Theory-Application-cont.

Continued from page 14

toward the origin in order to make FM better with weak signals are referred to as "threshold extension" techniques.

The steep portion of the FM characteristics in the threshold region means that when an FM signal gets into this region it is capable of rapidly being "swallowed up" by noise or it can rapidly come out of the noise with only a very small change in signal strength. That is, when FM is good, it is really good, but when it is bad, it's gone.

The FM curves can be used to explain why a low noise preamp can sometimes make such a vast improvement in an FM receiver. If an FM receiver is operating in the vicinity of the threshold of improvement (first threshold), a slight movement of the curves to the left (lowering the noise figure and consequent raising of the SNR at the antenna terminals) will result in a much greater change in the SNR at the output.

All the considerations apply when RTTY is being used. It is noteworthy that essentially all RTTY is FM (FSK or AFSK or AM or FM).

RTTY JOURNAL

Unfortunately, the results in practical situations are not quite as simple as portrayed. For example, a comparison of AM and SSB usually includes the transmitted power as well as the received signal. Especially in vacuum tube transmitters there is a gross advantage in using SSB because so much more peak power can be obtained with SSB than with AM in the same size package. Therefore, the overall performance of SSB vs. AM results in about an 8 dB advantage for SSB (with voice modulation) which is not shown here.

The interested reader is referred to the following references for more detailed information:

1. D.E. Schmitzer, DJ4BG, "Is FM Advantageous on the VHF-UHF Bands?", VHF Communications (UKW - Berichte), Volume 2, Edition 1, 1970 FEB, pp. 21-24.

2. E.F. Florman and J.J. Tary, "Required Signal-to-Noise Ratios, RF Signal Power, and Bandwidth for Multichannel Radio Communications Systems," NBS Technical Note 100, 1962 JAN.

That's all for this month, 73, ESCUL, RG.

*****

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RTTY JOURNAL

December 1971

EXCLUSIVELY AMATEUR RADIO TELETYPE

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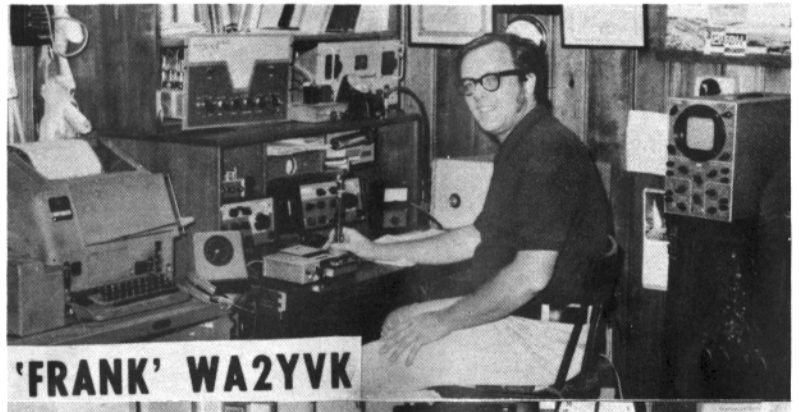
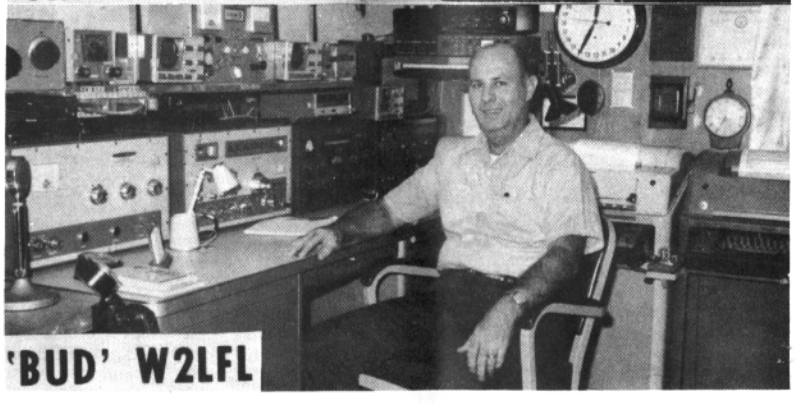


'FRANK' WA2YVK



'BUD' W2LFL

CONTENTS

VOLTA DX RTTY Contest

December 4-5

RULES

(1) TEST PERIOD
14.00 GMT December 4 to 20.00 GMT December 5.

(2) BANDS
The test will be conducted in the 3,5-7-14-21-28 MHz amateur bands.

(3) EXCHANGE POINTS
(A) All two-way contacts with stations in one's own zone will receive two points.
(B) All two way contacts with stations outside one's own zone will receive the points stated in the Exchange Points Table.

(4) Stations may not be contacted more than once on each band.
Additional contacts may be made with the same station if different band is used.

(5) MULTIPLIERS
A multiplier of one is given for each country contacted.
The same country may be claimed as a separate multiplier, if a different band is used.
The one's own country doesn't count as a multiplier.

(6) SCORING
Total exchange points times number of multipliers.

(7) COUNTRY STATUS
A.R.R.L. Country-list except KL7, KH6 and VO, to be considered as separate countries.

(8) MESSAGES
Stations will exchange messages consisting of:
(A) Check (RST)
(B) Zone number

(9) LOGS AND SCORE SHEETS
Use one log for each band.
Free log forms and score sheets are available on request from: SSB & RTTY Club, Box 144 Como. These forms are not obligatory. Log should contain: band; times; NR sent and received; call signs; countries multipliers; exchange points.

(10) SWL
The contest is valid also for SWL RTTYers. Are valid the same rules of the OM and a separate result table will be made for these entries. The logs must contain: date, time GMT, call sign of station heard, RST and number sent by the station heard, exchange point. The same station is valid only once on each band.

(11) DEADLINE
Logs and score sheets go to:
A.V. RTTY CONTEST MANAGER
FANTI Dott. FRANCO
VIA A. DALLOLIO 19
40139 BOLOGNA (Italy)
They must be received not later than January 20th, 1972 to qualify.

(12) CERTIFICATES
Certificates will be awarded:
-to the two top scorers in each country;
-to the two top scorers in each US call district;
-to the three top scorers with power under 100 Watts;
-to the three top scorers SWL.

(13) WORLD RTTY CHAMPIONSHIP
Points and positions achieved will be valid for inclusion in World RTTY Championship 1971.

*****

RESULTS- SARTG RTTY CONTEST

Dear OMs,

Included please find the complete results of **THE 1ST S.A.R.T.G. WORLD-WIDE RTTY CONTEST 1971.** It was very well attended, with stations from all continents and more than 50 countries, we consider this first RTTY CONTEST run by the Scandinavian Amateur Radio Teleprinter Group being a great success.

We will run the next "SARTG WW RTTY CONTEST" on the 3rd weekend of August 1972. The rules are to be slightly modified as by some of the suggestions received. Please watch your favorite magazine for the new rules in due time.

Bo V. Ohlsson - SM4CMG
Box 1258
S - 710 41 Fellingsbro, Sweden
awards manager

CONTINENTAL LEADERS, SINGLE OPERATOR:

AFRICA	CR6CA	158.640
ASIA	VU2KV	128.310
EUROPE	I1KG	218.705
OCEANIA	KH6AG	58.860
N. AMERICA	XE1WU	70.140
S. AMERICA	W9DDD/HK3	52.550

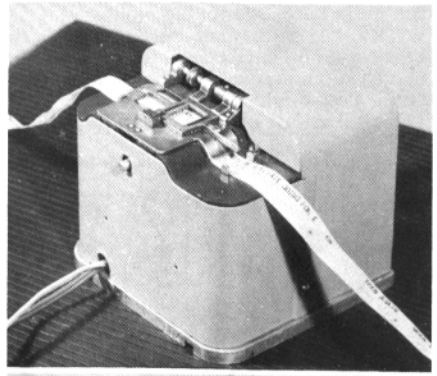
CLASS A, SINGLE OPERATOR:

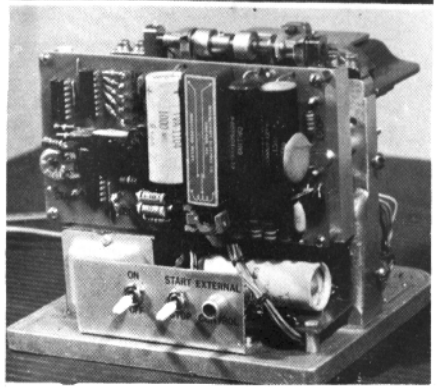
NR	CALL SIGN	SCORE			
1.	I1KG	218.705	40.	W3CIX	18.340
2.	CR6CA	158.640	41.	I1DML	18.200
3.	I1CAQ	154.770	42.	SM3DKL	18.070
4.	VU2KV	128.310	43.	ZL2ALW	17.460
5.	I6CGE	126.575	44.	F9RC	17.135
6.	EA8CI	112.515	45.	SM3AVQ	15.120
7.	9J2ED	103.170	46.	OZ7OU	13.800
8.	I1BAY	88.995	47.	WB6RXM	13.780
9.	IT1ZWS	79.500	48.	I1VGA	12.800
10.	XE1WU	70.140	49.	DLOAK (2)	12.430
11.	W3KV	68.640	50.	LA2YE	12.330
12.	4X4MR	68.510	51.	W7RSJ	12.100
13.	KH6AG	58.860	52.	CE3EX	11.305
14.	I5MPK	58.080	53.	OB8V	11.175
15.	VE7UBC	56.600	54.	EI5BH	10.530
16.	FO8BO	56.595	55.	DJ4KW-A	10.300
17.	W9DDD/HK3	52.550	56.	WA2YVK	9.975
18.	DL2XP	50.020	57.	SMOOY	9.010
19.	PY2CBS	49.600	58.	ON4CZ	8.460
20.	ZS6UR	48.360	59.	WB6QFE	7.590
21.	DL7IE	47.730	60.	XE1YJ	7.470
22.	ZS6BLV	44.145	61.	WA6TLA	7.315
23.	YBOAAO	41.040	62.	HA5FE	5.980
24.	SVOWO	37.450	63.	W6AEE	5.940
25.	K6YUI	37.170	64.	VK3KF	5.940
26.	WA3KEG	34.410	65.	PY2CYK	5.885
27.	OZ4FF	32.800	66.	DK1AQ	4.880
28.	I6THB	32.160	67.	OK1MP	4.760
29.	F6AOE	31.350	68.	PAOYV	4.130
30.	WA4KEY	30.240	69.	SK3RY (3)	3.420
31.	SM5BTG	30.080	70.	SM3BHT	3.200
32.	JA1ACB	29.700	71.	SM2EKM	3.060
33.	WA6WGL	29.640	72.	SM7BGE	2.530
34.	K3NSS (1)	29.380	73.	W5TZB	2.475
35.	K4VDM	25.265	74.	SL6ZK (4)	2.450
36.	KZ5LF	23.760	75.	OZ8O	1.800
37.	W6WIS	20.295	76.	W1BFS	1.755
38.	W4EGY	19.440	77.	JA1FFX	1.435
39.	I3GMF	18.760	78.	G3YJQ	.570
			79.	WOPHY	.360
			80.	KP4JM	.340

