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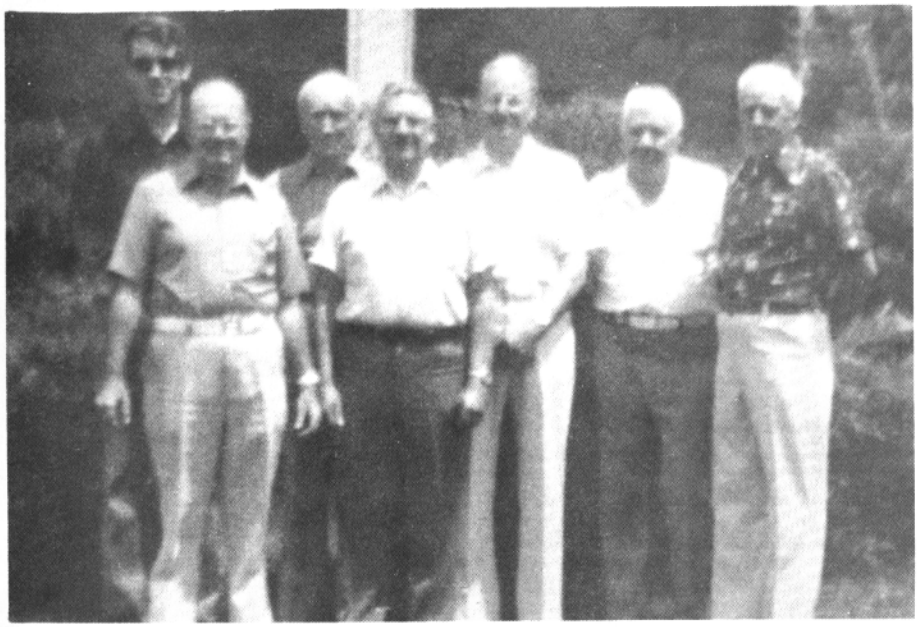
FIRST CLASS MAIL


# RTTY JOURNAL

December 1976

EXCLUSIVELY AMATEUR RADIO TELETYPE

Volume 24 No. 10 35 Cents



## Denver Amateur Radio Teletype Society.

**14 Members of this active club operate a repeater on 444.2 / 449.2 mHz on 16000 ft. Squaw Mountain.**

**Left to right in photo: Colin, WA2YUN/0; Leslie, W0OX, Arch, WA0HTR, Howard, W0MT, Art, W0ZL0, John, WA0RLQ, Paul, W0HFX.**

***CONTENTS-***

# GIANT RTTY "Flash" Contest

## January 15 and January 23, 1977

**RULES**

The **IATG** of Italy is once again sponsoring the « **Giant** » RTTY Flash Contest.
The purpose of this Contest is to promote increased interest in the RTTY mode of operation as used by Radio Amateurs.
This is a « flash » Contest because the total contest time is limited to 16 hours periods on two successive weeks in January 1977.

**1. CONTEST DATES**
1st 15,00-23,00 GMT January 15th 1977
2nd 07,00-15,00 GMT January 23rd 1977

**2. BANDS**
3,5, 7, 14, 21, 28 MHz Amateurs Bands and via OSCAR.

**3. COUNTRY STATUS**
The ARRL Countries list will be used except that the W Call areas WØ to W9 the VE Call areas from VO to VE8 and VK from VK1 to VK8 will be considered as separate Countries.

**4. MESSAGES**
Messages will consist of:
a) Call sign
b) RST
c) Zone number *(Example 11XXX 599-15)*

**5. EXCHANGE POINTS**
a) Each two-way RTTY contact with station in one's own zone will receive 2 exchange points.
b) Each two-way RTTY contact with station outside one's own zone will receive exchange points in accordance with the « escange points table ».
c) Each two-way RTTY contact via OSCAR will receive double points.
Note: stations may not be contacted more than once on any one band but additional contacts may be made with the same station if a different band is used.

**6. LOGS AND SCORE SHEETS**
Use one log for each Band.
Logs to contain: Data, Time (GMT), Call signs, Countries, RST and zone numbers sent and received, multipliers Country, Points and final score.
All Logs must be receiver by not later than February 28th 1977 in order to qualify.
Send them to:

Prof. Franco Fanti
Via A. Dallolio 19
40139 Bologna, ITALY

**7. MULTIPLIERS**
A multipliers is given for each Country worked. A separate multiplier may be claimed for the same Country if a different band is used.
The operators own Country does not qualify for a multiplier, count zero point and zero the QSO numbers.

**8. SCORING**
Total exchange points times the total number of multiplier times the total number of QSO.

**9. HANDICAP**
World championship holders: less 12% of the total final score
Winners of five or more Contests: less 8% of the total final score
Winner of one to four Contests: less 4% of the total final score
Contestants with a previous Contest placing 2nd to 10 place: less 2%.

**10. SWL'S**
This contest is also open to SWL RTTYers. For the SWLs the same scoring rules are valid. A separate results table will be made for these entries.
The Logs for SWLs must contain: date, time (GMT), Call sign of station heard, RST and Zone number sent by station heard, multipliers Countries, points and final score.
The same stationis only valid once on each band.

**11. AWARDS, MEDALS & FREE SUBSCRIPTIONS**
The Contest Committee will compile two separate lists.
a) General classification
b) Short Wave Listeners
In each of these two classes the following awards will be made:
1st: gold medal
2nd: silver medal
3rd: bronze medal
4th to 7th: will receive a 12 month's subscription to the **cq elettronica** magazine.
8th to 10th: will receive a 6 month's subscription to the **cq elettronica** magazine.
There will also be awards for all of the operators and SWL's that send logs.

**12. WORLD RTTY CHAMPIONSHIP TABLE FOR 1976**
Points and positions achieved will be valid for inclusion in the WORLD RTTY championship table for 1976. The « Giant » is the last Contest for consideration for the Championship for the year 1976.

**13. RULES OF BEHAVIOUR AND PENALIZATION.**
The Logs must be compiled in accordance with the rules listed in (6).
The contacts must be made by means of the RTTY mode and it is not permitted to use other modes of transmission either before, during or after the exchange of messages by Radio Teletype.
During the Contest it is expected that Amateurs will observe the fundamental rules of courtesy and good operating during contacts.
The « Contest disqualification criteria » of the ARRL are valid for this contest.
Failure to observe any of the above Rules will result in the exclusion of the entry from the final results and any such Logs received will be considered as check Logs.
All logs received become the property of the IATG and will not be returned.
The decision of the organising Committee in any dispute will be final and any subsequent controversy cannot be referred to the Civil Court.



# Laymans Guide to trouble shoot the UT-4

## No. 3 in a series of Articles.

RONALD LIGHT, WBØNSR/4
621 SW 70th Ave.
PEMBROKE PINES, FL. 33023

We have covered a fair amount of territory. By now to those who are not familiar with Digital Techniques and hopefully these people have at this time a good sound knowledge of just how the Nand Gate works and what has been done in the UT-4 with a few of these Nand Gate circuits. We are going to turn now to some further Nand Gate circuits in the UT-4 and these circuits will begin a gradual upward swing in complexity.

