RTTY

NEWS OF AMATEUR RTTY

MAY, 1962
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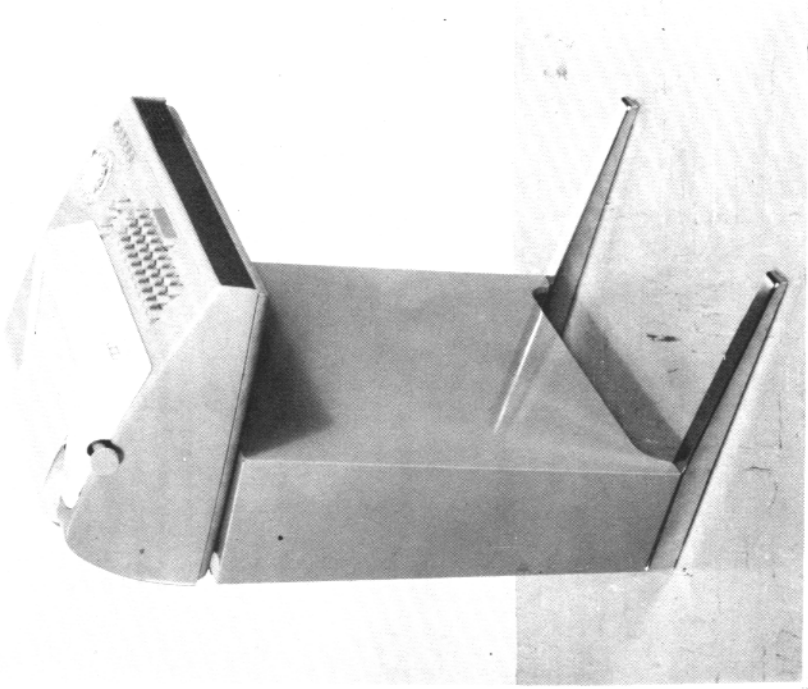


Model 32 Teletype

RTTY, Inc.
372 WEST WARREN WAY
Arcadia, California
Return Postage Guaranteed

PASADENA MAY 5 5 PM 1962 CALIF.

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.

WANTED: Facsimile equipments, Frank Crosby, OA5BN, P. O. Box 538, Lima, Peru.

SWAP: Hallicrafters S-76 for TTY Machines. State model number and condition. Bill Price, 619 North 12th, Petersburg, Illinois.

FOR SALE: Model 14 receive only, typing reperf. Sync motors, comm type, refinished covers. FPR-5 and FPR-21 types. Model 14 TDs. H. Carter O'Brien, W6YJG, 1123 Pine St., Santa Monica, Calif.

FOR SALE: 70 Boxes of Teletype paper, each box has 1150-6 part copies, more than 12 rolls of paper. Price $2.00 per box. Brownie. c/o Radio Products Sales, 1237 16th Street, Denver, Colorado.

FOR SALE: Model 100 Western Union printer (page printer). Ed. W1MCG, 3 West Street, Arlington 74, Mass.

WANTED: Manual for Telegraph Repeater, TH-18 ()/FG mfg by Stelma, Inc. Bill. K1CLD, Piermont, New Hampshire.

WANTED: Model 19 or 28 with tape. Pete, WOEWQ 2363 East 16th Avenue, North St. Paul, Minn.

WANTED: O5B/FR or O5C/FR or similar FSK exciter. Also URA-6 Converter. Sync motor for 19. W3LST.

FOR SALE: Howard Alltronics TU. Joseph Szabat, W3LST, 228 Plummer Street, Oil City, Pa.

FOR SALE: Model 15 (rebuilt) holding type selector, sync motor. Comm type Metal table, 85.00. Merrill Swan, 372 Warren Way Arcadia, Calif.

SPECIAL TO THE AMATEUR RADIO SOCIETY OF HARRISON

Club Bulletin*

TELETYPE FOR THE RADIO AMATEUR

Based on a talk given to the Club on November 2, 1961
by PAUL B. BOIVIN, JR., K2SKK

The first question asked by those who are exposed to radio teletype is naturally "Why?" One can communicate by voice so much easier these days, so why bother having to sit behind a typewriter keyboard clanking out what you could say in half the time? We will have to admit that radio teletype, commonly abbreviated as "RTTY", is much slower than voice, but then, so is c.w. for that matter, and who challenges the validity of International Morse as a way of communicating? Average c.w. operators can receive at around 20 words per minute, with the "old pros" hitting up around 50 wpm. The teletype machines available for ham use have a range between 55 and 65 wpm; speech varies from 100 wpm for a slow thinking male to 200 wpm for a gossiping female! We won't go into intelligibility, for we assume that it is understood that what the sender is transmitting makes sense to the receiver at the top speed posible. One can send 40 wpm c.w. to me and I will hear it fine; but don't ask me what is coming through since I "cut off" at 18 wpm! But the teletype machine follows right along at 60 wpm without thinking – writing down exactly what was sent at the other end.** RTTY, then, fits in between c.w. and speech as a mode of transmission, and appeals particularly to the experimenter with a mechanical mind. To the operator-oriented individual, RTTY has tremendous advantage in message traffic handling.

HOW DOES RTTY WORK ON RADIO

The teletype machine looks and acts very much like an electric typewriter. What is typed on the keyboard shows up on your own paper and simultaneously on the paper of any other machine that happens to be tuned to your transmission. You have a written record of what you are sending, and so does the receiver – no matter how far away he is.** Between the two machines there are quite a bit of technical details – which we will attempt to explain to you here.

Teletype transmission works on pulses – very much similar to Morse code. The code is binary – that is, composed of two conditions; ON or OFF. In Morse code, the key-up condition is "OFF" and the key-down is "ON" forming the code groups. Dashes are formed by holding the key down three times longer than the dot, and so different time-lengths of code come into the picture so that one recognizes "didah" as "A" and "dahdididit" as "B", etc. The teletype machine works on the same principle except that the code is slightly different. There are no "dashes", but all "dits". The number of dits transmitted or not form the code group. Below is a simple illustration of the teletype code group for the letter "R".

The BAUD is defined in the textbooks as "the unit of signaling speed equal to the number of code elements per second." Therefore, BAUD = SPEED, In the motion of your car, your speed is in "miles per hour" or "feet per second". In pulse modulation, we take a "code element" as a binary "bit". One baud then becomes simply "bits per second."