*****

A Digital Tape Distributor --

BERT KELLEY, K4EEU
2307 S. Clark Ave.
TAMPA, FLORIDA. 33609





Don't let the title make you think that this one is going to be complicated. It uses only four integrated circuits and two transistors so it is easy and does not cost much to build. The basic unit is sold as a five level tape reader by Meshna for $15. It should work with other tape readers with modifications to fit the tape advance method used. There have been different designs for accomplishing the same thing, perhaps the best known is WA8PCK's complex "PARSER".

A "clock" oscillator circuit operates at 45.5 cps, toggling a binary counter every 22 milliseconds, the length of one RTTY "bit". A decimal converter then converts the binary BCD output of the counter to up to ten equally divided pulses, again each 22 ms long. Only eight of the ten pulses are used in this application, and only the middle six are 22 ms long. The tape sensing fingers are either closed or open depending on the punched holes on the tape for the character, so, if the outputs of the decimal converter are connected to the sensing fingers by way of diodes, we will get a serial output of what was punched on the tape with the correct timing. The diodes form an "AND" gate and prevent the outputs from the decoder from being shorted together. When the binary counter has been reset, the decoder starts at positive voltage at pin 10, the (0) output which is mark-hold. The start pulse is on pin 9, a space, so we do not connect it to anything. Then the counter progresses through the five RTTY bits to the tape sensing fingers and the various contact combinations make the keying transistor key the loop.

When the counter reaches pin 2 (#7) output of the decimal decoder, the positive going edge of this pulse trips a monostable multivibrator which immediately resets the counter to zero and along with it, the decimal decoder. The same pulse inverts in the MC824P NOR gate to zero volts shutting off the oscillator. It also is applied to two inverters which drive the MJE340 transistor, turning on the tape advance magnet, and advances the tape one notch. When the monostable pulse ends, the output of the NOR gate goes positive immediately starting oscillation again, for seven more cycles. So it is the adjustment of the pulse length of this monostable that determines the length of time the stop pulse "dwells" at pin 10 of the decimal convert. For 60 WPM this would be 31 milliseconds. This is an adjustment you can make without a scope. Note that the monostable pulse width and the stop pulse width differ slightly, so if you are checking with a scope, the correct place to check is at the zero output of the decoder.

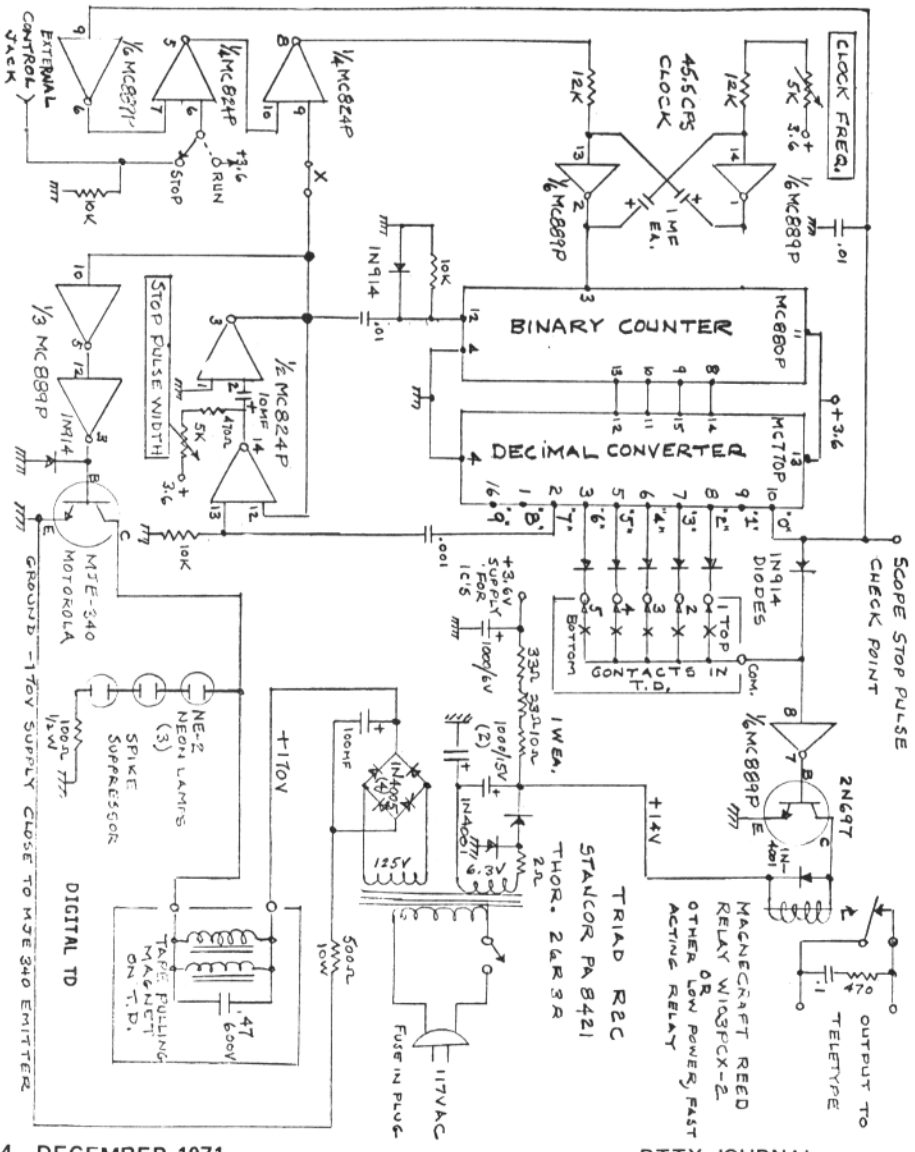
The gates wired to the stop-run switch are used to insure that the device will complete the character before stopping. Normally, the external control jack is unused, however, a positive voltage of 1.5 volts to 3.0 volts on this pin starts the TD. So this TD could be tied together with a SEL-CAL for WRU purposes.

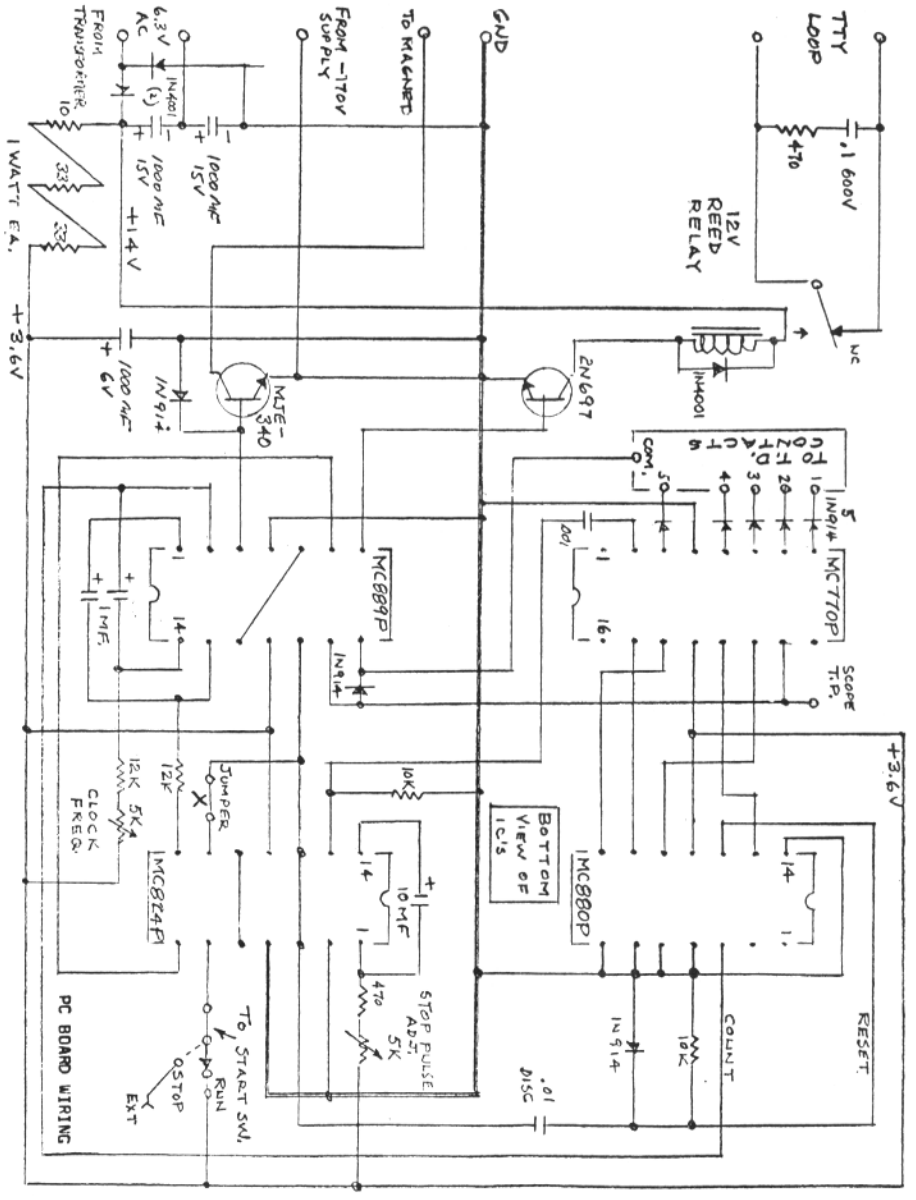
When the tape reader is received, it is necessary to remove all the parts on the side near the Blue Ribbon con-