Looking at illustration number 4 we will concentrate first on IC-2. IC-2 is used to select the proper output of a crystal controlled oscillator (called a clock) to the UART chip for the necessary timing that the UART requires. You will notice that there are two oscillators (clocks) required in this circuit. If your teleprinter is geared to the same speed that you are receiving from the air, the clocks will be externally set so that the frequency (speed) of the two clocks will be identical. If this were "always" the case, then there would be no need for IC-2 at all and it could be eliminated. But some people, like myself, like to run their printers at 100 wpm to help typing. Since there is so little 100 wpm activity on the air and in order to work 60 wpm on the air, some method of changing clock speeds to the UART was required as well as some method of switching all these clocks around from receive to transmit.

To facilitate this the first clock would be externally set to match the wpm speed you are going to be receiving from the air waves, while the second clock would be externally set to match whatever the printer was geared for. The frequency of this (these) clock(s) is easy to determine as it's simply the baud rate times 16. To save your calculator batteries, the frequency in Hertz (C.P.S.) is given in Table 1 and can be easily measured with a frequency counter.

Sometimes when putting the UT-4 together, a solder connection on the clock board may be overlooked or cold, and as a result, some extraneous clock frequency would be produced. This is easily recognizable as nothing but garble will be received on ALL signals as well as garbling all of your own transmissions. A quick check with a counter will spot this trouble. Remember there are **two** clocks to check.

Now that we have two clocks let's very briefly see where they go. Assume for the moment that the printer is geared for 100 wpm and the air reception is 60 wpm. In the UART chip, there are two semi-separate sections, one side is called the receive station and this is the side that receives information entering the system regardless of whether this information is being fed from the TU or the keyboard. The other side is called the transmit section and outputs information to the printer or your station transmitter.

So if we are now receiving information from the TU at 60 wpm we must set the clock speed to the UART receive section to the frequency corresponding with 60 wpm. The information is processed by the system and is outputted by the UART transmit section. Since our printer is geared for 100 wpm, we must set the clock speed of the transmit section to the frequency corresponding with 100 wpm, and now we are all set to copy RTTY.

But, what happens when we are ready to transmit, it's your turn at last. We are now feeding a 100 wpm keyboard into the UART receive section that is set up for 60 wpm, and the UART transmit section is ready to spit out this keyboard information to your AFSK at the rate of 100 wpm. This won't work at all.

So some method of reversing the two clock speeds with each other is needed. This is where IC-2 comes in and let's see now how it works.

Examining Section 2A and 2C first we see that the two outputs are tied together and go to pin 17 of the UART. Pin 17 is the clock input for it's receive section and so we must match this clock to whatever the UART is going to receive. You will notice that the two clocks are run to the inputs of 2A and 2C, one clock to 2A and the other to 2C. During receive conditions, 2A's pin 1 input will be high, 2C's Pin 9 will be low via the transmit/receive switch. Since we have a simple Nand Gate, only the one that has high inputs will be able to function. In this case, 2A will be the selected one and so the clock tied to its other input will be allowed to reach the UART. In this case it is the "first" clock and since we are in the receive position, this clock would be set to match whatever we are trying to copy.

If we now throw the switch to the transmit position, 2A will no longer be high and the first clock will no longer be used. Instead 2C will be high and its input is tied to the "second" clock, thus allowing this second clock to reach the UART. Since we are now in the transmit mode, the second clock must be matched to whatever the printer is geared to.

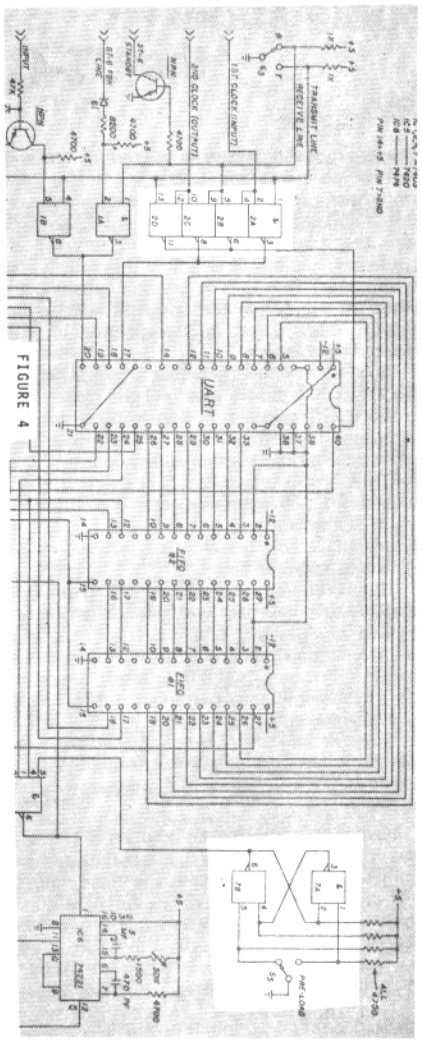


FIGURE 4

So we now have a method of switching these clocks around from one to the other. You will notice 2B and 2D now and see that its outputs are also tied together and run to pin 40 of the UART. Pin 40 is the clock input to the transmit section of the UART, and this clock must match whatever we are going to send the information out to, the printer in receive, the AFSK (FSK) in transmit. These two sections of ICZ function identically as the previous two sections, except the opposite clocks is selected to what the receive section is using at that moment. During receive conditions, 2D is selected which is the second clock which matches the printer, and during transmit conditions 2B is selected which is the first clock which matches the wpm speed that is going to be transmitted and matches what the other fellow was sending you. What we effectively have with IC 2 is a double pole double throw switch.

Turning now to IC7A and 7B we have two more Nand Gates and they are wired up in a configuration known as a flip-flop. A flip-flop is a circuit that will flip to one logic level and upon command flop to the other logic level, although no electronic designation has ever been assigned to what a flip or a flop is. How this circuit works can be found in any logic book. But for our purposes, Pin 6 of 7B is the output and when the switch is thrown down the output is high and when the switch is thrown up, the output is low. This high and low is used to determine if the UT-4 system will be allowed to output normally or if the contents will fill and store in the FIFO memories. We will get into this a little later and see how this works.

We will now cover one more Nand Gate and then proceed to some of the circuits that make the UT-4 work.

Let us turn our attention to Illustration 5 and IC5B. Here we have another type of Nand Gate. You will notice that this one has four inputs to it and one output. Don't let this scare you as it's still a Nand Gate and as such must behave and follow the rules of a Nand Gate. That being the output will be high until ALL of its inputs go high, at which time the output will go low. So armed with this, let's attack this Nand Gate.