In the 368 O.P.M. (operations per minute) 60-speed RTTY system, one "bit" is 22 milliseconds long, or .022 second. Since .022 can be divided into one 45.45 times, one BAUD then equals 45.45 bits per second. The "bit" is the time-length of the pulse, the baud is the speed of the pulse, and the operation is the process it takes to print one character. A free-running teletype machine tranmitting nothing else but letters (no space between) could then transmit 368 letters in one minute. All other non-printing functions – such as space, shift, carriage return, etc., take up one operation

*RTTY is indeed grateful to The Amateur Radio Society of Harrison for granting permission to reprint this material.–Ed.

**Assuming solid reception free of QRM and QRN.

each and when transmitted take same time as a character even though they are not printed. Thus, in RTTY, a "5-letter word" takes six operations since you must have a space between the words. The "word" in RTTY then is 6 operations long for calculations.

In International Morse Code, the "dit" is the binary unit, and the number of "dits" per second will give you the speed of BAUD. Since the "dash" is three "dits", and the space between "dits" and "dahs" is one "dit", and the space between letters is one "dash", it is an easy matter to figure out the BAUD and operations for a particular code speed. Unfortunately, the length of the Morse characters is uneven: "zero" is five dashes separated by four dits for a total of 19 dits, while the letter "E" is only a single "dit". Yet both letters require the same amount of time to print, either manually with a pencil (using the brain as a selector and fingers as mechanical printer) or with a "mill" (typewriter). It should then be possible for you to copy the letter "E" 19 times faster than "O"; does it?? In RTTY, all characters have the same time length code and so the operation speed is constant.

With this in mind, remember that the teletype printer carriage must return from right to left at the end of a line in the same amount of time that it takes to print one letter–or .16 second! If the carriage returns too slow, the next letter at the beginning of the next line will print half way on the next line, thus:

. . . TLFCB FMBNU SHRLF GNUBD SNVTB

LVCD SMGBF FGBHY IHJKR . . . (B)

This should be "BLVCD", but "B" is here

You can better appreciate this if you have had much experience with a typewriter.

The teletype machine keyboard is similar to the standard typewriter keyboard in use in the U.S.A. There are only three rows of keys, however, since only capital letters are used. There are two functions for each key (upper and lower case) so that the numbers one through zero are on the same keys as the "Q W E R T Y U I O P" letter row. The upper case of the two other rows include functions and punctuations. Only five functions have no upper case:

Every time a key is depressed, the mechanical action of the machine trips mechanical drum contact levers in the proper sequence to form the code group for that particular letter as shown above. The "start" and "stop" pulses are synchronizing pulses and are automatically sent with each letter – thus keeping the receiving printer in step with the transmitting printer. Since the teletype code is binary (i.e., "ON" or "OFF") we can then transmit the code groups as current pulses in a pair of wires. The "ON" condition is then 20 milliamps of current and the "OFF" condition is zero current. This is exactly the way commercial (TWX) teletype is operated – by passing current pulses between two machines through a pair of wires. It remains then that the radio amateur only adapt teletype equipment to transmit and receive radio pulses instead of D.C. pulses over wire. We shall see later on how this is done.

To continue our explanation of the keyboard, the letter keys actuate the pulse-forming contacts by mechanical crossbar latches beneath the levers. A fingered drum runs at constant speed from a 60-cycle synchronous motor and spaces the pulses at the correct time (22 milliseconds for 60 wpm speed). The time for one revolution (or one letter to be sent) is then 6 times 22 milliseconds plus 31 milliseconds, or 163 milliseconds. This is not only faster than you can write, but faster than you can think!

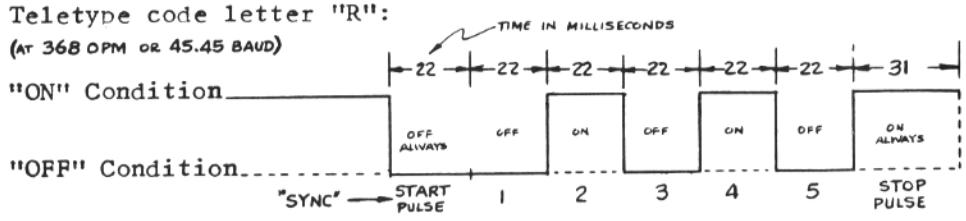
(60 wpm = 45.45 BAUDS = 368 o.p.m
(Bits per sec.)

European "Creed" = 66 wpm = 50 BAUDS
400 o.p.m. (Bits per sec.)

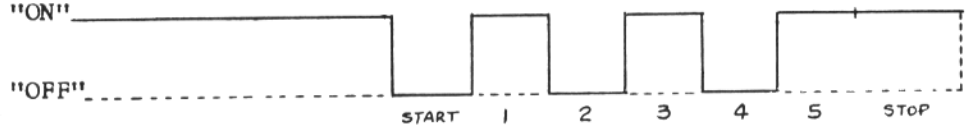
(Naturally the Europeans *must* have a different system than the U.S.A.)

The receiving – or printing – end of the teletype machine is made up of a selector magnet, rotary latch mechanism, the five "vanes" that determine which type pallet (letter or character) to actuate and the continuous printing mechanism. The selector magnet senses the 20 or 60 ma. current pulses from the keyboard, and operates the latches on a rotary wheel geared to the synchronous motor. This enables the latches to be switched in proper sequence and in turn operate the five type hammer vanes. The vanes in turn permit the continuous printing mechanisms to pick up the chosen type hammer and to strike and print the received letter through a ribbon – similar to a typewriter. This all happens in 163 milliseconds – 0.163 second for one letter!