nector with the exception of the pulling magnet detent. The large Advance solenoid and the linkage to the gate is removed, and the gate is secured with a collar-setscrew arrangement so it can not slide back and forth.

The parts can then be mounted in the clear space. It is possible to get all the electronics inside the TD but it is difficult. You might consider mounting the TD on a small chassis and using this to house the electronics, with the magnet supply mounted in the head. While I used etched circuit board 3" X 6" to mount the parts, there is not too much wiring to do and it should be possible to mount the ic's on 0.1" spacing perf board and hand wire with small wire.

Two adjustments have to be made when the distributor is finished. The clock frequency has to be set at 45.5 cps and the stop pulse has to be adjusted to 31 milliseconds. If the pulses were all 22 ms long, this would result in 389 operations per minute so we can take advantage of this fact and run a measured length of tape through the distributor until we get an adjustment of the clock frequency where exactly 39" of tape goes through in one minute. To make sure the stop pulse adjustment is not affecting the oscillator frequency, we open the control line at "X" in the diagram. Then run a tape and adjust the stop pulse width trimmer so that the distributor pulls tape satisfactorily, don't worry about how it is printing, yet. Now adjust the clock frequency so that 39" of tape goes through in one minute as mentioned above and do not adjust this trimmer





again. Restore the jumper at "X" and measure off 37" of tape (368 O P M) and adjust stop pulse width until this length runs through in one minute. The TD is now set up at machine speed, 60 WPM.

Two models of this TD have been built and both are working satisfactorily. There has been no difficulty with glitchs or RF, but it should be recognized by the reader that as a solid state device, this unit might pick up RF from a nearby transmitter and malfunction. Be sure that you shield it completely. It might be necessary to bypass the external lines to the loop and AC power with ceramic disc capacitors if shielding is not enough. Shielding was all that was necessary in the two prototypes.

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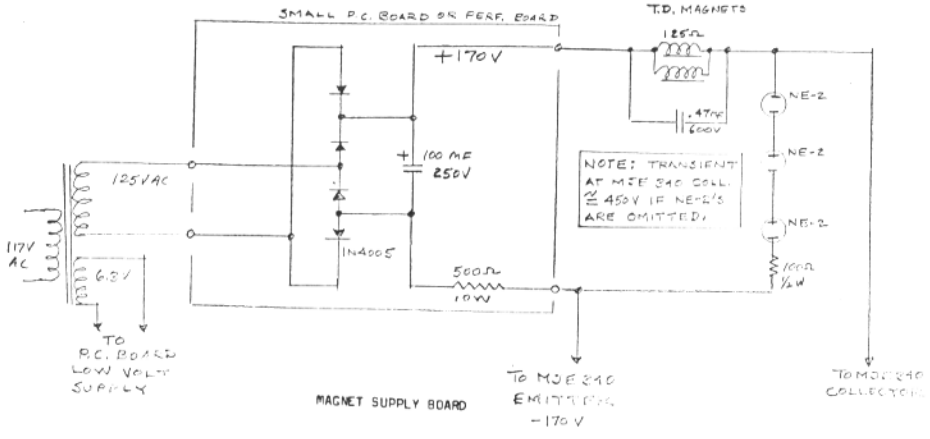


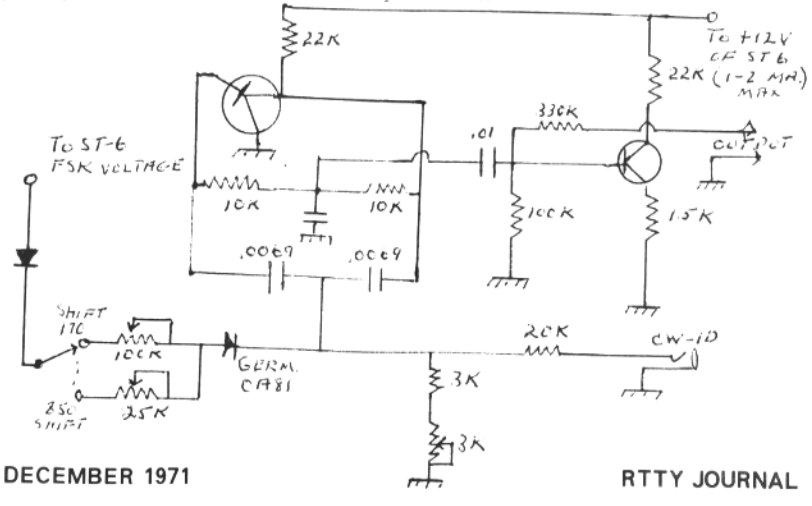
*****

SIMPLE AFSK for the ST-6

(We must apologize for losing the author's name. I hope he will write us so we can give credit later.)

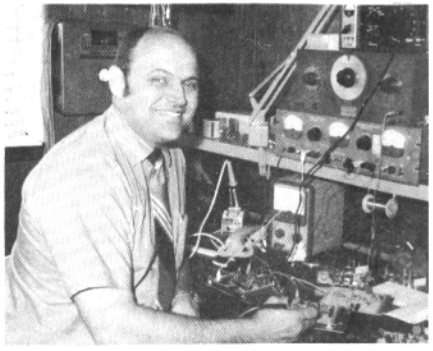
*

A simple two transistor AFSK unit was described in the QST for September 1969. This requires the keyboard to be wired directly to the AFSK unit and does not suit the operation with the ST-6. A very simple modification makes it easily compatible with the ST-6. The modified circuit is shown in Fig. 1. A silicon diode is necessary in the FSK input line tc prevent the negative voltage going to the keyer unit. If this is omitted the mark frequency will not be the same for the wide and narrow shifts. Also the CR1 (1N914) in the original circuit was replaced by a germanium OA81 and with the lower forward resistance gives better shift.



THE TTL SELCAL---

Part 1



KENNETH BRANSCOME, K5OJM
5935 Vanderbilt
DALLAS, TX 75206

THE TTL SELCAL

In 1967, I helped install a Teletype system for the Wycliffe Bible Translators to handle missionary traffic between North Carolina and Peru, South America. This work was done with the assistance of Mr. Vic Poor, K3N10, who designed and furnished most of the electronic equipment. One of the items furnished was a sequential selector built with discrete components. The addition of this piece of equipment made 24-hour auto start-standby a practical reality.

Then, in 1968, I was very pleased to read the article in **73 Magazine, May 1968,** about "The Selcal".

When I returned home to Dallas in 1969, I was asked to check into building the Selcal for the WBT International RTTY network.

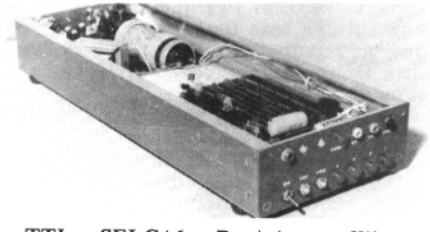
After much study and consultation with various engineers, I decided to use TTL (or the more popular name, T L) logic due to its greater noise margins and higher fanout capabilities. This provided a reduction in the number of logic packages required and increased reliability of operation.

At the same time, National Semiconductor came out with the LM309K voltage regulator integrated circuit which solved the regulated power supply problem. It is really quite a fascinating device.

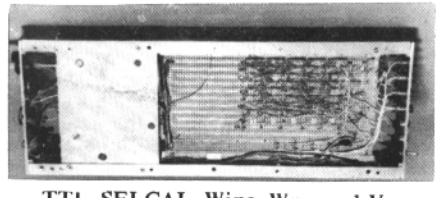
In the process of modifying the Selcal to TTL logic, many logic simplifications were found and it was noted that the Selcal, whether TTL or RTL, had a built-in regenerative repeater which was not used at all in the original version. This was the first addition to the TTL Selcal. The second addition was the alternate function control which allowed control of a second and third printer, if desired, from the same TTL Selcal with a minimum of additional logic by changing the last character in the calling sequence. The third and last addition was the "auto stop" control, which essentially is an idle line turn-off as well as the manual reset and "NNNN" turn-off.

In operating our original discrete component version of the Selcal, it was noted that on several occasions the teleprinter would get turned on but did not turn off. As a result, after setting for a weekend, we would return to the ham shack to find paper all over the floor and the motor running merrily along.

