although relatively unimportant should at least be called to the attention of the reader.

Most VFO's tune a variable condenser to change the frequency. Since the FSK system is in parallel with this condenser, a small change in shift will occur from one end of the VFO to the other. However, most CW bands occur in the same general part of the VFO dial, as a rule, and this change then becomes quite minor. The HT-32, etc., are the only offenders, and it is entirely possible to have the shift change perhaps 50-80 cycles from 20m to 80m toward the other end of the dial. It is therefore wise to purposely set the bit wide on twenty as it will then be a bit narrow on eighty. However, this is nothing to get concerned about, as if you are within 50 cycles of correct shift even the best converters *normally* show perfect patterns on the scope.

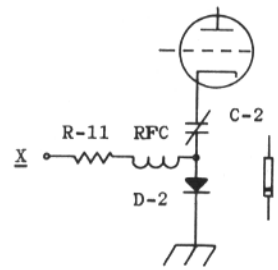
The other disadvantage will only be of importance to those who deliberately like to change the shift for experimenting with "narrow shift", etc. However, it is this very thing that causes the majority of stations to never know for sure the setting they have, as they change it back and forth so frequently. It is our opinion that a person desiring to play with narrow shift should install a second keyer and then at least one of the two units would always be correct, as it would need not be changed. At K8DKC, we have done this, and have one keyer for standard shift and the other keyer set usually for 170 cycles, although it is used only on rare and infrequent occasions—a switch changes the voltage between the two keyers and we can instantly go from correct 850 shift to correct 170 shift and return; having made no adjustments of any nature.

CONCLUSION

Were you to random sample the shift of the next 50-100 RTTY signals you hear on the bands, you would no doubt be appalled at the quite low number that even approach correct shift. In fact out of the last several months we have only found three stations that were within 30 cps of 850 cycles and one of them was using a commercial AFSK keyer.

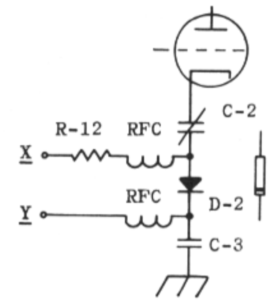
The truth of the matter is that a majority of stations have shifts that are between 700 and 800 cycles, which they call "850". If much less than 700, usually somebody then mentions to them that the shift is off somewhat.

In order to set 850 cycles and keep it, the Mainline System should be used, or some similar method not relying on electronic "tricks" of partial conduction with shift pot circuits, etc.



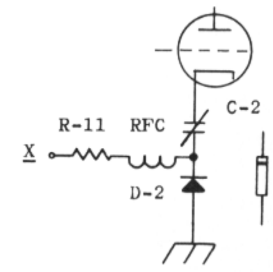
MAINLINE FSK KEYER A

FIGURE 1



MAINLINE FSK KEYER B

FIGURE 2



MAINLINE FSK KEYER C

FIGURE 3

STANDARD MAINLINE FSK DRIVER

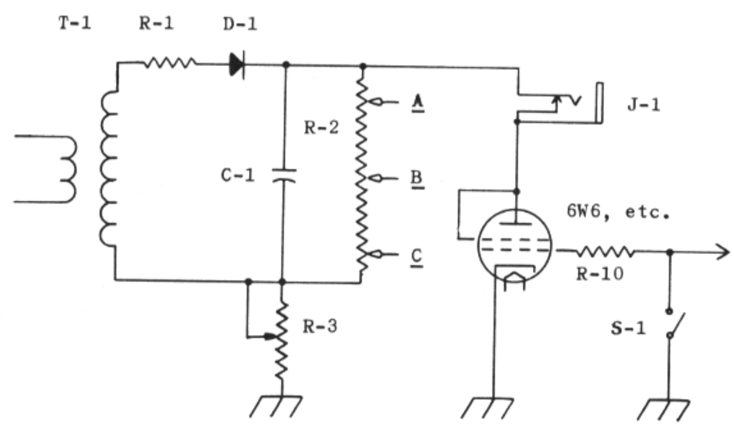


FIGURE 4

This cannot be emphasized too strongly, both to the newcomer to RTTY as well as to the old-timer, who is often the worst offender, as he is more prone to assume no corrections are necessary in his equipment than is the person just starting who is more cognizant of the possibility of being in error.