IC5B is used as part of the circuit to reset the FIFO character counter to zero when the FIFOs are empty insuring that the meter will be tracking with the FIFOs. You will notice that Pins 12 and 13, two of the inputs, are tied directly to five volts. This is because they are unused, so must be held high, and since they are unused, we're right back to a two input Nand Gate. The question might be raised at this point of why a two input Nand Gate wasn't just used if that's all that was needed. The answer is simply that all the existing two input Nand Gates have been used and it's common practice to use whatever is available to get the job done with whatever is unused, before resorting to adding more chips. So in this case, a four input gate was unused and thus selected, being made into a two input gate.

Let us now look at Pin 9 of IC5B and you will notice that it goes to a switch and also to Pin 15 of both FIFOs. Pin 15 of the FIFO is an input and is the "Master Reset." When Pin 15 is brought low, it will cause the FIFO to reset erasing everything in its contents or clearing it. This is a quick way to make the memory forget everything you have typed into it.

Getting back to IC5B, Pin 10 goes to IC11 which is the actual IC that tells the system that



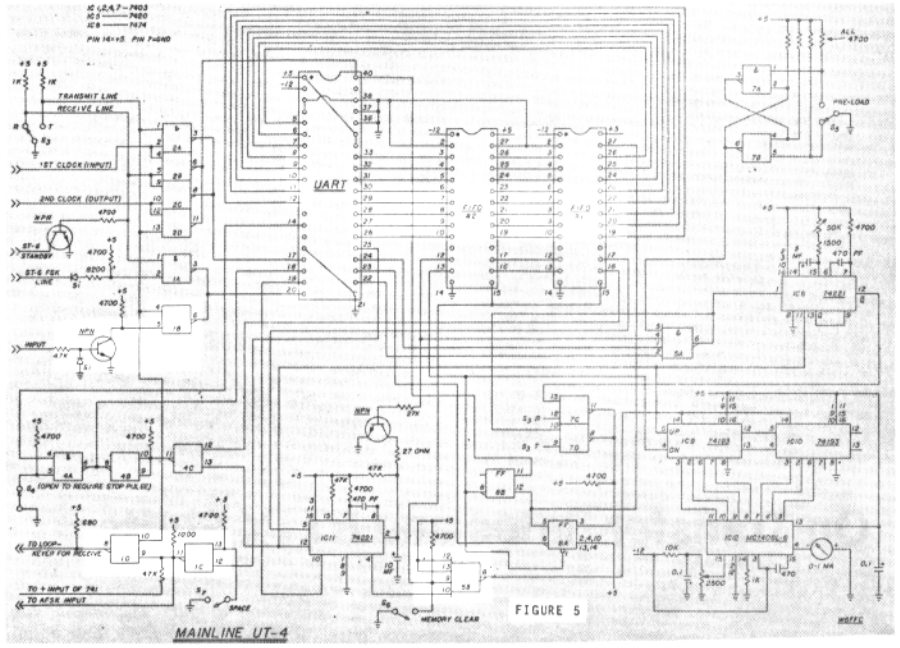



FIGURE 5

**TABLE ONE**

| WPM | BAUD RATE | Clock Freq. [hz] |
|---|---|---|
| 60 | 45.45 | 727.2 |
| 65 | 50 | 800.0 |
| 75 | 56.88 | 910.08 |
| 100 (5 level) | 74.2 | 1187.2 |
| 100 (8 level) | 110 | 1760.0 |
| 107 | 75 | 1200.0 |

the FIFOs are empty. Normally Pin 10 of 5B is high and since the other inputs are also high, the output of 5B is low. This low allows the FIFO counters to count. Since three of the four gates of 5B are normally held high, it would appear that we have just a simple inverter whose output is controlled mainly by Pin 10. Every time the FIFOs are empty, Pin 10 is pulsed to low and then returns to high again. This pulse is only about 50 microseconds in duration, so it is an extremely fast pulse and one that is difficult to see on a scope, impossible to see on a meter. But we can see its effect as everytime the pulse occurs, the output of 5B goes high for a corresponding time. This high will then reset the character counter and its meter to zero. Pushing the memory clear switch will do the same thing, as well as reset the FIFOs. So again we basically have an inverter with Pin 10 being the input.

Well, we have covered a good number of the circuits in the UT-4 which make it function, but we have not covered the timing circuits, and these are the "brains" of the UT-4. These timing circuits are really the ones that will either make the UT-4 work or prevent it from

**TABLE TWO**

L = Low  H = High

| Character | UART PINS 12 | 11 | 10 | 9 | 8 |
|---|---|---|---|---|---|
| CR L | L | L | L | H | L |
| LF | L | H | L | L | L |
| LTRS | H | H | H | H | H |
| BLANK | L | L | L | L | L |
| R | L | H | L | H | L |
| Y | H | L | H | L | H |
| K | H | H | H | H | L |
| W | H | H | L | L | H |

***

working, but it was necessary to show you these previously discussed circuits so that you could see how and where data, clocks, etc., were all fed in or out of the system. Before we get into these timing circuits, let's follow a character through the system and see where it goes.

The UT-4 is in the receiving mode, so our character is coming from the TU. It enters the system going serially to the transistor on the left of the diagram. Here it is inverted and sent to IC-1B which again inverts it and feeds it into the UART's input, Pin 20. Once it enters the UART, it is stripped of its start and stop pulses, turned into parallel information and appears as a parallel character on the UART's received data output lines. Pins 12 through 8. Pins 5,6 & 7 are not used at all when working with the 5 level baudot code and so may be ignored. Table

Two shows what you can expect to see with a meter on these output data lines for a few characters. Whatever character was sent will **remain** on these output lines until the next character is received, so it is easy to check these lines.

When the character appears on the receive section output lines of the UART, it is fed to the input of the first FIFO Pins 19-23 and is "bubbled through" the FIFO appearing on the FIFO's output lines Pins 10-6, where it enters the second FIFO, bubbles through it, and appears on Pins 10-6, the output lines of the second FIFO. At this time it enters the UART's transmit section input at Pins 26-30. Once inside this side of the UART, the start and stop pulses are added to it, and it is changed back into serial form. This serial character is then fed from Pin 25, the output of the UART's transmit section, and run to IC-1C where it is inverted, fed to IC-1D, where it is inverted again and outputted from the system to feed the kever transistor in the TU.

Exactly the same thing occurs during transmit with the only difference being that IC-1A feeds the input to the UART rather than 1B, and the output of the system is fed to the AFSK and no longer allowed to pass through IC-1D to the kever transistor.

You will notice that the AFSK is fed regardless of whether in transmit or receive, so the AFSK makes an excellent medium to use for the making of tape recordings without the noise and fades. Remember that garble on the incoming signal will also produce garble at the AFSK.

Now that we have covered about three-fourths of the UT-4 we will begin to concentrate on the "brains" of the system, the part that makes it work, and puts it all together, the timing circuits.

# On Transfer Rates and RTTY Shifts.

BILL WALKER, W5GFE.