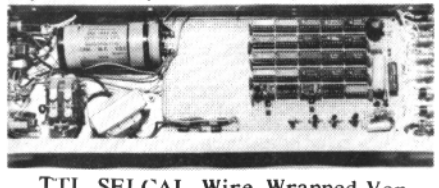
Several alternatives were tried. At first the loss of carrier was tried but this required an extra input to the TTL Selcal. Since some TU's interpret the loss of carrier as a steady space, it was



TTL SELCAL Prototype, Wire Wrapped Version, Front View with Top Cover Removed



TTL SELCAL Wire Wrapped Version, Bottom View



TTL SELCAL Wire Wrapped Version, Top View

thought that a space for 20 seconds could turn the teleprinter off. However, when used with the ST-6 and similar RTTY terminals, the anti-space circuit would immediately lock up with a steady mark on the input of the TTL Selcal. It was then that we decided to use the idle line approach.

The ALL-CALL circuit and message light were left out of the TTL selcal primarily because they were never used by WBT RTTY network. These could very easily be incorporated if desired.

TTL LOGIC DESCRIPTION

The TTL Selcal uses 7400 Series TTL logic. Five basic logic elements are used.

1. NAND Gate (7400, 7410, 7430)
2. NOR Gate (7402)
3. D Flip-flop (7474)
4. J-K Flip-flop (74107)
5. Retriggerable one-shot multivibrator (74122)

The fanout of each of the above devices (i.e., the number of inputs an output can drive) is 10 logical inputs. In the following descriptions, a high output or input is considered analogous to a 1 and a low output or input is considered analogous to a 0. In TTL logic, a 0 output is any voltage less than (plus) 0.8 volts, and a 1 output is any voltage greater than (plus) 2.5 volts, with respect to ground.

VCC and ground connections are not shown for clarity.

Figure 2 is the symbol of a NAND gate. When any one or more of its inputs are 0, its output will be 1. The only way for its output to be 0 is for all the inputs to be a 1. Figure 3 is the symbol of a NOR gate. When any one or more of its inputs are 1, the output is 0. The only way for its output to be 1 is for all inputs to be 0.

When all the inputs to a gate are tied together to form a single input, the unit is used as an inverter (Figure 4). That is, when a 1 is placed on the input, the output will go to zero and a 0 on the input will cause a 1 output.

Figure 5 is the symbol of a D-type flip-flop. The D input is the normal data input to this flip-flop, which is an edge-triggered device; that is, the Q output takes the same state as the D input when the CP line makes a transition from 0 to 1.

The S and R inputs are direct set and reset inputs which are independent of the CP line. When the R line goes to 0, the Q output goes to 1 and Q to 0. When the S line goes to 0, the Q output goes to 1 and Q line to 0. If both R and S inputs are 0, both outputs will be a 1 which is an abnormal condition. For normal operation under control of D and CP, both R and S should be held at 1.

Figure 6 is the symbol for a J-K flip-flop. The R input is independent of the other input gateing, and when it goes to 0, the Q output goes to 0 and Q output goes to 1 and will remain in this state until the R line goes to 1, at which time the input gateing will again take control. For the rest of the description, R will be assumed to be a 1.

The 74107 flip-flop used in the TTL Selcal is a master slave unit. The details are unimportant as far as the TTL Selcal is concerned; only the input and the output sequences will be described. While the CP input is 1, the state of the J and K inputs should not change or an unpredictable output will result.

With the J at 1 and K at 0, the CP line must make the transition 0-1-0. On the 1-0 transition of the CP line, the Q output will go to 1 and Q output to 0, regardless of its previous state. The reverse is true when the K is 1 and the J is 0.

With both J and K at 1 each time the CP line makes a 0-1-0 transition, the output will take up a state opposite its state prior to the clock pulse. This is called the toggle mode. With both J and K at 0, all CP transitions have no affect on the output. A flip-flop is considered to be ON when the Q output is 1 and the Q output is 0, and OFF when Q is 1 and Q is 0.

Figure 7 is the schematic of the basic latch used for the start flip-flop and is the heart of all flip-flops used, although it is not readily visible. Assume that all inputs are 1 and the output of A is 0. The output of A being 0 forces the output of B to 1 (NAND gate operation), making both inputs to A be a 1. This is a steady state condition.

When S goes to 0 the output of A goes to 1, now making all inputs to B a 1 and the output of B will go to 0, making the second input to A go to 0. Now, regardless of what S does, the output will be constant and the circuit will be in its second stable state. The same is true for the R input.

The retriggerable one-shot multivibrator (OSMV) (74122) is shown in Figure 8. The normal untriggered state of the OSMV is a 0 on the Q output and a 1 on the Q output. The purpose of this unit is to produce a 1 on the Q output of the device, once it is triggered, for a fixed period of time determined by the timing elements R and C. The Q and Q outputs

are always opposite in phase (i.e., when Q is 1, Q is 0, and the reverse).

Retriggerable OSMV means that once the OSMV is triggered and Q has a 1 output, if it is triggered a second time before the Q output has gone to 0, a new timing cycle will be initiated at the time the second triggering occurs without the Q output going low. This is retriggering.

Triggering is accomplished when inputs A and B are 0 and C and D are 1. To trigger the device again (not necessarily retriggering), A or B must make the transition 0-1-0. The 0-1 transition resets the OSMV trigger and the 1-0 transition fires the OSMV. The opposite is true of C or D.

TTL SELCAL OPERATION

The TTL Selcal is a sequential machine designed to recognize a string of four TTY characters. In the standby mode, the selector magnets are held in a marking condition and the teleprinter motor is turned OFF. Once the complete set of four characters is recognized in the proper sequence, the teleprinter motor is turned ON and the selector magnets are uninhibited.

A "force-on" switch is provided to override the sequential recognition circuitry and turn the printer motor on. In like manner, another switch is provided to turn the motor off.

Two additional means are provided to turn off the motor. First, recognizing the sequence NNNN, and second, the data line from the TU being idle (that is, no mark to space transitions) for a period of about 20 seconds will automatically turn off the teleprinter.

THEORY OF OPERATION

Basic Sections

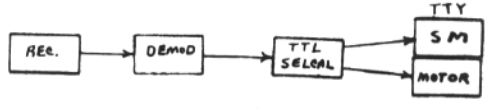


Figure 1. Connecting the TTL Selcal to Your RTTY Station.

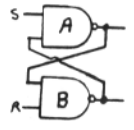


Figure 7. Basic Latch

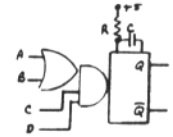


Figure 8. OSMV 74122, 8850 or 9601

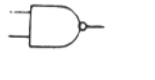


Figure 2. NAND Gate Symbol

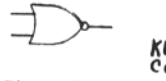


Figure 3. NOR Gate Symbol

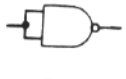


Figure 4. Phase Inverter

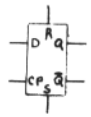


Figure 5. D Flip-Flop

Figure 6. J-K Flip-Flop

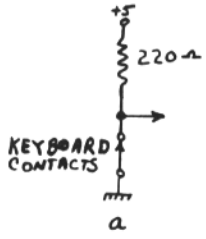


Figure 11. Attaching Teleprinter Keyboard for Checkout

a. Inverting Single Stage Input
b. Non-Inverting Two Stage Input

PROGRAMMING CHART					
SR→	1	2	3	4	5
CH1					
CH2					
CH3					
CH4					
N	0	0	1	1	0

Figure 9. Programming Chart

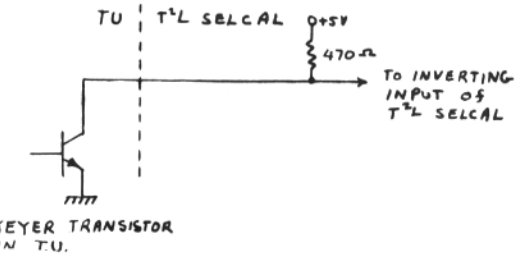
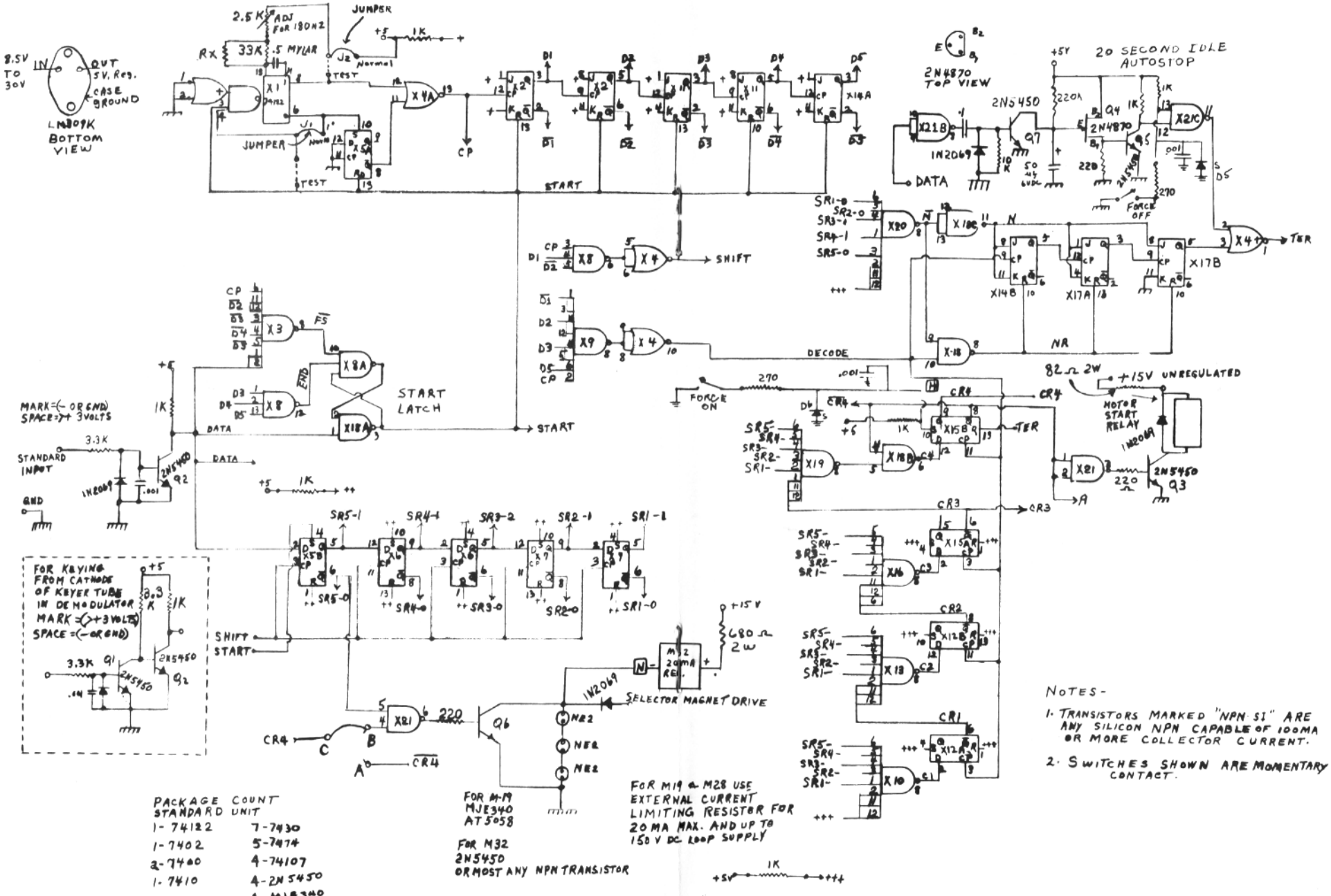