The keyers hook from point *X* to the proper tap, with R-5 in series if narrow shift CW ID is desired. As the narrow shift CW circuit varies depending on whether you use conduction during mark (variable CW ID possible) or during space (fixed shift for CW), these CW ID circuits will be included in later articles as a specific part of a particular recommendation for each individual transmitter, and will not be included at this time in this general article.

The Mainline FSK System also readily drives AFSK units, as will be shown in a later article.

PARTS IDENTIFICATION

T-1—Stancor 8421, etc., (150 volts at 60 ma or more).
S-1—SPST toggle switch—mutes converter when you do not wish to print; also converts for transmit.
C-1—At least 40 MFD at 200 WVDC or better.
C-2—3-12 MMFD Variable such as Erie 503; Crl 822; non-drift.
C-3—Not critical—0.01, etc.
RFC—2.5 mh RF Choke, miniature size (only draws 4-5 ma.).
P-1—Standard plug to fit Jack J-1—be careful to use only the shell terminal and not the usual tip terminal.
P-3—Standard plug to fit Jack on the bottom of the Mark IV unit; use the tip terminal in this case.
J-1—All RTTY units go in series at this point—all terminal distributors for tape; keyboards; printers; and reperforators, etc.
J-2—Jack on current TU that doesn't have seperate power supply for the keyer tube circuit.
D-1—Silicon power rectifier—at least 100 ma at 400 PIV.
D-2—Germanium diode — 1N270; 1N100; 1N297; etc.
R-1—22 ohm 2W surge resistor.
R-2—(You could use a 2-watt carbon pot here, but since it is a "set-and-forget" unit, we recommend a wire-wound fixed resistor with variable tap. They come in large wattages in this resistance region but do not be alarmed at they take under 1 watt from the loop supply.)
20 ma loop 10K 10W
60 ma loop 25K 25W (unavailable in 5W or 10W).
R-3—Depends on loop current:
20 ma loop 7500 ohm 25W, variable WW
30 ma loop 5000 ohm 25W, variable WW
60 ma loop 2500 ohm 25W, variable WW
R-4—Present resistor in TU.
R-5—5K 5W isolating resistor for narrow shift CW ID.
R-6—50K pot for CW ID—normal ½W carbon.
R-10—470K ½W bias resistor for keyer tube.
R-11—18K 1W.
R-12—10K 1W.