*Bill Walker, Ph.D., Dept. of Computer Information Systems, West Texas State University, Canyon, Texas 79015

Although the law presently allows the use of RTTY shifts up to 900 hz, amateurs have traditionally utilized shifts of 850 hz or less. Recent trends have been toward much narrower shifts, typically 170 hz.

If one defines "transfer rate" as being the amount of information that one transmits in a given time interval, them most amateurs are aware of the fact that higher transfer rates require correspondingly greater channel bandwidths to accommodate the information.

With the new bandwidth proposals now before the FCC, it behooves the amateur fraternity to pay attention to transfer rates, vs channel bandwidth, particularly in view of the probable legalization of more esoteric codes such as ASCII, and others under the pending rulings.

Amateurs usually use one of two methods of transmitting RTTY information. One method, which we shall not explore, consists of turning a single carrier on and off, much in the manner of CW, in order to generate the make and break patterns required for character recognition. This method has a set of attendant and very real technical problems, which most amateurs avoid by using the second common method of transmission, that of moving the carrier frequency back and forth a given interval to distinguish between "make" and "break." This method has many advantages, particularly at the receiver, and it is this method that this paper is intended to address.

For the purposes of this discussion, the words "band" and "shift" will have their usual amateur meanings. "Channel width" will refer to the total amount of spectrum consumed by a signal.

In contrast to standard amateur practice, we will propose the following definitions, however. "Wide shift" will refer to use of a shift greater than or equal to the baud rate, while "narrow shift" will designate use of a shift less than the baud rate of a particular signal. Thus the vocabulary becomes dependent on information transfer rates, and not on an arbitrary selection of a borderline.

We will reserve the narrow shift case, which includes the "no shift" case of a single "make-break" signal for another discussion, and devote ourselves to the study of the wide shift case.

**THE WIDE SHIFT CHANNEL WIDTH PROBLEM:**

When a single carrier is modulated by information in a make-break fashion, it can be shown that the frequency of this modulation is equal to one-half the baud rate. Thus the total bandwidth of this single signal (carrier plus upper and lower sidebands) is essentially the baud rate, expressed in cycles. Thus a typical amateur baud rate of 45 baud, results in a bandwidth of 45 cycles, on a single make-break carrier. Since the usual practice is to use two carriers, and shift from one to the other, with one carrier active on make, and the other on break, we must consider the total spectrum

CONTINUED ON PAGE 7



# The POOR MAN'S UT-4

W. REILLY, VE3HSY
641 Griffith St.
LONDON, ONT. N6K 2S5

After copying the smooth print out of RTTY stations using the UT-4 circuit and noting the obvious advantage it offered to other sporadic, hunt and peck typists like myself, it seemed that the eventual incorporation of the UT-4 system at this station was inevitable.

However, owing to the relatively poor availability of the required UART chip in this area an alternative system offering this advantage seemed desirable.

Drawing heavily on the old adage that true genius lies not in complexity but rather in the reverse, the following somewhat "steam" approach was developed.

To slow down the rate of transmitted data it is only necessary to lengthen the 31ms stop pulse occurring at the end of each transmitted character, as this is achieved when typing from the keyboard by simply typing slower the following circuit was devised to average out the time between each typed character.

In an attempt to simplify and keep abreast of the current trend away from circuits using discreet components and to keep constructional work to a minimum, the use of a 555 timer IC seemed the logical way to go. The 555 IC is a highly stable device unaffected by supply voltage variations and has a time interval variation of only .005 percent per degree centigrade change in temperature. For operation in the astable mode the frequency and duty cycle can be accurately set by only two external resistors and one capacitor, moreover, the output circuit of the IC can handle currents in the maximum order of 200ma.

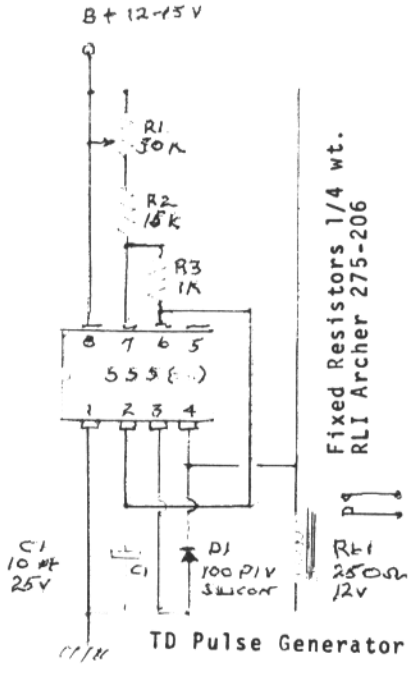
The circuit requires little in the way of comment, RI is the speed control and determines the rate of transmitted data, the contacts of RLI are inserted in the clutch circuit of the TD, the diode across the winding of RLI is to surpass back emf pulses and to provide protection of the IC.

*****

To put the unit into operation it is only necessary to feed the controlled TD with punched tape from a perforator or reperf on a separate loop, and to adjust RI for the rate of transmitted data.

With a little practice it is easy to find the correct adjustment to suit your particular typing abilities.

The unit has been used successfully with the author's three head TD and results indicate that the station on the other end of the QSO is unaware that a mechanical rather than electronic system of control is in fact is use.




## Transfer Rates ---

CONTINUED FROM PAGE 6

occupied by these two signals. For the purpose of this discussion, we will treat these two carriers as two separate signals, separated by the amount of shift, and each modulated by the same information, albeit inverted. Thus each carrier occupies a bandwidth equal to the baud rate. The space between the carriers is filled up with the lower sideband of one signal, and the upper sideband of the other signal. Thus we may consider the total spectrum occupied by our transmission as being the baud rate plus the shift. See figure 1.

Should an amateur seek to employ a higher baud rate for a given amount of spectrum, it is apparent that he must reduce the shift accordingly.

But how much?

Consider figure 1. Intuitively, we notice that the two carriers have sidebands, which must not be allowed to interfere with the opposite carrier. Amateur filters being what they are, we might guess that it would be reasonable if we were to plan our system so that the upper sideband of the lower carrier, and the lower sideband of the upper carrier interfered only with each other, and not with the opposite

carrier. Thus the narrowest shift which would allow our filters to distinguish one carrier from the other without interference from the other carrier's sideband, would appear to be the most economical use of the spectrum that we would hope for in the wide shift case. As a matter of convenience, let us arrange that each sideband reach at most half-way to the opposing carrier,as in figure 2. Thus,for a 22.2 hz modulating signal (45 baud) we would need to space our carriers by 44.4 hz.

Since the channel width is the baud rate plus the shift, it can be seen that under a restriction of a maximum allowable channel width of 350 hz,we should use 175 hz shift,and up to 175 baud.

However,the above discussion assumes rather good engineering in amateur filter design. I personally feel that we would be better off using shift rates at least twice as large as the baud rate,as this would make filter design considerably easier. Figure 3 details this situation.