FIG 12 CONNECTING THE T²L SELCAL TO A T.U. WITH AN NPN TRANSISTOR KEYER STAGE. NOTE THAT THE ORIGIONAL LOOP SUPPLY CAN NOW BE USED ON THE OUTPUT OF THE T²L SELCAL.



PACKAGE COUNT

STANDARD UNIT	
1- 74122	7-7430
1-7402	5-7474
3-7400	4-74107
1-7410	4-2N5450
1-LM 309K	1-MJE340
1-W110	1-2N4870 UJT
	4-IN2069

NOTES-

1. TRANSISTORS MARKED "NPN SI" ARE ANY SILICON NPN CAPABLE OF 100MA OR MORE COLLECTOR CURRENT.
2. SWITCHES SHOWN ARE MOMENTARY CONTACT.

TTL SELCAL

1. Clock and count-down string
2. Control logic
3. Input circuit
4. Character decoding register and select magnet driver
5. Character sequence tree and auto start relay driver
6. Auto stop control
7. Regulated power supply

1. Clock and Count-Down String

X-1 is a 74122 (or 8850) OSMV which is set up as a gated, free-running multivibrator with associated logic X-5A and X-4A, which prevents turn-on transients and presents a positive output pulse on the output of X-4A. The clock will continue to run as long as the start line is 1. This can be held at 1 by placing the equivalent of a space on the input to the TTL Selcal.

With J1 and J2 in the normal position, the CP is too narrow to be seen on the average home-type oscilloscope (about 25 to 30 nanoseconds). Therefore, the test position for J1 and J2 is provided to allow for troubleshooting. The oscillator OSMV X1 will not gate ON or OFF, however, the CP will be gated. In the test mode, the timing of the first CP will not be an exact 1/4-bit period after the leading edge of the start signal and the operation of the system will not be optimum. The CP in the test mode of operation will be several milliseconds wide.

In the normal mode of operation, oscillations of the 74122 can be checked for gateing by observing the sawtooth wave form which is present at pin 13 of the 74122 when it is oscillating. The CP line can be checked by observing D1 as a square wave when the clock is running.

The 74122 oscillator in the normal mode of operation is an OSMV with the Q side of the output fed back to the input gateing. This retriggers the OSMV as soon as the OSMV has timed out its normal timing function.

Normally, the latch X-5A is held in the off condition (Q at 1) by the start line being 0. The Q line of X-5A forces the output of the Nor gate X-4A to 0. In this off state, the Q output of X-1 is 0, which would make the output of X-4A a 1 if it were not for the input from the latch X-5A. Once oscillations start, the Q output of X-1 goes to 1, except for narrow negative spikes which form the clock pulse when inverted in X-4A.

When the start line goes to 1, the hold on the reset line of X-5A is released and allows for Q line of X-1 to control the latch X-5A. The start line going to 1 also triggers the first pulse from X-1. The Q line of X-1 goes to 1, acting as an additional cutoff holding the output of X-4A at 0 (note that no CP has occurred yet) at the same time the Q line of X-1 goes to 0, forcing the Q side of latch X-5A to 0 and turning the control of the output of X-4A over to the Q side of X-1. The negative spikes on the Q line are transformed into positive spikes on the output of X-4A. At the end of a character the start line goes to 0, forcing the Q side of X-5A to 1, cutting off X-4A and holding its output to 0.

The frequency of the CP line should be the following:

60 wpm - 180 cps
75 wpm - 228 cps
100 wpm - 300 cps

The countdown string is a five-stage ripple counter which is used to generate the control signals used in timing and decoding each character. These signals are:

a. SHIFT used to shift the character decoding register which occurs at the center of each bit period of the teletype character.
b. DECODE is a pulse which tells the character sequence tree when the five information bits are in the character decoding register and it can check for a character.
c. END turns the start flip-flop off at the end of a character.
d. FS will turn off the start FF if a noise spike has triggered the start FF and a mark is present during the first or second clock pulse.

The operation of this counter can be checked by observing the square waves at D1, D2, D3, D4 and D5.

The frequency of D1 is 1/2 the CP frequency.

The frequency of D2 is 1/4 the CP frequency.

The frequency of D3 is 1/8 the CP frequency.

The frequency of D4 is 1/16 the CP frequency.

The frequency of D5 is 1/32 the CP frequency.

2. The Control Logic

The heart of the control logic is the START latch X-8A and X-18A. This is turned on by the first negative excursion of the data line and turned off by the END pulse or the FS pulses previously described. If the START latch is turned on and not turned off by the FS signal, the TTL Selcal will take one complete character cycle (similar to a Teletype machine). The START latch is considered on when the start line is at 1.

Concluded next month.

RTTY theory & applications.

RON 'RG' GUENTZLER, W8BBB
Route 1 Box 30
ADA OHIO, 45810

Receiver Characteristics

Last month we described receiver sensitivity and the meaning of signal to noise ratio. This month some of the important peculiarities of receivers will be discussed.

A very meaningful description of a receiver's performance can be obtained by looking at a graph of the signal to noise ratio at the audio output versus the signal to noise ratio at the antenna terminals. Such a graph is show in the figure.

Taking a single sideband (SSB) voice receiver first (the curve labeled SSB), it can be seen that regardless of the signal to noise ratio at the antenna terminals, the signal to noise ratio at the speaker terminals is the same as at the antenna terminals. For example, if the signal to noise ratio at the antenna terminals is 0 dB, it is zero dB at the loudspeaker; a 20 dB signal to noise ratio at the antenna will result in a 20 dB signal to noise ratio at the speaker. These values assume that the receiver has a noise factor of 1 (noise figure of 0 dB, a perfect receiver) and that the bandwidth of the receiver is exactly that required for the signal being received. The latter is usually true, or nearly so, but the former definitely is not, especially in the VHF range. If the noise factor were 3 (noise figure, 4.8 dB, a pretty good receiver), the curve would be shifted to the right (or the horizontal scale shifted to the left) by 4.8 dB. That is, a 4.8 dB SNR (signal to noise ratio) at the antenna would result in a 0 dB SNR at the speaker, and a 24.8 dB SNR at the antenna would result in a 20 dB SNR at the speaker.

An interesting sidelight is that the noise figure has a pronounced effect upon the SNR for weak signals, but not much for strong signals. A degradation from 4.8 dB SNR at the speaker to 0 dB is very noticeable, but a decrease from 24.8 to 20.0 dB SNR is hardly noticeable.

In the case of an AM receiver the situation is somewhat different. The AM and SSB curves are the same except for SNRs near the origin where the dashed line applies for AM.

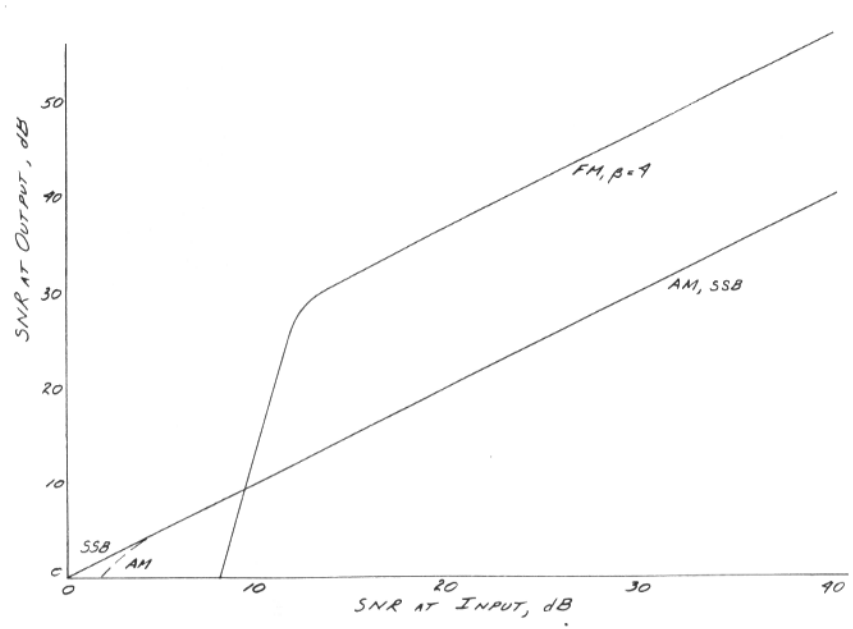
Assuming that the receiver bandwidth is matched to the signal (a 6 kHz bandwidth for a baseband signal of 3 kHz), the performance is the same as with an SSB signal (and an SSB receiver) at the higher signal levels. However, when the signal gets quite noisy the SNR at the output falls below that at the antenna terminals! The explanation as to why this happens requires describing an AM detector in detail.