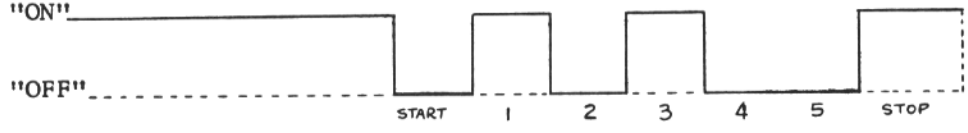
Teletype code letter "R":
(AT 368 OPM OR 45.45 BAUD)



Similarly, the letter "Y" is:



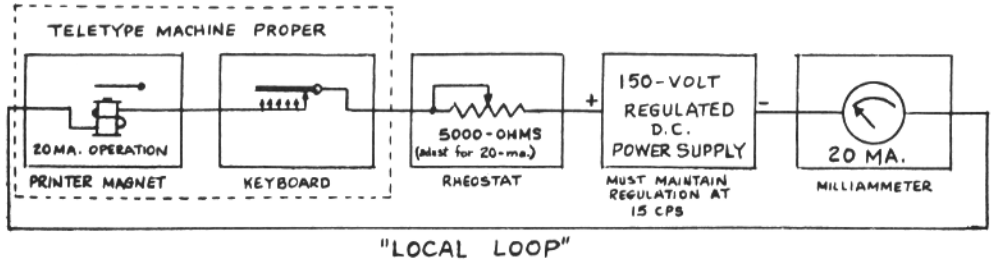
--- and letter "S":



carriage return (1) | line feed (2) | blank and shifts (3) | FIG (4) | LTRS (5)

Combinations: $2^5 = 32 \times 2$ (upper & lower shift) $= 64$ (IN BINARY CODE, COMBINATIONS $= 2^n$ where "n" is the number of units; in our case, $n = 5$; $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$)

Used $26 \times 2 = 52 + 5 = 57$
(LETTERS IN ALPHABET; CHARACTERS PER KEY; NON-PRINTING)



"LOCAL LOOP"

(The "vanes" are similar to the tumblers in a cylinder lock — which line up only when the proper key is inserted into the lock).

A block diagram of the current transmission loop is shown below:

Note that any number of printer magnets and keyboards can be cut into the loop — IN SERIES. This is a "constant-current" circuit for those who are familiar with that type of wiring. To transmit and receive this by radio, then, simply means adding a transmitter and receiver somewhere in the loop. We can't do this too simply, however, since it's more fun to be complex! So a whole system of "terminal" gear is employed, which looks complex at first glance but upon close examination is actually simple.

We could connect the keyboard contacts into the transmitter key jacks. The receiver would then receive this signal as an "on-off" r.f. carried similar to c.w. Since a keyed r.f. signal is hard to copy (thumps), the B.F.O. is turned on in the receiver and a tone is heard. This tone, however, will not operate a printer selector magnet, so an audio tone -to-d.c. pulse converter must be inserted between receiver and printer magnet. We have heard of quite a few RTTY novices who couldn't figure out why the teletype machine would not print when the magnet was hooked up directly across the speaker output terminals on the receiver! (believe it or not!) Systems of this nature —keyboard plugged directly into c.w. key jack—were used in the pioneer days of amateur RTTY; it was called "make-break" keying. This worked fine locally with strong signals, but became miserable with weaker stations—for the same reason A.M. is inferior to F.M. — NOISE. An F.M. system was worked out whereby the carrier was left on continuously but its frequency shifted by the keyboard contacts. This is called FSK, or "frequency-shift keying". FSK is so much better than CK (carrier keying) that most all high-powered commercial stations now transmit International Morse by shifting the carrier.. The FCC classifies FSK as F-1 emission.

Early in the years of FSK RTTY, a shift of 850 cycles was chosen. It was later found that narrower shifts, down to 170 cps, were better for QSB and selective fading. A shifted carrier clearly shows the effects of selective fading. We saw previously that a constant current through the printer magnet keeps the machine at idle. With FSK then, the constant carrier provides this constant current to hold the machine at idle—converted to an audio tone by the receiver and converted to d.c. loop by the Terminal Unit or "TU". The absence of current to form the pulses is accomplished by the shifted carrier — to whatever width desired. Since most gear in use today is designed around 850 cps, that is the standard. The FCC rules permit the use of any shift up to 900 cps maximum. To those versed in d.c. keying circuits, the contacts of the keyboard are neutral while the TU contacts are polar when a polar relay is used. The reason for a polar relay is to overcome the bias distortion that creeps into the transmitted radio loop. An ordinary relay has neutral contacts — the restoring force supplied by a spring which in RTTY pulse could introduce appreciable bias distortion. Bias distortion is either the lengthening or shortening of the pulses from the regular 22 millisecond length, severe rounding of either the leading or trailing edge of the pulses, or providing more or less current for the "mark" signal than for the "space" signal. The more the signal suffers from bias distortion, the more garbled the print on the machine. Many RTTY signals "sound" very good and solid to the ear, but have so high bias distortion that it is beyond any well-adjusted printer to make any sense out of the transmitted pulse. RTTY amateurs have to be very careful to eliminate all bias distortion in order to put out a clean signal — as in any mode of operation.

We now have shifted carrier at the receiver. We will show *how* to shift a transmitter oscillator later on. Engineers have found that two audio frequencies used in AFSK must not have audio harmonics that interfere with each other in the TU filters. The two frequencies of 2125 and 2975 cps are two frequencies that have the least possibilities of interfering with each other and are used for AFSK terminal equipment. The high tone of 2975 cps is used as the "mark" signal and is produced by beating the receiver's BFO against the transmitted carrier. (See Appendix) An 850 cps shift should produce the lower audio tone of 2125 cps to provide the "space" signal. If the BFO is on the wrong side of the received signal, the "space" signal will be 3825 cps instead of 2125 cps. Since the terminal gear has sharp audio filters tuned to 2125 and 2975 cps, 3825 cps will not

work and care must be used in tuning in the FSK RTTY signal. Note also that the steady "mark" tone is the higher frequency. The accepted standards is to shift down. Some stations shift up, which is legal, but will result in illegible print from the machine– what is termed "garbage" by RTTY-ers. Shift up keying is known as inverted keying, and the terminal equipment (TU) should have provisioins for reversing such. Inverted keying can also be reversed by placing the receiver BFO on the other side of the signal – but this is not good for net operation where all carriers or "mark signals" must be on the same frequency. (See Appendix). There is *no* FCC Rule concerning *direction* of shift; common usage is determining factor.