ALTERNATE MAINLINE FSK DRIVER

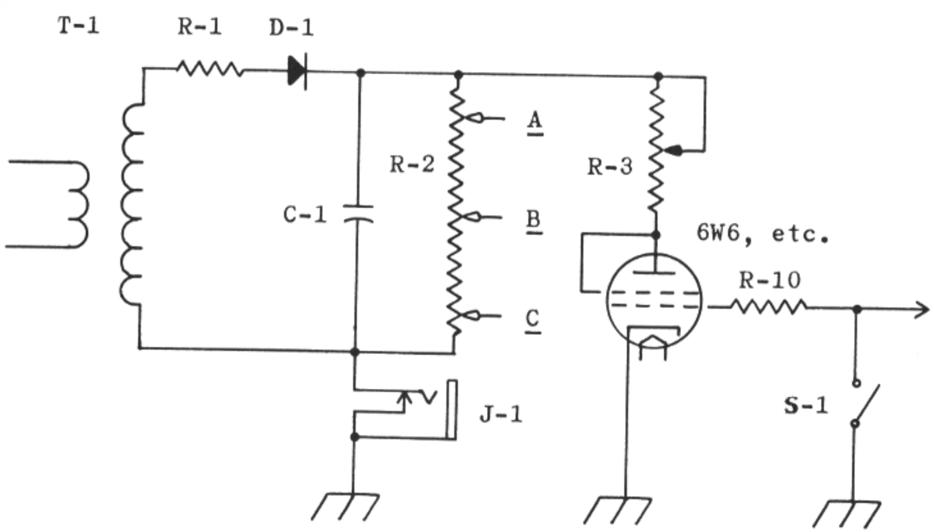


FIGURE 5

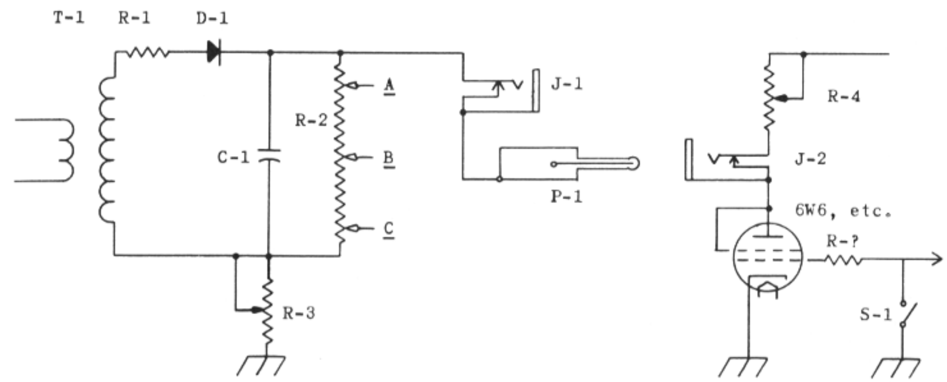


FIGURE 6

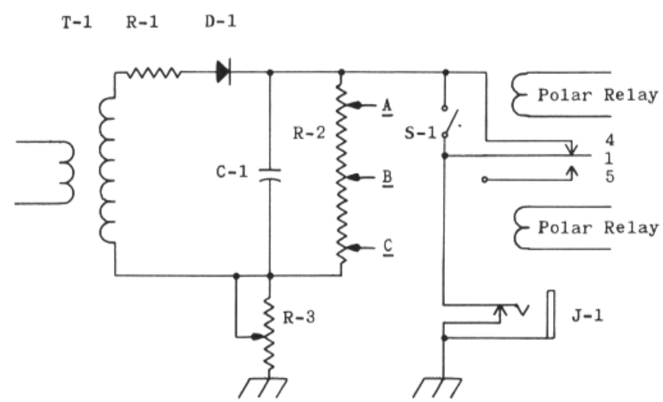


FIGURE 7

PROPOSAL FOR INCREASED SPEEDS OF OPERATION IN AMATEUR RTTY

It has been considered by many RTTY operating amateurs that speeds of operation other than only 60 WPM would be advisable. While the present 60 WPM speed is generally satisfactory for manual keyboard sending, the use of perforated tape transmission indicates a faster speed is desired. With the use of tape transmission in high volume traffic stations the 60 WPM speed is not very efficient of "Air" time. It is obvious, that at higher speeds more accurate traffic could be sent at higher volume with lower reception error and distortion than at low 60 WPM speed. Also, in the future equipment being released by the commercial communications people will be designed for the higher speed operation. In some cases, the 60 WPM will be available with the higher speeds, but much of the equipment will be designed for 100 WPM or higher speed only. The commercials are going to 100 WPM in favor of 60 or even 75 WPM speeds. More and more conversions are being made to the higher speeds as equipment reaches the market. The 60 WPM speed is now considered obsolete.

Any consideration of higher speeds for amateur operation should be based on present commercial standards. With presently available machines, the 60-75-100 WPM speeds could be used. 75 WPM should be included, so that the 14/15/19 series Teletype Corp. equipment might be used. The 28 series will operate at the 100 WPM speed as well. The military and civilian version of later Kleinschmidt equipment will operate on speeds to 100 WPM. It can be seen, that the 60 WPM speed should not be done away with or replaced by the faster speeds, but offer the possibility of higher speed operation to those amateurs who have the equipment and desire for the faster speeds. The speed availability would be much the same as our present variable shift condition. We are not limited only to 850 cycle shift, but can use any shift to 900 cycles. This has served no burden on any of the amateur RTTY operations, but has in fact indicated many advantages with narrow shift that would have not been available if the regulations were not changed to allow variation.

In many traffic networks the higher speeds would allow faster more accurate high volume copy to be sent in less on the air time. While as pointed out, in manual keyboard sending higher speed operation would serve little or no advantage, the use of tape can use the full effective advantage of high speed. In many auto-start nets and local nets tape is used, and when many stations participate in such nets, the higher speed, even 75 WPM would be a help in speeding operations. If at such a time national or world wide traffic networks for RTTY are formed, the high speed operation is the only system that would be satisfactory. No additional equipment would be required for either transmission or reception of higher speeds with the exception of simple gear change in machines. Many amateurs have two or more machines and can operate one at 60 WPM, and the other at 75 WPM or even 100 WPM. In fact, many of the model 15 and 14 machines are equipped with 75 WPM gears upon receipt. It is easier at present to find printers with 75 WPM gears than with 60 WPM gears. There should be no problem with FCC monitoring of variable shift speeds since they have indicated recently that they are not even equipped to receive 60 WPM RTTY in many locations. All I.D. is made in CW or Phone as the regulations require. On this basis, the FCC should have no objection to the use of higher speeds anymore than they have objected to narrow shift.