Most of the readers have noticed that when listening to an AM signal on shortwave, a dip in signal strength due to QSB will result in only noise and if the signal fades far enough, no sound at all. The effect is somewhat like ocean waves rolling on the signal.

The net result is that SSB is better for very weak signal work than is AM. If the receiver were other than perfect, the curve would be moved to the right as for the SSB case.

With FM the situation is more complex. Again, it will be assumed that the receiver is one designed for the bandwidth of the signal being received. This means that if the total signal bandwidth is 36 kHz, the receiver bandpass is 36 kHz, etc. For sake of discussion, assume that a 3 kHz tone is being used to frequency modulate the transmitter. Further, assume that the modulation index is 4. A modulation index of 4 with a 3 kHz modulating signal gives a nominal deviation of plus and minus 12 kHz. The actual bandwidth is then 24 kHz plus four times the modulating signal frequency (a "rule of thumb"), or 24 kHz plus 12 kHz, giving a total bandwidth of 36 kHz.

For relatively high SNR at the antenna terminals, the portion of the FM curve that is parallel to the SSB-AM curves applies. It can be seen that the signal to noise ratio at the speaker terminals is higher than at the antenna terminals! For example, with a perfect FM receiver receiving a 3 kHz signal with a modulation index of 4 and a 20 dB SNR



at the antenna terminals, the SNR at the speaker terminals is 37 dB! This means that when using FM, the signal to noise ratio is improved by the receiver, or that FM is better than AM or SSB. If the modulation index were 8, (3 kHz baseband requires a bandwidth of about 60 kHz compared with 6 kHz for AM and 3 kHz for SSB) the results would be even better.

The FM results are actually as good as portrayed and lead to such claims as "FM is noise free," etc. The improvement in results over AM or SSB is commonly referred to as exchanging bandwidth for noise.

Unfortunately, there is a price to pay (other than the large bandwidth required). As the signal at the antenna decreases, the curve suddenly heads downward. The knee in the curve is referred to as the threshold of full improvement or the second threshold of improvement. Once below the knee, the signal degenerates very rapidly. The point where the FM curve crosses the AM or SSB curve is called the threshold of improvement or the first threshold of improvement.

The reason for the FM curve shape is the capture effect. When two signals on or near the same frequency are present, the stronger signal tends to dominate the output or to capture the receiver from the weaker signal. With an AM receiver, when two signals are present on or near the same frequency, a heterodyne results and copy is difficult unless the difference in signal strengths is great. With FM only a slight difference in signal strengths allows the stronger signal to suppress the weaker. Heterodynes are relatively uncommon in FM because the two signals have to be very close to the same strength to produce one.

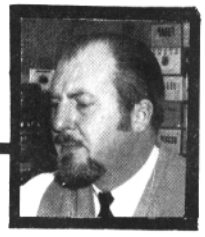
Whether one of the signals is actually a signal or just noise is relatively unimportant. When both noise and a signal are present the stronger captures. This accounts for the steep rise in output SNR for a small increase in input SNR in the threshold regions. Once the signal has completely captured the noise, the noise is suppressed by a constant amount as shown for the portion of the curve above the threshold of full improvement.

A curious fact is related to the location of the threshold of improvement. Notice that the signal to noise ratio is fairly high before the signal begins to capture. The capture would take place with a 0 dB ratio if both were signals. The reason the signal has to be so much higher than the noise is related to the statistical properties of noise. Noise has large peaks, therefore its rms value is much below its peak value (which is somewhat nebulous). Therefore, the noise will momentarily capture the receiver even when its rms value is several dB below the rms value of the wanted signal.

Attempts at moving the thresholds

Continued on Page 20

RTTY-DX



JOHN POSSEHL - W3KV
Box 73 Blue Bell, Pa., 19422

Hello there . . . .

By any standard of measurement the recent CARTG Contest must be considered as being a great success. Band conditions - "Excellent". Activity - "Excellent", and in addition, as W3CIX so aptly put it, "The year of the Narrow Shift".

During the week prior to the Contest we noticed a peaking of conditions on all bands. Ten and Fifteen, which have been quite dead for several weeks suddenly became alive with openings to all parts of the world during the daylight hours. With the Contest still some days away we were fearful that the peak would decline. However, our fears were unfounded and at least from here the propagation was excellent to all parts of the world on all bands, a notable exception being 80 meters here in North America. This band was quite noisy with QRN making weak signal RTTY reception difficult. It is probably quite a different story in Europe on 80 meters where the multiplier possibilities are excellent with so many countries in close proximity to each other. To paraphrase the political jargon, we believe that 40 meters was the "dark horse" in this contest. We heard more activity on that band than in any previous contest and it will reflect in high multiplier totals for those that took advantage of it. Forty still seems to be a two frequency band for RTTY, you must monitor 7040 and 7090 khz to make sure you do not miss anything. It should be remembered that 7090 and vicinity is considered the DX fone band and the wider signals make even narrow shift difficult at times. As for the narrow shift, it seems as if Dusty's "brainwashing" over the past few years has finally paid off. Speaking for ourselves, over 90 percent of the contacts made were on narrow shift, and we only went to the wide in a few instances to accommodate the other fellow that may have been having some difficulty with the copy. On the strength of the narrow shift activity in this contest many of the fellows are changing their equipment to make 170 hz the primary standard of operation. Let's keep it going.

Possible multipliers on two or more bands were as follows - CE - DL - EA - EI - ET3 - F - FG7 - FO8 - G - HA - HB - HK - I - IS - JA - KH6 - KL7 - KP4 - KZ5 - LX - OA - OE - OK - ON - OZ - PA - PY - SM - UK4 - VE - VK - VO - VP7 - W - XE - XX6 - YV - ZL - ZS - 4X4 - 9I7 - 9Q5. That is quite a list of possible multipliers for a RTTY Contest and we are sure that there were a few more that we were not aware of. Two really rare prefixes showed up in the Contest. XX6FL was operated by Jo, CR6CA, from an Electronics Fair and Exhibition in Luanda, and 9I7ED was the special new prefix of Ed, 9J2ED.

Along with the recent issue of the BARTG NewsLetter came a copy of the membership list and included therein were such eye openers as, GW3UJC, GW3TMM, GM3ZTP, GM3IBU, GM3DJT, GM3UDL, GM6ACC, GM3ZVV, and 9G1DY. While all have an obvious interest in RTTY we are not aware if all or any are in a position to get on the air in the immediate future. If any of you readers are acquainted with any of these chaps, you might, through the art of gentle persuasion, induce them to get on the H.F. bands. The only thing we can offer is that, for a while at least, they will be the most sought after stations on the amateur bands.

Something we should have thought of at the time it was written but didn't. George, VK9GG, wrote to tell us that the equipment we indicated as being on its way to him was in fact still held on the docks at Seattle due to the dock workers strike that has been in effect there for quite some time. At this writing there has been a temporary lifting of the strike but we do not know to what extent or in what priority material is being moved. The strike has also caused an embargo on certain Air Mail in the "small package" category, which at the moment affects my sending of WAC certificates overseas. Those in DX countries expecting the WAC certificate please stand-by and

we will get them to you as soon as possible.

New additions to the WAC roster this month are--

Nr. 171 John Towse WOFU
Nr. 172 Elmer Mooring W3CIX
Nr. 173 Lars Nordgren SMOOY

Congratulations to all, and of the above, W3CIX made it with less than 100 watts and a dipole, which is quite a rarity these days.

A recent new station that is QRV on 20 meters is GI3VYZ. Les was initially running at 50 band but slowed things down to 45 and has been having a lot of contacts. He is in the Army with the Royal Signals and is located in Londonderry. The equipment is all military and Les is able to use it when not on duty. QSLs go to --

L.W. Thompson
69 NIA Sig Sqdn V
Duncreggan Camp
Londonderry, N. Ireland

FR7AB has returned to the RTTY bands and is now transmitting as well as receiving. Gin, JA1ACB, says he has a terrific signal into Asia, and on a recent Sunday morning we heard Uli, DK3CU in QSO with him on 15 meters. Roland only speaks and understands French so have the dictionary handy. For you lucky ones to catch him his QTH is listed as--

Roland Nativel
9 Champ Fleuri
St. Denis, Reunion Island

Bud, W2LFL sends word of a new station on from the USSR which he worked in early September. The call is UK2RAY and is located in Vilzandi, Estonia. Bud has not printed him since and wonders if anyone else has found him active.

WAC-YL may soon be a possibility. Maria. PY2DDS is active on RTTY from Brazil and was the subject, along with Antonio, PY2CBS, of an article published in the July issue of Electronica-Popular. As you know, Antonio has been very helpful to us all in getting a PY multiplier in all the Contests.