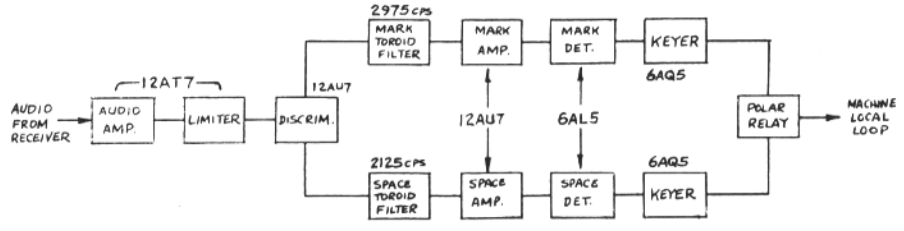
With two audio tones now coming out of the receiver– either from the speaker or headphone terminals – a converter must be inserted to change these audio pulses to DC pulses. These are called Terminal Units – TU – and may be built or bought. Commercial terminal units cost upwards of $1300 today and those made for amateur use (by amateurs) sell for around $200. Many prefer to build their own from already established circuits available in magazines like CQ, etc. The most famous TU circuits come from W2PAT, W2JAV and W6AEE. There are many more but those three are the most popular according to present-day on-the-air contacts. New contacts for TU's are coming into the lime-light by W4EHU and W6NRM. Of course, there are also those who avail themselves of schematics of commercial TU's and build excellent "Chinese copies" of same.

The audio TU consists of a stage or two of 1 kc. bandwidth audio amplification centered on 2550 cps, followed by a limiter-discriminator type of FM detection. The two discriminated audio tones are detected by diodes which key the grids of two separate keyer tubes. In the plates of these keyer tubes is a polar relay which flips either way between two contacts depending on which tube is conducting. The polar relay contacts then become a phantom keyboard and can be inserted anywhere in the local teletype machine current loop. Some people do not like polar relays, so the printer magnet is put directly in series with the plate of the keyer tube – letting the tube act as a current switch. Again, some people do not like electron tubes (like W2JAV!) and use semiconductors instead. As you wish– the idea being to print RTTY in the most efficient way the individual thinks possible.

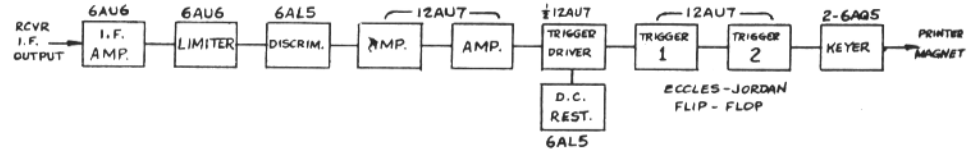
Another type of TU should be mentioned here. AFSK reception is hampered by the audio frequency response of a communications receiver. Most receiver audio sections are designed around speech, or 400 cps. They fail miserably up around 3000 cps, which is close to the AFSK mark tone. The audio stages can then distort the received signal by making the mark tone half as strong as the space tone at the TU input terminals, resulting in bias distortion. To get away from audio, TU's have been designed to work on the receiver's I.F. of 455 or 50 kc. This can be called "RFSK Detection". In the case of an RFSK TU, the signals used are either 454,150 cps for "space" and 455,000 cps for "mark", or 49,150 cps for "space" and 50,000 cps for "mark", which cannot be heard. The TU's are similar – only the frequencies used being different. The AFSK TU's the mark and space tone filters are tuned circuits designed around readily available 88-millihenry toroids. The RFSK TU filters use conventional I.F. "cans" for filters. (toroids for AFSK TU's sell for approximately $2 each, and are available from RTTY amateurs. Check listings in CQ and RTTY Magazines for those selling these.)

For the RTTY SWL (and there are quite a few), this is where we could end our discussion. For the licensed amateur who wishes to get "on-the-air" with RTTY, we must show how to hook up the machine's pulse -forming keyboard to the transmitter and the procedures used to establish and maintain contact.

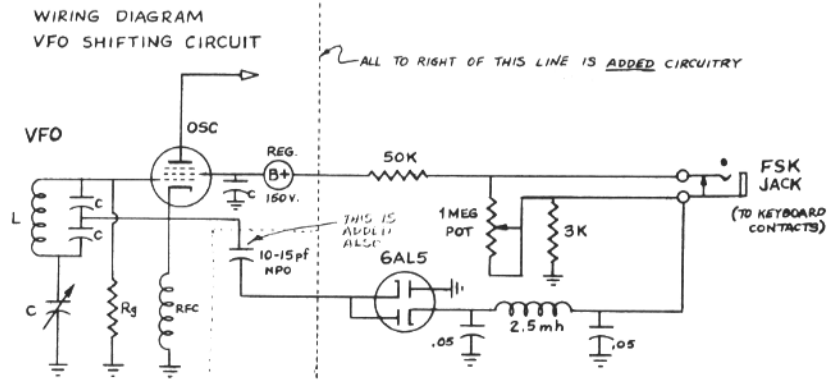
A transmitter's VFO can be shifted by inserting (or removing) as much capacity from the oscillator coil as is necessary for the desired shift. Drift-free VFO enthusiasts may wince at this practice of affecting the VFO, but the method of driftless shifting to be explained below should alleviate their fears. We now have NPO capacitors and stable diodes available which make the job quite easy–without the fear of drift. For the series-tuned Colpitts or Clapp oscillators, this usually means around 10 mmf. added to the cathode of the oscillator tube for 900 cps shift between1800 and 2000 kc. It could be possible to hook the TTY keyboard contacts in series with this capacitor to the oscillator tube cathode. Then, too,



BLOCK DIAGRAM - A F S K TERMINAL UNIT
RADIO TELETYPE RECEPTION



BLOCK DIAGRAM - RFSK T.U.



you could try to transmit with a spark transmitter! Not only would the signal be horrible but the shift would be inverted. The use of DC voltage keying a back-biased diode is made to insert or remove the 10 mmf. shift capacitor. In the non-conducting mode, the diode in series with the capacitor provides no return path to ground for the capacitor. In the conducting mode, the oscillator sees the full 10 mmf. By varying the conduction of the diode, the amount of shift can be "fine-tuned" from zero to maximum. All that need be added to a standard transmitter for RTTY, then is an FSK key jack, double-dioode, shift adjuster (DC pot) and a 10 mmf NPO capacitor, (for the uninitiated, "NPO" means "negative positive zero" variation of capacity with temperature). The DC to operate the diode is "stolen" from the regulated B+ supply in the transmitter. The 1 megohm shift adjustment pot is across the FSK key jack to which the keyboard contacts are plugged in. A small R.F. filter must be included to keep R.F. from getting back down the DC line. Care must be taken not to provide excessive forward bias on space (open) condition as this will reverse or invert the keying. Either tube or semiconductor diodes can be used. A hand-key inserted into this FSK jack will enable one to transmit Morse code on FSK (F-1) emission. Note that the FSK jack must not be grounded, as it "rides" 3,000-ohms up on the DC voltage divider network. Fiber insulating washers must be used to insulate the body of this jack from the chassis, and no part of the line to the keyboard contacts should be grounded.