Amateur practice can easily lead to filters of 60 hz bandwidth. Thus, we should require our shift to be at least 60 hz. These considerations lead to the following system of inequalities, which the casual reader may choose to ignore, since we will provide their solution: $0 < b \leq 350$

$60 \leq s \leq 350$

$b + s \leq 350$

$b \leq (s/2)$

where b is the baud rate, and s is the shift.

Using standard linear programming techniques,we seek to maximize the possible baud rate,while still remaining legal. This leads us to the solution of b= 116.67,and s= 233.33,for a total spectrum consumption of 350 hz.

If instead of maximizing the baud rate, we were to minimize the shift (an entirely different problem),we learn that b = 30, while s = 60. Thus the maximum baud rate that can be supported by 60 cycle shift is 30 baud, a figure which is much slower than amateurs ordinarily use.

We observe that for 45 baud (60 wpm baudot) we would wish to use a minimum shift of 90 hz. Indeed many amateurs have reported success with much shifts.

The upshot of the above is that if we wish to operate under 350 hz bandwidth restrictions, we must operate at baud rates less than 116.67 baud, and corresponding shifts of twice the baud rate.

The author observes that many computer installations use 110 baud ASCII as a standard, with the next highest standard speed being usually 300 baud. Thus,amateurs will be able to carry on conversations with computers and other amateurs at a standard speed which is universal to the industry. The author further comments that 110 baud ASCII (8-level) is equivalent to 10 characters per second,a speed which few amateurs will ever need to exceed.

Oh, yeah! After reading all of the above, I still want to know?

I operate 170 shift with 60 wpm baudot RTTY on 20 meters. Will I be legal when the new rules come into effect?

Yes. Your bandwidth for your channel will be 170 (shift) plus 45 (baud) equals 210 hz. So don't panic,but look forward to many more fine years on the green keys.

The author wishes to thank Joe Bethancourt, WA7TUM/5 for this kind assistance, both technical and journalistic.

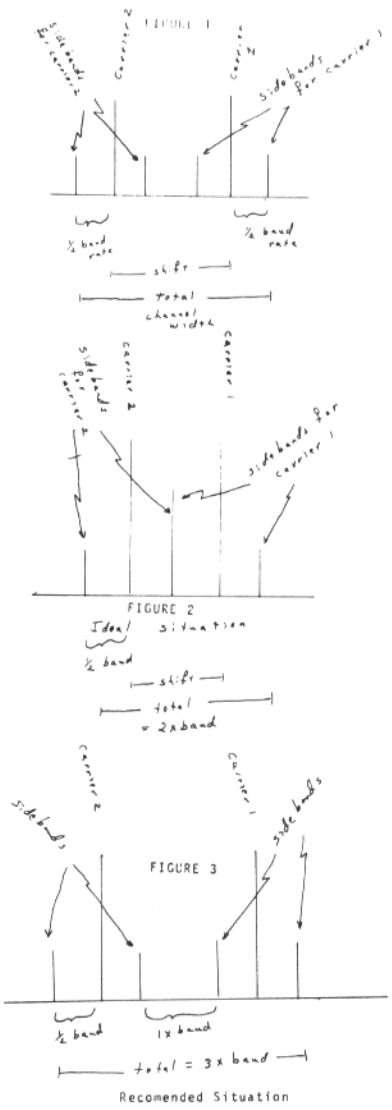
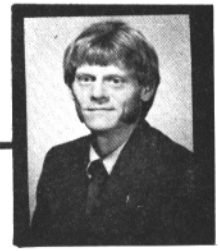



FIGURE 2

FIGURE 3



# RTTY theory & applications.



**Ron Guentzler, W8BBB, Editor**
**212 Grandview Blvd.**
**Ada, OH.45810**

RTTY SIGNAL BANDWIDTH
Part 2 - NONSINUSOIDAL SIGNALS

Last month we discussed considerations necessary when making calculations in ordinary AC circuits. Three things were necessary: 1) The signal (voltage or current) had been present for a while so that any transient had died out,2) The signal was a pure sinusoid so that formulas such as V = IZ could be applied and so that ordinary AC meters could be used to obtain meaningful measurements, and 3) The elements within the circuit were linear so that Ohms law (R = V/I) could be applied.

Although these may seem to be quite limiting, most AC currents meet all the above requirements. However,what happens when a signal such as that found in a telegraph loop is to be subjected to calculation or measurement? In order to answer that question, a few new concepts and terms will be introduced. A signal that recurs regularly is called a periodic signal.

A sinusoid is a special form of a periodic signal. A signal that does not recur regularly is called a non-periodic or aperiodic wave. .A periodic signal can be viewed on an ordinary oscilloscope with ease (assuming its magnitude and "frequency" are within the capabilities of the 'scope). A non-periodic signal can, in general, be viewed only on a triggered-sweep oscilloscope. For a non-sinusoidal wave, the oscilloscope may be the only means of measuring the signal.

**TELEGRAPH SIGNALS**

When a telegraph signal is sent a character at a time, it is a non-periodic signal, because it is not possible to predict when the next character is going to occur. A telegraph signal when sent from a tape can also be considered as being non-periodic because no two characters are alike, and therefore, the signal does not recur in a perfectly repetitive or periodic fashion. On the other hand,when a repeated character such as the letter 'R' is sent from a test set or from a keyboard that has a repeat key, the signal is then periodic. (Alternate RYs are also periodic. For that matter,so is the sentence "THE QUICK BROWN FOX,etc.," if it is continuously repeated,but the period or length of time before the signal exactly repeats itself is so long that it is probably best to consider it non-periodic.)

Although a single repeated character,such as 'R',when sent from a test set is periodic, a much better signal for test purposes and purposes of analysis is a simple square wave.

The preference for a square wave over that of a repeated character is that the period of repetition of a square wave is much shorter than that of a repeated character. Figure 1 shows the letter 'R' and a square wave having the same Baud rate. Among other things, the period of repetition of the letter 'R' is 7.42/2 times as long as that of the square wave. This means that when analyzing the two waves, more work is required in the analysis of the signal having the longer period. (Also, when viewing the signals on an oscilloscope, the entire letter must be shown; when viewing the square wave,only two alternate "bits" need be shown. Therefore, the resolution on the oscilloscope is 7.42/2 times better with the square wave. This is especially important when accurate measurements are to be taken.)

**SQUARE WAVES**

Because there is a close resemblance between a square wave and a typical telegraph signal,and because the square wave has the shorter repetition period, we will concentrate upon the square wave, and eventually come back to the actual telegraph signal.

If a square wave exists in a circuit,how can the circuit be analyzed? The answer is that there are two different approaches that can be used. Which one is used will depend upon the nature of the circuit and the type of results desired. The methods are: 1) Fourier series, and 2) Transient analysis. Before commencing with these two different methods, let us see how they relate to our original AC circuit calculation considerations.