We recently obtained a very interesting and useful operating aid from Irv, W6FFC. It is a computer read-out of beam headings and distance from Blue Bell, Pa. to over 300 locations throughout the world. In addition to the true and magnetic bearing to a distant location it also gives the distance in miles and Km. We understand he can only make them up for locations in the U.S. and Canada at the present time. A SASE to Irv will get you additional details.

In answer to the many queries received we can now say that the QSLs from Manuel, EA8CI have been sent out. Well worth waiting for too. The reason you have not heard him recently is because he has been in Spain. He has been visiting with Rene, EA7PZ, and we understand that Manuel will be returning to the Canary Islands with a Model 28 ASR. So with his strong signal and that versatile machine he will be doing great things on RTTY.

From Jan, ZS6BBK we understand that new operators are now at Marion Island, ZS2MI, and at Gough Island, ZD9BR. Fifty baud is the speed and times of operation are not fixed but as their work schedule allows. Arthur, ON4BX, printed ZS2MI during the Contest but with no contact and we doubt that they were aware that a contest was in progress.

We have received preliminary information from the Alexander Volta and BARTG Contest Committee giving the dates for their respective Contests. Mark your calendar now. Volta Contest - 1400z December 4 to 2000z December 5, 1971. BARTG, 0200z March 25 to 0200z March 27, 1972. Details will be published in an early issue of this and other ham magazines.

In the January issue we will publish the RTTY-DX Honor Roll and we appreciate the scores sent in by so many so far. I only need two numbers, Countries worked/Countries confirmed. Please send a card or bk bk if you hear me on the band. The positions are changing rapidly and it is getting to be a hot race at the top. The next 100 confirmed should not be long in coming.

It does not seem possible that another year has passed, but the calendar doesn't lie. I would once again like to thank all you readers for your support in making this column possible. Believe me, I could never do it without your help. It certainly is a pleasure to be associated with such a fine group of amateurs as those with an interest in RTTY-DX. I extend Best Wishes to All for a Happy Holiday Season.

*** 73 de John

RTTY NETS ?

In the Armed Forces communication test, held last May, we note that for the second time in a row more correct RTTY messages were submitted than CW. If any one is interested in forming a traffic net on RTTY drop the ARRL communication department a letter, if enough are interested they might be glad to function as a clearing house.

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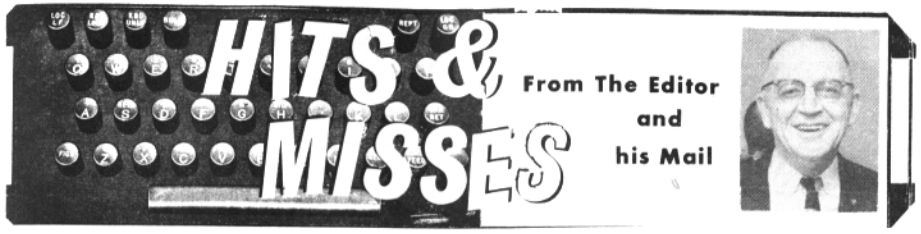

We will be receiving a number of renewals for the next six weeks. It would be appreciated if you noted on your renewal any special type of articles you enjoy or anything special you would like to see in the Journal. We are limited to space and also to the articles that we receive but from past experience some of our good readers are always able to supply just about anything we ask for. With postage cost almost the price of a good cigar we would not ask for special letters for this survey but with a renewal being sent in you can get more for your 8 cents by telling us what you like or don't like at the same time.

***

We recently received a letter from Jean, FG7XT, commenting on the fact that only the ARRL could issue a DXCC award. As the ARRL started and controls the DXCC his point is probably well taken, but only as far as the name of the award is concerned. DXCC, from the ARRL means - DX Century Club - The awards from the Journal will be called "100 DX Countries Confirmed on RTTY" abbreviated to 100 DXCC on RTTY - on the plaque.

Jean also comments that any award not furnished by a National Society is of doubtful authenticity or value. Since the ARRL refuses to recognize RTTY as a separate mode and provide any awards or contests for RTTY someone in this large country should attempt to set some goals and provide incentives for RTTY operation. Many foreign countries have RTTY societies working within the National Associations and are offering information, incentives and awards for RTTY operations. The RTTY JOURNAL awards are free and there is certainly no obligation for anyone to participate. The JOURNAL probably has a larger circulation among RTTY fans including foreign stations, than any other magazine. We offer the award as a goal or measuring rod for outstanding DX operation, the same as most specialty groups offer awards for outstanding performance. As for authenticity - John, W3KV, the DX editor is as careful in checking cards as anyone can be. We are certain that any cards John passes on would meet anyones criteria.

The Journal has no ambition to be anything but what we are. We do feel that issuing of awards, helping in contests and bringing any news of RTTY to our subscribers or others interested in RTTY is a legitimate purpose. Certainly no one is obligated to participate or even agree with us.

BACK ISSUES---

New subscriptions and classified ads are cash in advance as we have no method of billing. New subscriptions will be started with the current issue and one back issue if requested. Please do not ask us to start any further back than this. If available, back issues may be ordered at 30¢ each at time of subscription. The Journal is mailed about the 20th of the month preceding the dated month.

1966-Aug.-Sept.-Oct.-Nov.-Dec. (5)
1967-March (1)
1968-Mar.-May-June-Sept. - (4)
1969-May-July-Sept.-Oct.-Nov.-Dec.- (6)
1970-None
1971-Jan.-April-May-June-July-Sept.-Oct.-Nov. - (8)

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SALE: 6 AND 2 METER HC-6/U xtras--all frequencies and 6-8 MHz FT-243 xtras $1.00 each. Sase for list. Mac Robbins, WA3KDJ, Hamerschlag A307, P.O. 766, Carnegie-Mellon Univ. Pittsburgh, PA. 15213

MORE RTTY! THAT'S RIGHT. In 1970 there were more feature RTTY articles in HAM RADIO Magazine than any other general amateur magazine. You need RTTY Journal, but you need HAM RADIO also. $6.00 per year; $12.00, 3 years. Ham Radio, Greenville, N.H. 03048

SALE; KEYBOARD FOR MODEL 15, with 'here is Answer Back Attachments' 21 characters to set up identifications, complete with all key tops, springs and gear - excellent $11.00 each. FRXD-10 Combo; combining typing reperforator, a reader and distributor, on one base. The unit can be used separately or together, syncronous motor, no tape container or cover, used good, $20.00 each. Parts for most teletypewriters also gears and motors including Mite teletypewriter parts. Atlantic Surplus Sales, 580 3rd Ave. Brooklyn, N.Y. 11215.

SALE MODEL 28 Synchronous MOTOR PD67/U, code LMU-12 1/12 hp. 3600 rpm, 115 VAC 60 cycle, 1 phase, used excellent, $18.50 ea. TT334/UG model 28 transmitter - distributor, high speed, 8 level, adaptable to 5 level code LBXD-9, used excellent, $40.00 ea. TT315/UG model 28 typing reperforator, code LPR35BWA tape data; 11/16 with chadless or fully perforated, part of AN/UGC-13 (M28ASR) used, excellent $40.00 ea. Atlantic Surplus Sales, 580 3rd Ave. Brooklyn, N.Y. 11215.

TELETYPE PICTURES FOR SALE. Vol 1 $1.00. Vol 2 $2.00. Vol 3 $1.50. All for $4.00. Perforated tapes available. 200 different pictures. W9DGV-a. 2210-30th Street, Rock Island, Illinois 61201.

BACK ISSUES - RTTY JOURNAL - Have all issues from Vol. 1, No. 1, will reproduce any issue for $1.00 PP. John Isaacs, 3175 Val Verde Ave. Long Beach. Cal. 90808.

WIREWOUND Pots, 2.5K, 25W loop current adjust; 95¢ each, 2/$1.50. Standard 11/16" PERFORATOR tape. 10 rolls - $1.50. 40 rolls for $4.95 FOB Paramus. Polar relay sockets, latest type, with contact filters. Regularly $1.25, now only 95¢ postpaid: Spectrum Display Units, built-in 3" scope, rack mount, 110vAC, 60Hz - $18.50 FOB. Simplex/Stromberg DATE-time stamps. 110V, 60Hz. As is. Ideal for traffic or logging. $18.50 each, FOB. Jim Cooper. POB 73, Paramus, NJ 07652.

TOROIDS: LOWEST PRICE ANYWHERE!! 40/$10.00 POSTPAID. (5/$2.00). 44 or 88mhy. center tapped. Mite miniature UGC41KSR page printer, Completely reconditioned, SPECIAL $175. 32KSR page printer also completely reconditioned by experts ... $225. Model 15KSR printer $65. 1800RPM Sync motor with baseplate $7. Gears for all machines ... 14Tee Dee $25. TDA2A Distortion Test analyzer $50. 14 reperf with cover, working $30. Ribbons, Tape, supplies, Stamp for list. Van W2DLT 302R Passaic Stirling, N.J. 07980

EPOXY DIODES - 1000 Volt PIV at 1.5 Amp, 24¢ each ppd. 88 Mhy Centertapped unpotted toroids.$1.50 for 5 ppd. Send stamp for list. M. WEINSCHENKER BOX 353 IRWIN, PA 15642.

TYPEWRITER RIBBON REINKER, Hand operated model now only $3.50. K575 or K764 Ink available at all National Cash Register Co. stores at 75¢ per tube. Walter Nettles W7ARS-8355 Tanque Verde Rd. Tucson, Ariz. 85715

RIBBONS TAPE REINKERS ... Fresh ribbons for all teletypewriters, box of 12 individually wrapped $3.50 POSTPAID. Reinker for 15/19 $1.00 POSTPAID. 11/16" tape $8.00/case/40 rolls. Toroids 40/$10.00 POSTPAID. Machines, supplies, stamp for list. Van W2DLT 302R Passaic Stirling, N.J. 07980 (201-647-3325 after 10 p.m.)