The F.C.C. requires that RTTY be restricted to cw portions only of any amateur band between 80 and 15 meters. RTTY is prohibited on 160 and on 6m is permitted only between 52.5-54 Mc. On ten meters, RTTY is prohibited on the lower megacycle (28-29 Mc.) and so 10 meter RTTY is found only between 29 and 29.7 Mc. On VHF frequencies (144 Mc. & up) RTTY is permitted anywhere on the band, but is usually in the upper megacycle by mutual agreement of VHF RTTY amateurs. Another word on VHF RTTY while we touch it: since it is difficult to FSK an oscillator at these frequencies, tone-modulated AFSK is used. A 2125/2975 cps oscillator is shifted by the keyboard fed into the microphone jack of the transmitter's AM modulator. .The transmitter then operates in the AM condition and the signal is received as conventional AFSK with BFO turned off. This is permitted on any band 6 meters and up, is known as F-2 emmission, and is used quite universally. Some die-hards are known to be experimenting with FSK on 2 meters. One advantage to F-2 reception is that use of the receiver's AVC can be made, combating fading. Back in the old days when amateurs had the 11-meter band, F-2 was permitted as well as A-2 on that band. RTTYers were the hardest hit group when 11-meters was taken away and given to the citizen-banders. (See Appendix)

The F.C.C. also requires that the station call be identified on International morse before and after each transmission—as well as by RTTY. The same ten-minute identification rule applies to RTTY as well. So, to establish contact, you tune up your transmitter for cw, call "CQ RTTY DE your call—on cw and proceed to call CQ on RTTY by leaving the key down and typing out whatever you want to transmit on the keyboard.

Example:

CQ RTTY CQ RTTY CQ RTTY DE K2SKK K2SKK LIVINGSTON N J CALLING CQ RTTY CQ RTTY CQ RTTY DE K2SKK K2SKK LIVINGSTON N J CALLING CQ RTTY CQ RTTY CQ RTTY DE K2SKK K2SKK LIVINGSTON N J CALLING AND STANDING BY ON FREQUENCY K K K K K K K K K K K

("K" means "go ahead" as it does on c.w. Not so many are needed, but it seems to be the accepted practice these days to fill half a line of "K"'s at the end of every transmission.)

Your call must also be sent in cw at the end of the typing. Although RTTY can be used anywhere in the cw portion of the amateur SW bands, spot-frequencies have been adopted to narrow down the spread and cut confusion amongst the cw fraternity. The amateur RTTY frequencies established so far for 80 thru 15 meters are as follows:

80 – 3620 kc (3610-3630 kc)
40 – 7040 kc (7035-7045 kc)
20 – 14.090 Mc (14.080-14.100 Mc)
10 – 21.090 Mc (21.080-21.100 Mc)

No spot frequencies exist for any other band. RTTY nets which meet on 6 and 2 meters use frequencies suitable to their own region. An RTTYer can call CQ on any one of those four frequencies on most any evening of the week and come up with at least

one contact. Our experience on 80 meters has been in 3 and 4-way contacts responding to what you normally expect from that particular band, the RTTY being inferior to cw but superior to AM. (We won't mention SSB here!) To the non-RTTYer, the radio teletype signal sounds like just so much bird-chirping for a bandwidth of about 1500 cps on F-1 and 3000 cps on F-2 for each signal on the air. Sun-spots have a way of making the amateur bands miserable, and the same propagation misery can be expected via RTTY. It is impossible to print a local (200 mile radius) on 80 meters when the DX skip is in. If the QRM were not so fierce due to the DX skip, KH6's and W6's could be worked on RTTY on 3620 kc!* (Many have done this during the fall of 1961 despite the QRM).

*From the eastern seaboard, first, second, third and fourth call areas.

Last, but not by any means least, (there is RTTY tape gear which would take another 5 pages to describe!) how does one tune in on an RTTY signal? For AFSK, the receiver must be peaked (tuned) to the center of the shifted signal received, or 425 cps lower than the carrier and the BFO tuned to exactly 2975 cps. The ear cannot accurately detect this (although many old-time RTTYers can do it!) An indicator scope is constructed which makes use of the 90° phase shift that exists between two frequencies passed through a series-tuned resonant circuit, tuned mid-way between the two frequencies. Thus, for AFSK a toroid coil and condenser are series-tuned to 2550 cps. There will be 45° phase shift across the capacitor or another 45° phase shift across the coil when 2125 or 2975 cps are fed in. If the scope deflection plates are tied across this tuned-circuit—horizontal from capacitor to ground and vertical from coil to ground – a straight vertical line will result on a tone of 2550 cps applied to the horizontal plate and ground. A tone of 2125 cps will yield an oblique line running from top left to bottom right and 2975 cps will give an oblique line from top right to bottom left. Both signals (2125 & 2975) together produces a figure "8" with a lot of hash due to the beats between the two frequencies. Alternating the tones—as is done on RTTY—gives a letter "X" on the scope. Calibration is accomplished with an accurate audio oscillator (tuning-fork) standard if possible) and marked hairlines on the scope tube. It then is only necessary to determine which way to place your BFO and tune in the RTTY signal with frequency dial until the two shifted tones produce lines on the scope which coincide with the marked hairlines. The audio for the TU and scope indicator can be taken from either phone jack (high Z) or speaker terminals (low Z) taking into account impedance matching. If the audio comes from the phone jack, you won't be able to hear any signals coming in. If the audio is taken from the speaker terminals, some form of attenuator will be required on the speaker to suppress the ear-splitting 2 & 3 kc audio signals that result. In order to limit properly in the TU, the audio gain of the receiver must be kept full up. This imposes quite a demand on the receiver's audio output tube and power supply—another reason for RFSK. In receiving RFSK, the BFO is not required, and so the receiver's S-meter can be used—with AVC on to tune in the signal until the printer operates. Indicators for RFSK tuning are possible but quite a bit more involved due to higher frequencies. The simplest RFSK TU indicator is a zero-reading milliammeter which measures keyer tube current. Next to that is a 6AF6-G twin-indicator tube which can be wired into the keyer tube grids in a way that one "eye" closes on mark and the other closes on space only. Tuning with the zero-center meter, the dial is tuned for a null on the meter when receiving a 20-cycle per second square-wave "reversal" signal, or the letters "R" and "Y" transmitted in rapid succession from the keyboard or tape transmitter. This is the reason for the RYRYRYRYRYRY-RYRYRY . . . , test signal used so widely by RTTY Stations. Tuning with the 6AF6-G indicator is similar—equal "eye flicker" is watched while tuning through an RTTY FSK signal. The 6AF6-G indicator circuit was first proposed by W1FGL, the "X" scope indicatotr by WØHZR and the zero-center meter by the "commercials."