Because the square wave is not sinusoidal, we strike out on that score. However,if we can somehow convert the square wave to a sinusoid,then we are back in the game. If we consider the circuit as being all-transient, we may not be able to use ordinary AC circuit techniques but we can go ahead with a straightforward transient technique. If the circuit is non-linear, forget it! About all that can be done with a non-linear circuit is to plug

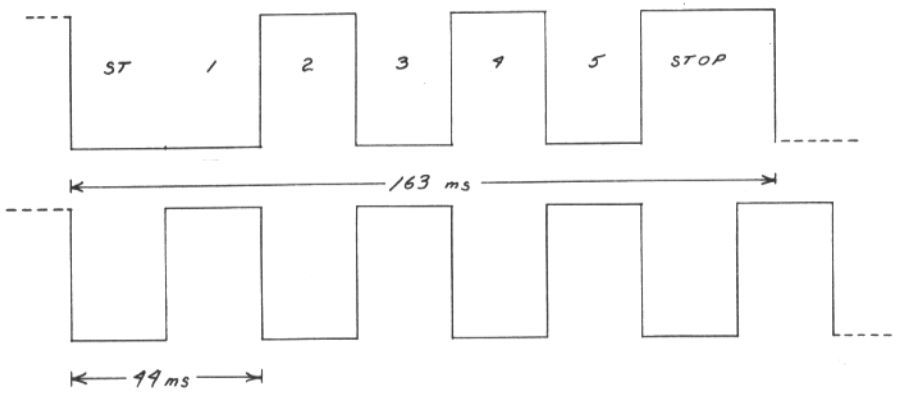



Fig. 1.. A 60-Speed letter R and a square wave having equal Baud rates.

it in,turn it on,let is pass the "smoke test;" and then look at it with an oscilloscope. (Actually, calculations can be made, but the non-linear circuit analyais is beyond anything we want to get into here.)

**TRANSIENT ANALYSIS**

For rather simple circuits like a simple loop, the transient analysis is relatively straightforward and may be easy to accomplish. The approach is, basically, to analyze the circuit every time a change is made from a Mark to a Space or from a Space to a Mark. We have done this in this "column" several times in the past when considering loop time constants. (See RTTY: 1967 DEC., p. 8; 1968 JAN., p. 10; 1968 FEB.,p. 10; 1969 MAY,p. 8; 1969 JUN.,p. 8; BEGINNERS RTTY HANDBOOK, Parts 15 and 16).

The transient analysis is quite straightforward and easy when the loop or circuit is simple and when the time constant of the circuit is much smaller than a bit (22 ms in a "60-speed system.) This is because the result of calculation during one interval does not affect that of the next interval.

If the time constant is long compared with a bit, the solution becomes more involved because the initial conditions for one interval are dependent upon the results of the preceding interval or intervals. Nevertheless, the calculation is still practical. However,if the circuit is more involved (two energy-storage elements may be enough) some other means of solution might be better.

**FOURIER SERIES**

The approach to solving circuits containing non-sinusoidal,periodic signals that is especially rewarding is that of Fourier Series. The basic idea is to take the signal and "decompose" it into a group of sinusoids. So long as the circuit contains only linear elements (and any 'turn-on' transient has disappeared),the solution of the circuit is obtained by solving the circuit for each of the sinusoids independently and then simply adding all the results. A side benefit is that the true bandwidth of the signal is also revealed and the effects of frequency response due to intentional or unintentional filtering will become readily apparent. In fact, many times the Fourier series is obtained, not to solve the circuit, but simply to determine the bandwidth required by the signal.

Next month we discuss Fourier series.

**VHF OPERATING INFORMATION**

In the 1976 OCT Issue we had information on the Westchester County (New York City) Repeater,WR2AIS,provided by Paul Vydareny, WB2VUK. Paul indicated that a lot of interest was generated from the information in the column,especially the simultaneous RTTY and voice operation. We did manage to make one goof: The auxiliary RTTY input frequency is 146.565 MHz. Thanks for the information,Paul, and sorry for the error. John Sheetz,K2AGI,had a writeup on the WR2AIS repeater in the latest (1976 SEP) issue of the Static from Murray Hill.

**CURRENT AWARENESS**

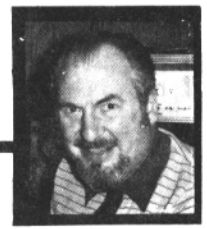
"Update on the phase-locked loop RTTY demodulator," Nat Stinnette, W4AYV, Ham Radio, 1976 AUG. pp. 16-17.

That's it for this month. Keep the information coming, and look for part 3 next month. 73 ES CUL, RG.

***



# RTTY-DX



**John Possehl, W3KV, Editor**
**P.O. Box 73, Blue Bell, PA.19422**

**Hello there...**

Since our last meeting here the big event in RTTY was, of course, the CARTG "Olympics Sweepstakes." This annual October affair traditionally starts the Fall DX season and brings out the boys in force. This year was no exception and the bands were bedlam for the Contest weekend. Africa was perhaps the toughest continent to log. To our knowledge only EA8FO, EA8NL, and ZS6BBK, were available to hand out contest numbers. In past years Asia was always the most difficult to find but lately the RTTY from Japan has increased tremendously making that continent fairly easy to log,conditions permitting. Prefixes like JG,JJ, JI,JA,JH,JR6 and JD are apt to inject an element of confusion but amateur radio activity in general has advanced so rapidly that the traditional JA prefix was completely allocated many years ago. JD of course is assigned to Marcus and Bonin and each counts as a separate country. JR6 is Okinawa, but now counts the same as Japan proper. There were some really rare stations active in the contest if you had the good fortune to find them. Some of those reported were 9M2MW in Malaysia, FO8BO was terribly strong here but tied up in a sked and not in the contest. Alf, JX6XF, was quite active and gave many stations their first Jan Mayen contact. Lord Howe Island was reported and perhaps this could be the long awaited debut by VK2BKE/LH, however, further details are not available at this writing.

This Contest should break all records for total contacts made and we will all look forward to the official results when they are published a few months hence. If you participated at all we urge you to get your score in as there is still time to do so.

There is renewed activity from Cyprus and this time by the Austrian contingent of the UN Mission stationed there. 5B4BK is the call and Otto is the operator. His home call is OE30HA and QLS's can go via the Austrian QSL Bureau, P.O. Box 999-A,1014 Vienna,Austria or direct to — Otto Holler
P.O. Box 375
Larnaca, Cyprus

The signal is tremendous from a variety of antennas including the classic rhombic oriented on Vienna. This gem is 80 meters long per leg and is sitting on towers 20 meters high. Regardless of the BK in the call sign Otto takes a dim view of BK'ers and is apt to go QRT when such tactics get out of hand.