Some amateurs have expressed the fact that any speed other than 60 WPM would obsolete their machines. While it is true, that the model 12 and 26 printers and much of the old Western Union equipment is low speed only, it should be remembered, that the use of higher speed operation is with tape and in nets that are for the most part all tape. For manual keyboard sending the 60 WPM speed is just as good as any other and for most casual QSO's the 60 WPM speed will be used and retained for many years. However, it should also be remembered, that the older machines as the 12 and even the model 26 are now obsolete, and the model 15 series soon to follow. The Teletype Corp. no longer stocks parts for the older units. With these considerations in mind, the investigation into higher operating speeds should be made now, before many more of the newer printers are available.

While no doubt there are many reasons why higher speeds are an advantage, there are also many possible considerations to retain the 60 WPM speed only for amateur work. It is the desire of the writer only to poll the RTTY amateurs as to opinion and comments to the use of high speeds in RTTY. If upon due consideration it is felt by the majority of amateurs that such high speed consideration should be made, then it would be advisable to petition the FCC for such changes in the rules to allow the use of 60, 75, and 100 WPM speeds in amateur RTTY operations. If on the other hand discussion indicates that the 60 WPM speed should be retained *only*, then at least future thoughts on this matter would be relegated to past opinion. I am sure that sooner or later this subject will come up for consideration and should be aired both from the technical and operating advantages.

A. A. Panzer, W8ZEP

NOTE: The opinions expressed in this proposal are those of the writer only, and do not represent any group, organization or society. The NORTHERN OHIO TELEPRINTER SOCIETY is acting only as a clearing house for comments and opinions of other amateurs on the subject of RTTY speed change considerations.

ERRATA — MARK IV TU ARTICLE (March 1963 RTTY)

Two errors have been discovered in the Mark IV Terminal Unit article. Corrections are as follows:

(1) The output transformer that drives the discriminator from the 6AQ5 output tube is *Stancor A-3878;* not A-3738.

(2) The "vectorpins", type 65-IT, are not manufactured by Vector Electronics. The exact type referred to is type 651-T, manufactured by Alden Products Company, 3167 N. Main, Brockton, Massachusetts. Price—$8.00 for package of 1,000 "miniature ratchet terminals". It is to be noted however that Vector makes some pins for their boards, such as the type T9.4, but these pins are bigger and somewhat clumsier than the Alden pins referred to above.

For information, specifications follow on the output transformers applicable to the Mark III/IV TU designs:

Stancor A-3332 is an output transformer, 2000 ohms to 4 ohms. (5 watt)

Stancor A-3878 is also output transformer, 7000 ohms to 4 ohms. (5 watt)

Also, transformers of other impedances are available, such as:

Stancor A-3329, an 8000 ohm to 4 ohm unit; ideal for coupling the TU's 4-ohm input out to 8000 ohm headphones or similar high impedance devices.

Stancor A-8101, a line-to-voice-coil transformer, impedance 500 (600) ohms to 4 ohms; ideal for feeding TU input from receiver having 600 ohm audio output. For this purpose, replace the A-3332 unit with this one.

de W6NRM . . .

NEWS . . .

Received the following message from W3MUA today via 14 Mc. SSB at 1840 GMT this date.

W3MUA, Gordon, Damascus, Md.

PHILLIP CATONA, W2JAV, IN HOSPITAL. HAD OPERATION. VERY LOW. GALLSTONES. WOULD APPRECIATE GET-WELL CARDS. TELL OTHER TELETYPE HAMS PLEASE. ADDRESS: JEFFERSON HOSPITAL, 10th AND WALNUT, PHILADELPHIA, PA. ROOM SCAR 28.

1963 ARRL PACIFIC DIVISION CONVENTION, FRESNO, CALIFORNIA MAY 18-19, 1963

The Fresno Amateur Radio Club will host the 1963 ARRL Pacific Division Convention in Fresno, California, on May 18-19. Headquarters for Convention activities will be The Towne and Country Lodge.

Registration at $6.50 per person includes the banquet dinner, and must be postmarked not later than May 7, to be eligible for the pre-registration prize drawing.

ARRL President Herbert Hoover, Jr., W6ZH, and ARRL Pacific Division Director Harry Engwicht, W6HC, are featured speakers. ARRL National Emergency Co-ordinator George Hart, W1NJM, is an expected guest.

A full slate of technical talks and demonstrations are planned and many interesting activities for the ladies' program will be arranged.