AUTO-CR-LF KIT, MI5-19, $27.50; Tape winder (windup) $12.50, gears galore (shifts, too). Quantity discounts on above - also 74913, 78509-10, 80165, 91287, many more. SASE for list. Wanted LXDs, any condition; all parts, Model 32-33. Typetronics, Box 8873, Ft. Lauderdale, Fla. 33310 W4NYF.

MODEL 32TG KSR, new in original carton. $375 or best offer. Model 33TAH KSR new in original box, 8 level terminal $400. BRPE 11 as new, some use, $50.00. LMU 41 motors for model 28, model 35, new in box. $55.00, with 120cps tuning fork. 7025 comp. with 65K memory and TTY terminals (not time sharing) best offer over $20,000. Some perifial equipment available. No Collect calls. SASE with inquiry. Douglas Craton, 5625 Balfrey Dr. W. Palm Beach, FLA. 33406.

SALE: 100 WPM TYPING REPERFORATOR Kleinschmidt TT-230, good condx, $30.00. Pick up or you pay shipping. Frank Fallon WA2YVK 118-43 228th Street Cambria Heights, N.Y., 11411 212-525-4493.

WANTED: COMPACT 28KSR such as UGC-20A or UGC-20B or similar models. WANTED: BRPE-11 High Speed tape punch. WANTED: 651S1 Receiver. FOR SALE: 51S1 Receiver, 30S1 Linear Amplifier, 75S3C Receiver with 500 and 1500 Hz filters. RME VHF-126 converter, BC-1031 Panadaptor, SB-8B Spectrum Analyzer, SB-15 Spectrum Analyzer, PM-2 power supply for KWM-2, AM-1365/URT UHF linear amplifier, Tektronix Scopes (Models 515A, 541, 541A, 502, 581 and many assorted plug-ins and accessories), Boonton 91CA RF voltmeter, HP 202C Audio Oscillator, Fluke 801B Differential voltmeter. Hank W6SKC South Pasadena, Calif. 213-799-5886.

TRADE - 75A4 with N.B. vernier dial, 3 filters for 28KSR-ASR. Want-R390 I.F. sub chassis, manual. Sell; SB620 $85.00. Robert Ward, W1NDC, RFD 1 Box 152, Bath, Maine 04530.

MODEL 28 LBXD-9 transmitter distributor for Model 28 ASR, S/N 21938, brand new, $95.00 FOB or trade for KSR 3-speed gearshift or 28 ROTR in mint condition (cash difference). AN/USM-32 oscilloscope, excellent condition with all probes and manual, $125.00 FOB. Pair of BC-611 walkie-talkies with manuals and accessories, brand new, $90.00 FOB. Wanted: Model 28 ROTR with cover in mint condition. Price correction on URC-35: $2950.00 (firm). Write Ronald Ott, 2320 C Parker Street, Berkeley, California 94704.

HAVE RADIOLA 3-A Good - Want HRO-5 or HRO-7 with all coils, power not necessary. Want motor, pulley and toothed belt for 28 reperf, 60 WPM 10 2API-902 nicoloi shields left. R. Hayes, W8CL, 218 11th St. S.E., Massillon, OH. 44646.

SOLID STATE RTTY TERMINAL UNIT Model FSTU-1. Completely wired and tested and built on a 5x6" circuit board, using top grade components throughout. This hot solid state unit features a 500 ohm input, tuned filters (standard mark and space frequencies-(2125-2975) or 2125-2295) please specify when ordering). Reversing switch, output for scope monitoring, and drives selector magnet directly. Unit can be mounted according to your needs. Power requirements 12 VDC @ 65 MA. Factory warranty and repair service available on all our models and kits. Model FS-1A completely wired and tested. $39.95. Power supply for above, solid state, regulated 12 V 1 amp. $14.95. Frank Electronics, 407 Ritter Rd. Harrisburg, PA. 17109.

SAROC SEVENTH ANNIVERSARY January 6-9, 1972. Advance Registration $9.00 per person entitles registrant to SAROC Special room rate $12.00 per night plus room tax, single or double occupancy, effective January 4 thru 12, 1972; tickets for admission to technical seminars, HAM RADIO MAGAZINE and SAROC Happy Hour Thursday, SWAN ELECTRONICS and SAROC Social Hour Friday, HY-GAIN/GALAXY ELECTRONICS and SAROC Champagne Party Saturday, Buffet Hunt Breakfast, Sunday. Ladies who register will receive transportation for shopping tour, luncheon and Crazy Hat program at the New Union Plaza Hotel downtown Las Vegas, Saturday, Advance Registration, with Flamingo Hotel mid-night show, two drinks, $14.50. Advance Registration, with Flamingo Hotel Dinner Show (entrees Brisket of Beef or Turkey) no drinks, $17.50. Tax and Gratuity included except for room. Frontier Airlines SAROC group flight package planned from Chicago, St. Louis, Omaha, Denver, send for details. Fifth National FM Conference, ARRL, WCARS-7255, WPSS-3952. MARS. meetings and technical sessions scheduled. Accommodations request to Flamingo Hotel, Las Vegas, Nevada before 15th. December. Advance Registration to SAROC, Southern Nevada ARC, Inc., Box 73, Boulder City, Nevada 89005, before 31st. December.

LMU-3 MOTOR/ BASE excellent condition, stator teletype part number 160306 1/12 H.P. Brand new. Model 28 typebox, communication pallets, excellent condition. Selector magnet driver teletype part # 198360, condition unknown, looks brand new, includes installation instructions for 15, 19 or 28. 2 parts manuals for 28KSR or RO in good condition. DX60B/HG-10B no covers, HG10 has two small holes drilled in it. 3 speed transmission (60-75-100) teletype part #161807 for 28ASR aux. reperf only, does not control entire machine, excellent condition, make offer on any of above or what do you have to trade? What else do you have to trade. Wanted complete cover assembly for 28LPR reperf, must be in excellent condition. Model 28 T.D. KL7GRF, John E. Fail, Box 1196, Petersburg, Alaska 99833.

FOR THE FIRST TIME you can now have the J & J AFSK generator with both the high and low tones rack mounted or table top cabinet. Low distortion, high output, compact-10 lbs. J & J Electronics, Canterbury, CT. 06331.

MODEL 14 TD, MODEL 14 typing reperforator, (2) teletype pad-top tables like new. Heath Oscilloscope 5", Heath sine-square wave generator. Jack Hardman, 50 Mountain Rd., Verona, N.J. 07044

PC BOARDS; 5 for $1.25 ppd. At least 30 parts plus edge connector on every board. T. Million, P.O. Box 294 Penrose, Colo. 81240.

GETTING TIRED OF GARBLE? If you can afford it treat yourself to the very best - the Mainline TT/L-2 RTTY demodulator. The Cadillac of the converters. J & J Electronics will custom build this fantastic terminal unit for you. Send for Brochure.

WEEKDAYS MONDAY-THRU FRIDAY 9-4:30, Saturday 8-4:30, Sunday 8-noon until further notice. Selling out model 14 teletype machines, 15 machs, 100's. 14 TD's, 28 td's, all kinds of parts, supplies etc. Model 15-19 covers $10.00. Loads of facsimile machines at $10 & one junker FREE for parts. Electronics, PC boards, power supplies and too many items to mention NO LIST AVAILABLE. Facsimile paper. Western Union Naval Observatory Clocks and so marked on dial square or round with internal pendulum and battery operated approximately 20" x 20". All clocks in operating condition and ready to go - ONLY $50.00 delivered your door - a real collectors find and just perfect for your ham shack in case of power failure. Goodman, C.B. & Co. 5826 S. Western Avenue, Chicago, Illinois 60636.

SELL; ST-5 TERMINAL UNIT, both shifts, tuning meter & wood grain covered cabinet. $75.00. 2 inch Tuning Scope, home built, metal cabinet $50.00. Pictures on request. WA2KKU, W.H. Moody, 5774 Buffalo St. Sanborn N.Y. 14132 - Phone (716) 731-9907.

SALE; SYNCHRONOUS MOTOR for Mite teletypewriter, 115 VAC, 60 Hz. 1 ph. unused, excellent $27.50 ea. Parts for Mite teletypewriter such as selector magnets, arms, cams, level assembly, latch assembly, blocks, modifcation kits, surtches, platens, pinions, etc. Unused excellent - send us your requirements. Reperforator, TT16/FG includes tape perforator, typing unit, range finder, tape reel, sync motor in metal square cabinet, used good, $35.00 ea. Atlantic Surplus Sales, 580 3rd Ave. Brooklyn, N.Y. 11215.

RTTY PICTURE TAPES - ERROR FREE. Order early for holiday season. Over 250 different pix available. Send stamp for list to K2AGI, 5 Hansell Rd., Murray Hill, N.J. 07974.

DELUXE SPACE/ONE RTTY DEMODULATOR. Completely solid state, three shifts, 850/170/425, plus driving voltages, contains all the latest features of a sophisticated TU. Rack mounted or table top cabinet. Small compact 25 lbs. Send for free brochure. Special introductory offer $250.00 FOB. J & J Electronics, Canterbury, CT. 06331.

WANTED; MODEL 28 TTY units in poor condition needing repair or overhaul. Bill Gieckel, W20WH, 14 West Holley Dr. Sayville, N.Y. 11782.

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Another shipment of RTTY Binders, Red with Gold lettering is in stock. The last two shipments of binders have increased in price and with the added postal increase we have been forced to raise our price to $3.00 each in the US and possessions, $3.50 in Canada and Mexico.

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Use NARROW Shift !!