Be on the lookout for renewed activity from Rumania. ON4CK recently had a cross mode QSO with =?2AYD. The station was receiving Bob's RTTY and answering in CW, as his FSK was not yet ready. Perhaps this minor problem has been solved by now and should you contact QSL's can go to — Octavian Rusanda
P.O. Box 90
Arad, Rumania

Mid October also brought RTTY signals from French Guiana. Joe, FY7YM was just getting things going and while his shift at the time was non existent he was quite printable. The machine is a Creed 7BN4 and he is using a Drake Line into a three element beam. Cards go to — Joseph Cheng A Long
P.O. Box 63
St. Laurent du Maroni
French Guiana, S.A.

It has been a couple of years since the last activity from this area and we hope that Joe will continue to keep the prefix active in the mode.

Reports received here indicate a very good possibility of activity from South Georgia by VP8MS. Apparently there is commercial equipment available from time to time and when he does get going it would be in the time slot 1500-1600z on Sundays. As more definite information is received we will be happy to pass it along.

From the Far East Gin reports that 9M6MU is waiting for a printer to arrive. With the prefix assigned to sabah the pile-ups will be fantastic when he gets going. Dusty tells me that 9M2SS has subscribed to the Journal. While this does not guarantee activity it does indicate an interest,like that old saying which goes, "where there's smoke, there's fire."

At this time we take great pleasure in introducing the latest addition to the RTTY JOURNAL DXCC roster.

Plaque Nr. 24 for 100 RTTY DXCC
TO
Sam Leslie W4EGY

Sam's first exposure to RTTY was back in 1959 and at that time the equipment line-up was a Model 15 machine with WX type, a DX-100,and a HRO 50 receiver. A contact with Eric,VK3KF,started him chasing DX. While the road toward DXCC was slow and tedious Sam

found the 16 year effort to be very enjoyable. The present gear consists of the 28KSR, 28RO, 28TD, and 28 Reperf. Listening is done with a 75A4, and Drake R4C. Sending happens with a T4X driving a pair of 4-400's that feeds a tri-band beam with dipoles for the lower bands. Control equipment and Tu's are all home brew of his own design. More personal statistics are that Sam is 37, married, with two daughters, and is an electrical engineer by profession.

Until a few months ago KØJWX/6 was KA2PJ over in Japan. Active in all the contests. Paul finds that doing it from Stateside is a bit different than from a DX location. Also, when your job is connected with the military, assignments change so frequently that the QTH is never current in the call book. Just in case you were wondering, here is how you can reach him at the present time: Paul K. Johnson
3425 Gurnard Ct.
San Diego, CA 92124

Marv, KJ6DL, has been very active in the latest contests much to the delight of many DX'ers and he is also fast in QSLing. He did say that the QTH of his stateside manager as previously published is not current. Everything is okay except that the location is on 479 Washington Avenue, Gulfport, Miss. 39501. Also it will be more convenient for Asian stations to QSL via JA10CA.

By this time most all of you should have received your QSL from JY9BB. Blackie apologizes for the delay but has been doing a lot of traveling and in fact most of the cards were mailed from England while he was passing through.

Here in the States recent changes in the regulations governing amateurs have permitted many to trade in their old call for a two letter call of their own choosing providing it is not currently assigned and that you have the necessary "time in grade". Hal, W9OEQ is hooked on RTTY for life as apparently he asked for and received W9RY. We have noticed many more such calls on the band which we are sure belong to familiar faces. If you have made a change let us know so we can publish them here. Then everyone will know Who's Who.

Please take particular note — we plan to publish the RTTY DX HONOR ROLL in the JANUARY issue. Please try to have your totals of WRKED/CFMD here by the end of November. No list required, just two numbers.

The WAEDX RTTY Contest has just about taken place by the time you read this, so we hope to have a report next month. In the past the German boys have usually come up with a few surprises in this one so we hope that there was a new country or two in it to raise your DXCC totals.

**73 de John**

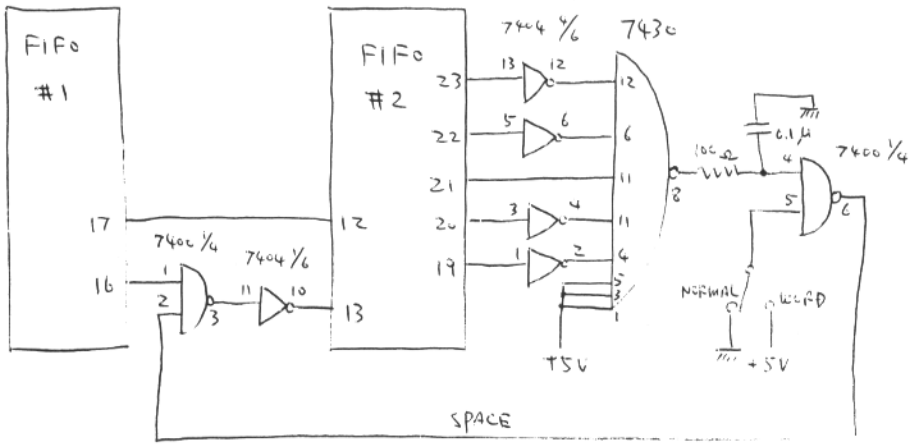
***

# WORD MODE for the UT-4

TED.H.TAKAHASHI,JA1FFX
3-28-6 Kami-Ikedai
OHTA-KU, TOKYO, JAPAN 145

I recently finished building a UT-4. After it was working fine, I added a "WORD MODE" with very simple logic as shown on the schematic.

Decode space character at the input of FIFO 1 and gate out "in ready" flag from FIFO 2 to FIFO 1. That is all. It is very useful to correct mistyped letters before transmission. Try it —

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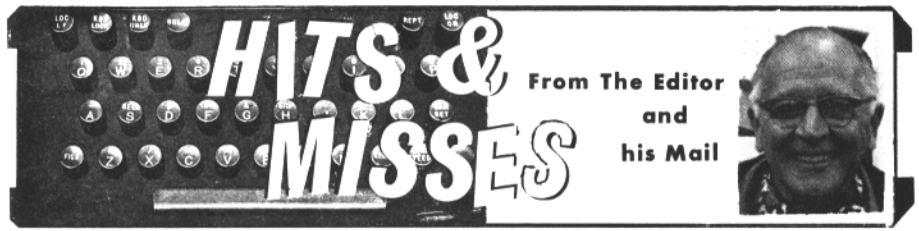


This issue, December brings up a lot of subscription expirations. About three times the normal amount. Check the last page for a stamped notice of expiration. December is a busy month for everybody so if you plan on renewing — do it now! It will assure you keep getting the magazine and save us a lot of work.

Even though it is more work for us and not as convenient for many subscribers we still prefer single year subscriptions.

***

I have a problem with my Model 28 ASR set that perhaps you or one of your readers may be able to help me with. The problem is as follows: I have an ASRset with a double transmitter base and mounted above this is an auxiliary typing reperforator. I wish to install a TD base mounted answerback unit in this machine; Teletype Corp. specifications say this cannot be done. I know for a fact that it can but I need information from someone who perhaps has solved this problem. I have heard that some Hams in the Florida area have done this successfully, but so far I cannot find a workable solution. Any help would be much appreciated.