Requests for additional information, motel reservations, and registrations should be sent to: Registration Chairman, Howard Craven, W6DUD, P. O. Box 783, Fresno, California. The Convention General Chairman is Tom Dixon, K6YDU.

NEWS . . .

"Naturally, I have a beef to pass along—nothing bothers me more than to hook up with a station using a machine that does not shift back to letters when they go to upper case on abbreviations or figures, I spend half my time fighting the machine, trying to get it shifted back to letters, so won't have to read a bunch of figures, symbols, etc.—WØDML."

EDITOR'S NOTE: *It's good practice to use both figures and letter keys to shift both ways. Also it is proper to end each line or TRANSMISSION with two CR LF LTRS. Lack of transmitting these, is the sure sign of a "NEWCOMER to RTTY operations."*

"Tuned across the band and saw W4MGT's 'little wiggle' but didn't have time to fire up and see if I could still print the stuff—the 'little wiggle' is what I get on the X scope from his narrow shift and think it is an appropriate name for the narrow shift. Conversly I have seen a few 'Twist' signals—that those guys with too big a 'wiggle.'"

Hi, WØPHD

DX-RTTY

Hi Gang:

Due to the illness of my XYL, operations at DX HDQ have been necessarily curtailed this month. Thanks to K3GIF, DL4IA and W8SDD for the following DX news items. Hope things improve so I can be back with the regular report next month—73.

Bud, W6CG

ITEM —

DL4WR/P, Larry — WB2BYB — operating portable from Hanau, Germany, has been putting a fine signal into the east coast on 14 Mcs. He is using a Collins 500 Watt rig—Motorola R390 receiver. All this in a van and powered by a mobile power unit. Larry is finishing his hitch in the Signal Corps and will be returning to his New Jersey home by the end of April.

ITEM —

SVØWT, John — W4BKJ, Columbia S. C.—is quite active from Iraklion, Crete. John has worked W8SDD as his first American QSO followed by K3GIF and W1BGW. He is with the Air Force and has been in Crete since the first of the year. He is using a BC-610 into a dipole. His receiver is a 75A4. Machines are a pair of 15's with a 14 typing reperf.

ITEM —

At this moment the German RTTYers are by far the most active in Europe—their allocations are as follows:

Eighty Meters . . . 3580 to 3600 Kcs.
Forty Meters . . . None
Twenty Meters . . . 14100 to 14120 Kcs.

NEWS . . .

QST QST QST RATTS NET QST QST QST RATTS NET DE W6CAL W6CAL W6CAL RYRYRYRYRYRYRYRYRYRYRYRY Amateur RTTY Stations are urged to monitor RATTS Net for traffic and bulletins. Regular net frequency is approximately 3625 Kcs.

Commencing 1 March 1963 the scheduled net times are:

Monday—9:00 to 9:30 P.M. PST
NCS—K6DYX
Thursday—9:00 to 9:30 P.M. PST
NCS—W6CAL
Friday—9:00 to 9:30 P.M. PST
NCS—K6DYX

Messages shall be listed by destination and held ready on tape for immediate transmission. Net control will also accept third party traffic for distribution on this net or for relay via the National Traffic System.

To assure the speedy clearing of traffic: Please—No QSO's or general comments until after net time.

TNX DE W6CAL

BUD SCHULTZ, W6CG
5226 North Willmonte Ave.
Temple City, Calif.

RTTY is not allowed on fifteen, ten and six meter bands.

ITEM —

DL4IA reports that CN8HP—Buz—will put Morocco on the air momentarily. TA2TC is about ready to get on FSK from Turkey. Bill also says that HB9KU is expected to start sending bauds from Switzerland very soon now. DL4II is coming on the air with his Knight T-160. DL4GG is now using the HX-10 with a new Warrior linear. DL1VR, Munich, is reported to have worked Okinawa on RTTY recently. DL4IA reports hearing several KR6 stns. but was unable to raise them. ON4HW is off the air with RTTY. WILF says that after a year of tests at ON4HW the Belgium government decided against further FSK operations.

ITEM —

W6UGA broke the ice to Europe by working Bill, DL4IA. Many of the west coast Hams are getting their licks with the Europeans on twenty meters these days. South African contacts during the past month have been very poor. YV1EM has been coming thru on 21 Mcs. with fine signals.