The writer wishes to acknowledge the help of the RTTY column of CQ magazine plus five years of experience with amateur RTTY for all the technical information necessary for the dissertation above. *RTTY Technical Manuals* are now available from three separate sources:

- Cowan Publishing Corp. (CQ)
- RTTY Society of Southern California, Inc. (RTTY Magazine)
- 73 Magazine

These cover in greater details all of the aspects of amateur RTTY, including the mechanical functions of the machines and use of punched paper tape equipment. Anyone sincerely interested in RTTY is urged to subscribe to CQ Magazine and RTTY Magazine.

In reply to the often-asked question: "Where does a ham get a teletype machine and how much do they cost?" Since this is a difficult question to answer, due to rapidly changing conditions, for answers to this query you should either obtain one of the RTTY TECHNICAL MANUALS mentioned above or contact the author of this paper.

APPENDIX

Some clarification is in order regarding SHIFT and the DIRECTION of shift: up or down.

It was previously stated that the VFO must be shifted *DOWN* according to convention, that is, the mark frequency is the carrier and the space frequency is shifted down 850 cps from this carrier. This is correct and remains as described.

With regard to AUDIO SHIFT, the mark becomes the *LOWER* frequency, or 2125 cps, and the space tone is the higher frequency, or 2975 cps. Note then that in keying an audio oscillator for VHF use, you shift *UP*. This is also by convention from years of usage by amateurs.

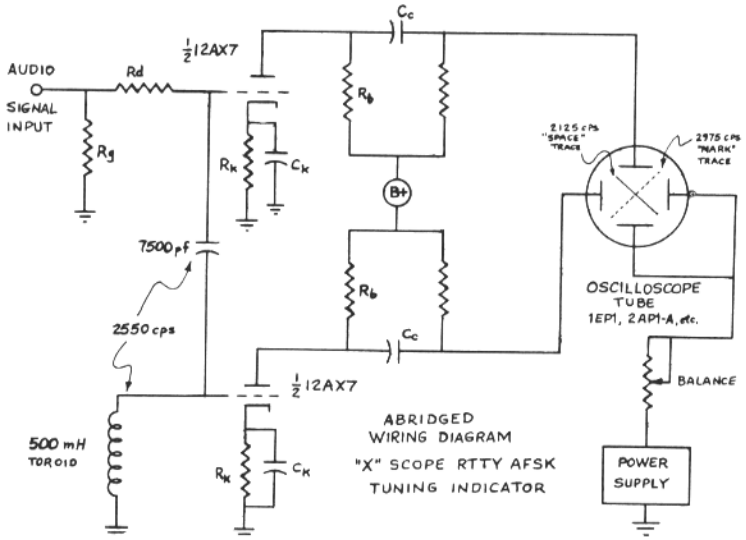
Why? It is easier to diode shift an *audio* oscillator UP than it is to shift down. As you have read before, a closed circuit in the diode shifter causes a VFO to shift down, provided the correct voltages are used on the diode, due to ADDED capacity in the oscillator circuit when the diode conducts. Since AFSK came into use long before FSK, the practice there was to key the oscillator directly causing a removal of capacity and a higher space tone.

How does this come out on the Audio Terminal Unit? Exactly the same. Your AFSK terminal unit is adjusted so that in the NORMAL mode of operation, the 2125 cps tone produces a holding loop current (mark) and the 2975 cps tone is open loop circuit (space). In aligning the receiver for RFSK reception, the BFO is varied off center frequency until the correct shift is detected on the terminal unit—and monitoring 'scope if one is available.

It should be pointed out that use of a well-balanced correctly adjusted polar relay in the output of the terminal unit is extremely useful in that no matter how the signal is transmitted and received, the signal may be inverted by switching one contact to the other. This cannot be done without a polar relay. Another advantage to the polar relay is that its contacts may be inserted in series with any loop without electrically upsetting that loop.

REMEMBER: in transmitting, FSK, "LSMFT": Lower Space Makes Finer Teletype.

In transmitting AFSK, mark holding tone is the lower frequency.



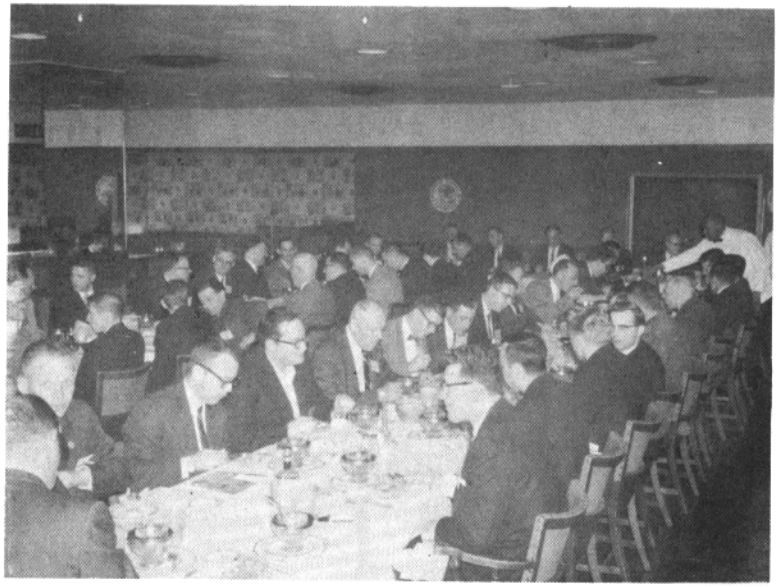
BOSTON AND NEW YORK CITY RTTY DINNER MEETING, 1962