ITEM —

Cas—HL9KK—has received permission for RTTY operation on all bands but will restrict his operations to 14090 and 7040 Kcs. He sent in copy made during the last contest on the following: K7CET, W7ESN, W7PHG, W6CG. Korean CW stations have been logged on the west coast recently around 0130 GMT on 14090 and about 0900 GMT on the low end of forty meters.

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RTTY Society of
Southern California
and is published for the benefit of all
RTTY Amateurs and Experimenters

For "RTTY" Information:
W6DEO W6CG W6TPJ W6AEE

HORSE TRADES

FOR SALE: Gear part number 97576 for tape gate, 60 wpm, brand new, $1.00 PP. W8MTI, 4761 Baldwin Street, Onondaga, Mich.

WANTED: Comparator keyer CM-32, part of FRR 24 Terminal Unit. W4BOC, 32 2nd Avenue, N.E., Atlanta 17, Georgia.

FOR SALE: Model 15 $100.00, new condition. Complete with cover, table, rectifier and sync motor plus new Boehme AM-103B/U make-break converter. Model 15 $75.00, complete with cover, table, rectifier, and syn motor. RME-45, all-band receiver from .540 to 33.0 mcs with manual, $60.00. Vertical antenna, $15.00. 10.15.20.40 meters Mosley V-4-6. WA6VVR, 850 Linden Lane, Davis, California.

FOR SALE: 14 Teletype Sed-Receive reperf with 14 Teletype trans., $100.00. D. J. Wagner, 6207 Sylvester Way, Carmichael, California.

FOR SALE: 11/16" good quality oiled tape — 10 rolls/$2.25 or 40 rolls (case) $8.00, FOB. 10 rolls 13 lbs, case 50 lbs. Punctuation type palletts for model 14 or 15 (specify which machine) $0.15 each. Keytops, $0.30 each. 82484 brush holder with brush, for sync motor starting switch, 3 for $0.50. 74185 pull bars for 14 and 15, 20¢. 150439 gear for model 28, page printer. Safety glass for 15 or 19 cover 95¢. Open type tape reel for 11/16" tape (14 typing or nontyping reperf, 14 tape perf, FRXD, etc.), $2.00. 103628 tuning fork, 87.6 VPS, gvnd motor speed indicator. $5.00 PP. Model 14 typing reperf, or tape printer base, with polar relay socket, cables, diagram, etc., $4.75, for low base (has tape out alarm mechanism), $9.75 for high base (has tape reel). Complete manual (1" thick) model 28 page printer, $7.50. W4NZY, 119 North Birchwood Avenue, Louisville 6, Ky.

FOR SALE: Model 14 tape printer, with kybd, series AC motor, $25.00. Model 14 tape printer, with kybd, sync motor, $50.00. Model 14 nontyping reperf, w/o cover $35.00. Klienschmidt tape transmitter, w/o distributor, $25.00. W5KQJ, 3742 La Joya Drive, Dallas 20, Texas.

FOR SALE: Boehme keying head and driven, not all original, $50.00 or trade for Teletype. John Riley, 914 North Cordova Street, Burbank, Calif.

FOR SALE: Half-Dux 14, 15, TD, CV-89, BC-221 exciter, Switcholitte set up. WA6AVJ, 4135 Jackson Street, Arlington, Calif.

WANTED: VFO with built-in FSK TTY shifter. Prefer one that covers amateur as well as MARS frequencies. Also desire monitor scope for shift calibration use. Give complete details in first letter, including shipping costs. K4FPW, 1935 Strathmoor Blvd., Louisville 5, Ky.

FOR SALE: Spare AN/FGC-1, complete with tubes and in good working condition. Photographed manual included. W9WKC, 517 South Market Street, Hoopeston, Illinois.

FOR SALE: Model 14 typing reperf, $39.00. Model RA-87 pwr supply, $9.00. FGC-1 TU's complete in cabinet, $95.00. 11/16" reperf tape, case of 40 rolls, $8.00. Send for list of additional equipment. W5LCU, P.O. Box 174, Harlingen, Texas.

FOR SALE: Model 14 typing reperforator with keyboard, no cover or end of line indicator, $60.00. W8PHG, Route 6, Midland, Michigan.

FOR SALE: BNC type connectors, great for shielded leads. Chassis socket or male plug, either type 4/$1.00 PP. W1FSH, 93 Tanner, Manchester, Conn.

FOR SALE: RTTY Hand Book, $3.95. CQ Magazine, 300 West 43rd Street, New York, 36, N.Y.

LEN SMELTZER, W4KZF