The Eastern RTTYers planned and held two very excellent RTTY dinner meetings. Credit for planning goes to Tom Howard, W1AFN and El Swanson, W2PEE for the most part. Al Hughes, W1FGL, and others assisted but do not have names, etc. The Boston (BARTS) meeting was held at Motel 128, as was last year. Excellent food and good room. Tom Howard's new Model K was shown, and described by Al Hughes, W1FGL, due to Don Wiggins, W4EHU's not being able to attend due to work. Sherman Wolfe assisted in showing the features of the Model K. Thirty-three in all attended. K1ABW, W1ACS, K1BUF, W1BYX, K1CLF, K1DSW, W1EFF/xyl, W1FGL, W1HRY, W1IYU, W1JTL, K1KHN, K1KPM, W1MCG, W1PBS, W1QPM, K1QUM, W1RUU, W1WJ, W1YDA, W1YDH, W1YXZ, W1ZQM, W2ANB/xyl, W2ZPR, W6AEE, Sherman Wolf, Al Cuoco.

The New York City dinner was held at the White Turkey Town House, like last year—great. Seventy-two attended. Introductions were made by El Swanson, W2PEE, followed by talks by, Howard Weaver, W2AZF on the Trepac. Frank White, W3PYW on Armed Forces Day activities. Wayne Green, W2NSD, on 73s RTTY Hand Book, and requested photographs and material for 73 on RTTY. Merrill Swan, W6AEE, talked on growth of RTTY, and its coming of age. Carl Stanley, WØYZD, talked on RTTY modifications of the Collins KWM-2. Mentioned a booklet covering this modification was available. Phil Catona, W2JAV, talked on Printed Circuit TUs and showed both the single and dual versions. He also displayed and demonstrated a very good piece of equipment for RTTYers. A Flip/Flop signal generator.

Byron Kretzman, W2JTP, reported on the FCC action on the cw dual ident problem. Also called attention to need for a two meter frequency for the New York area. Chuck Peters, W2DHE, gave an excellent talk on History of TTY in the Sig Corp. Mentioned that Sig Corp still feels the AN/FGC-1 is best TU available. Also talked on new developments on TUs and related matters. Fred Muccino, W3ITO, displayed his Printed Circuit Terminal unit. W3TUZ assisted him on this project. Fred VE2TY reported on RTTY activities in Canada. Recent release of Teletype equipment is providing a rapid increase in stations active in VE land. Howard Hale, W6FYM, reported for the NCARTS group. Dick Segerstron, W6CQK, reported on the RTTY efforts associated with the OSCAR project.

Your Editor regrets he did not get a more complete report for our readers, and hopes he did not overlook anyone. W1AFN, W1FGL, WIKKP, K1MWP, K1NQJ, K1NMO, W1QP, K2AAA, W2AKE, W2AZF, W2BVE, K2DHE, WA2DMY, W2DXD, W2FWZ, W2ISK, W2IZQ, W2JAV, W2JJC, W2JTP, W2KDW, K2LGS, WA2LKF, W2NSD, W2OKO, W2RMB, K2SKK, W2TAM, W2TFM, W2UAE, W2UUI, K2VAM, W2ZKV, W4IAA/2, K3BHK, W3DTH, W3ERS, W3FEY, W3FMC, W3ITO, W3IUV, W3PYW, W3SYN, W4GJY, W5CNI, W6AEE, W6CQI, W6FYM, W6LDG, W6WGW, K8VDU, W9VSU, WØEPY, WØYZD, KG6ALM, VE2RS, VE2TY, VE2VV, VE3CDX, VE3CM, KH6AED/3 and xyl.



DX-RTTY

BUD SCHULTZ, W6CG
5226 N. Willmonte Ave.
Temple City, California

Hi:

Glad you stopped in—you're just in time to help me unload the mail bag!! Don't mind the QRM from the printer; it's just K3GIF and ZS1FD having their usual week-end chat. Speaking of Ed; this first letter is his monthly DX report and as always its loaded!! He gives top billing to the FSK debut of Bill, ZS6UR. Ed says Bill broke in on SSB after his sked with ZS1FD and reported that he was printing K3GIF solid. It didn't take much persuasion to get ZS6UR to try out his rig on RTTY—the result; his first two way on the green key mode! Bill is using a Creed 7B he secured from ZS1FD to make bauds on the output of an HT32 and a TA33 beam. From personal observation I can add the news that ZS6UR comes thru to the West Coast on fifteen like a ton of bricks and in his first week of operation he has already worked such as KR6MF. He told Ed that ZS6ARL is about set to go on RTTY so it begins to look like the South African lads are really coming up fast. So far my count looks as follows: ZS1FD, ZS1UE, ZS6CR, ZS6KD, ZS6UR and ZS6ARL. Here's a quote from K3GIF's letter: "Got an airmail from Nosey, KH6IJ. He has taken a job with SEATO as a teacher in Pakistan. He is leaving within a few months and desperately needs a fifteen with a fifty cycle sync motor. This is the third or fourth request I have had for a fifty cycle sync machine. I think it would be worth the Society's while to dig some up since they are badly needed in DX areas." Good idea, Ed—anyone with a fifty cycle 15?

Here's a note from Rod Newkirk, W9BRD, advising that because of the increased importance of RTTY among the DX'ers he is including news of this facet in his fine "Hows DX" column in QST. Rod writes a fine monthly DX summary and merits any help we can give him. Nuff said?

Shank, GM8FM, apologizes for not getting on the keyboard more often but has been QRL working on his tape reader and T/D. He is still hoping for his first West Coast FSK contact but says even when the W6's are coming thru on CW he doesn't hear any RTTY. Now it's our turn to apologize,Shank. He says he's still working the DJ stations on 20 meters. Here's word from Bob Engel, TG9AD, that he is out of business on fifteen meters due to beam trouble. However, he says twenty is still OK for him. Bob tells me that TG9DM has a Siemens printer and a fine S-line setup but still needs a TU before he can get on RTTY. As long as we are checking on activity from South of the Border let's open this one from Venezuela. It's from Jack Pitts, W6CQK, who is now stationed near the QTH of Frank Bencini, YV1EM. Jack is putting the final touches on the Heath Apache and HA-10 linear that he brought with him. He and Frank are now working on a remote control unit to operate the rig from a mountain top about five miles south of the operations shack and they will even have telemetering of the KW output power!! Here's an interesting quote from W6CQK/YV1EM: "A little later in the year, there is a good possibility of some hot DX-RTTY news from here. At present I can't say anymore than that I hope to put on the air a Country that has never before been on RTTY!" Please keep us up to date on this one, Jack.

Here's a thick airmail from G3CQE and G2UK's fine BARTG Bulletin. Let's find out what the hot rumors from Europe look like. Bill's letter opens thusly; "Have you ever woke up one morning and wondered if all this RTTY progress was not just a little too fast for you?" The reason for this query comes from the fact that Bill had his RTTY Column for "Short Wave Magazine" all written and ready for mailing when all kinds of new DX showed up and it was outdated before he could get it in the post box! (Happens to me every month, Bill.) Bill reports that ON4UN and ON4HW are very active now and others are in the offing such as ON4WI, ON4VI and ON4AJ. He enclosed a copy of the first RTTY bulletin from VERON (PAØAA) which is broadcast each Sunday at 1330 GMT on 3625Kcs. Wish I had

room to print the entire transmission; it is a very sharp effort on the part of the Dutch lads. I think the attention getter for the Dutch bulletin will bear repeating here!

"QST DE PAØAA TESTING RYRYRY-RYRYRYRYRYRYRYRYRYRYRYRYRY HAM HAM HAM HAM HAM HAM HAM HAM HAM HAM HAM HAM HAM SIX DUTCH MILLS HAVE A GREAT JOB TO PUMP THE WATER OUT OF THE ZUIDER SEA RYRYRYRYRYRYRY-RYRYRYRYRYRYRY RYRYRYRYRYRYRY"

Well, anyway, you'll have to admit its different! G3CQE is just finishing up his SSB exciter so won't expect to hear much from Norwich until the novelty wears off. Don't worry—He'll be back—Bill's got too much FSK in his blood to desert us. Doc, G2UK, has done his usual fine job on the BARTG Bulletin this month. He reports that the membership is now about 80—a fine tribute to that worthy organization. From Doc's news letter I see that VE7KX now has a "V" beam, 625 feet on each leg and 125 feet high beamed on London. Ole Jim must be really getting serious about this DX biz.

Here's a nice note and QSL from Frank, OA4BN, who is a "regular" on the FSK channels now. Frank is looking for some facsimile gear. Any help would be appreciated. Another new member of the clan is Luis, XE2IL. Luis got his gear thru the generous help of Doc, W6EGZ and Erosa, XE1BI, is helping him over the rough spots. The news in a long airmail from Eric, VK3KF, has been pre-empted by a couple of long RTTY QSO's in the past week. Eric is doing some travelling for a few weeks and then expects to settle down for some serious DX'ing. His sigs are once again starting to bang in here like they did last fall. George, ZL2AFZ, the vice pres. of SPRATS writes to ask if anyone can give him any catalogues or info on his second hobby of archery. Any of you Robin Hoods help ole George out?

Here we are running out of space and the mail bag is still loaded with un-opened mail. One from Bruce, ZL1WB, another from ZL3HJ, some copy someone sent in from ZK1BS, etc. Well, you can't win 'em all! Before I forget—Congrats to Jack Berman, W1BGW, on qualifying for WAC-RTTY Award nr22. We still have a couple of certificates left so get going!

Well that should give you a rough idea of how an average month of correspondence goes here at DX Hdq. That's it for now. This is your buoyant baud boy bellering "BCNU". 73, Bud W6CG

EDITOR'S NOTE: This cornball is about to flip his wick!! Prospective applicants for the job of RTTY DX Editor should send in a letter containing their qualifications before the fifteenth of next month!!

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NINTH ANNIVERSARY RTTY SWEEPSTAKES RESULTS -- (W6TPJ)

Top honors for the 1962 Annivedsary contest held Feb. 23-24, goes to Wayne Connor, W7ESN, of Bellingham Washington with a score of 10,209 points. After placing fifth in the Eighth Anniversary contest held in 1961. Wayne bounces back to dethrone W3PYW and take possession of this kingdom for the following year. Placing third in the First World Wide SS Contest in 1961, and always a top contender, Wayne will be the number one man to beat during the next fracas. Congratulations for a fine job Wayne.

Second through Fifth places were taken by WOPHM/4-9087, W6YJG-8,330, W7-PHG-5,976 and W7FEN-5,724.

The following stations submitting logs are listed in order of highest score.

CALL	SECTIONS	POINTS
W7ESN	41	10209
WOPHM/4	39	9087
W6YJG	35	8330
W7PHG	36	5976
W7FEN	36	5724
W4EGY	32	4032
W8PHG	30	3900
WOYIQ	35	3850
WONFA	30	3540
W3CRO	31	3100
VE4BJ	28	2800
W6WLI	25	2800
W6AEE	28	2576
W8KJK	26	2392
W9HJV	25	2300
KH6IJ	31	2201
WOPHD	23	2093
W6CG	23	2032
W1KKP	25	2025
K2SKK	22	1804
K4JXG	24	1680
W4B0C	24	1536
K6OWQ	20	1440
W1BGW	17	918
W6ZNU	16	832
W6TPJ	18	828
K6MTX	15	630
K5KDN	15	570
W1JRV	14	560
VE7AIK	11	550
W9COW	12	468
W9DJE	12	408
W9LFK	12	384
KH6ANR	12	360
W4IAA/2	10	240
K6JWQ	7	196
W1BDI	9	153
W2FAN	9	153
W9PPW	6	72
W1FSH	5	60
ZS1FD	3	18
W3ERS	3	15
WA6VRQ	2	12