**David D. Elsea** P.O. Box 218
Middletown, VA 22645

***

Dear Dusty,

How about a 200 Hz standard? What for? Well, try this on for size: There is an US standard for computer information exchange via telephone lines. This happens to be a 200 Hz FSK set of signals, one set for originate, and one set for answer.

Most changes are made for economic reasons, or what boils down to economic reasons. This might be the case here; First of all, we have inexpensive MODEMS (TU & FSK keyer to RTTYers) coming on the market. And second, Motorola puts out a single chip that has both TU and Keyer onboard in a single 16 pin DIP package.

O.K., it's going to take some playing and experimenting to make it go the way we want it to, but there are several advantages besides the economics that I can see:

1) 200 Hz shift — darn close to 170 shift when thinking of modifying existing equipment.
2) Answer tone set, 2025 Hz & 2225 Hz — also darn close to our low and FSK frequencies on existing systems.
3) 2100 "Echo Suppressor Diable" tone on chip — What did you say about Autostart?
4) These are US standard tones, and if and when we go to ASCII, they just might open up unlimited ideas for access to phone lines via RTTY.

The Motorola chip is the MC14412VL, and is available from: Tri-Tek, Inc.
6522 N. 43rd Ave.
Glendale, AZ 85301
for $21.74, data sheets alone are just $.60, both ppd. Almost forgot, the clocking circuits are Xtal controlled with a 1 Mhz xtal which is also available at $4.95.

Hope this puts some ideas in the heads of all that talent out there.

**Bob Grater K6SUB**

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**I WISH TO THANK EACH AND EVERYONE OF YOU** whom I have had the pleasure of serving this past year. Your letters and requests for copies have certainly been appreciated. Wishing you all a Merry Xmas and a Happy New Year. R.H. Wilson WB0ESF.

**PAPER WINDER LPW300** (Never used original carton) $45.00 delivered; CV89A with manual $45.00 plus shipping; Radiation TDMS Receiver Transmitter - make offer. KZ5OD Box 284, Balboa Heights, Canal Zone.

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**DOVETRON MPC-1000R (E Series) REGENERATIVE RTTY TERMINAL UNIT** retains all the features of the MPC-1000/MPC-1000C Terminal Units plus the benefits of the TSR-100 Teleprinter Speed Converter-Regenerator. Front panel controls permit signal speed selection (60, 67, 75, 100 WPM Baudot and 110 Baud ASCII), Memory Functions (Unload, Reset, Preload and Recirculate), and Character Rate Over-ride. Two front panel LEDs indicate the status of the Memory Section (Full or Empty) and the state of the TD inhibit line. The latter is controlled by a unique automatic memory unload circuit that prevents character over-runs even when pulling tape. The BLANK diddle character is generated by the tri-state mode of the UART regenerator and prevents a signal time-delay or first character error on the outputted signal. MPC-1000R: Commercial: $995.00. Amateur: $745.00. Shipping and Insurance: $9.50 Continental USA. Delivery: 30 days ARO. DOVETRON, 627 Fremont Avenue, South Pasadena, California, 91030. 213-682-3705.

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**PRINTED CIRCUIT BOARDS:** RTTY SELCAL with TTL logic, (73 Magazine, November 72) $12.00. ST-5A-W/PS (2 boards) $6.25. AK-1, $4.25; CW ID'er (Feb 73, 73 Magazine) $4.75. Logic probe (Dec. 74, 73 Magazine) $1.00. Autostart RTTY encoder and decoder (Jan. 67, 73 Magazine) $11.00. Synthesizer - 75-S Collins Rec. (Dec. 75, Ham Radio) 2 boards $12.50. Instructions and parts list included. S.J. Zalewski, 29307 Red Cedar Drive, Flat Rock, MI 48134. (313) 782-9316.

**MODEL 28 ASR's** — KSR's, Repurfs - Keyboards, TD's - Printers, Parts - All priced for Hams. All in excellent condition. A.D.M. Communications, Inc., 1322 Industrial Avenue, Escondido, Ca. 92025. (714) 747-0374

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**AUTOMATIC CW ID UNITS.** Programs up to 32 dots, dashes, or spaces, easily programmed. All on one board. Less supply, kit $12.95; wired and tested $17.95 (your call must be supplied.) Interface for above for ST5 or ST6, AFSK or FSK, Kit $4.50, wired and tested $5.50. 10 minute automatic resettable timer for ID unit, kit $8.95, wired and tested, $11.95. 5V 1A fully regulated, short proof TTL supply, with transformer and plug in or hard wired board, kit $12.69, wired and tested $16.69. SAVE on all four units, package of above reg. $39.09, kits sale price $35.95. Reg. wired and tested price, $51.09, sale price $47.00. Cabinet for above, unpunched (Dozy E box) $7.25 each. NuData Electronics, 104 N. Emerson St., Mt. Prospect, IL. 60056.

**RTTY PICTURE PERF TAPES.** Hundreds, including nudes, cartoons, animals, works of art, landscapes, all of the RTTY Art Contests entries. Chad type (fully punched, no lids) 11/16 inch standard Amateur 5-level paper tape. Guaranteed COMPLETELY error-free. Run times from 2 minutes to 10 hours. Listing and info free if request typed on 5-level printer, otherwise send 24 cents in STAMPS. For "Intro Pack" of ten picture tapes of the best, various subjects, various lengths (total run time - 2 hours 12 minutes), send $6.00, immediate delivery, POSTPAID, listing included. Due to popularity of above, "Intro Pack Deluxe" now offered, run time 12 hours 44 minutes, $30.00, shipped PRIORITY mail in USA, surface postpaid overseas. Joe Dickens, WA9UGE, 601 S. Dodson, Urbana, IL 61801.

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**NS-1A PLL TU** (Journal 1/76 Ham Radio 8/76) Wired/tested $29.95 ppd. Board $4.75 ppd. Parts only $15.00 ppd. SASE for info. Nat Stinnette Electronics, Tavares, FL. 32778

**WANTED: HEATH MONITOR SCOPE** with manual in good condition. W7JWL, 10660 Riviera Drive, Sun City, Arizona 85351.

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**MODEL 28 ASR's** - Keyboard typing reperforator, keyboard answerback, auxiliary perforator, dual transmitters, gears-your choice. Excellent appearance and operating condition. Will crate and ship. $400. Box 218, Middletown, Virginia 22645.

**RTTY PICTURE PERF TAPES:** Over 575 different available. Special for Christmas - Three $5.00 gift packs - each over three hours running time. No. 1 Religious - Madonna, Wise men, Angels, etc. No. 2 general - traditional - Santa, banner, reindeer, Xmas bells, etc. No. 3. General popular - March of the Elves - Charlie and Lucy, etc. Send for free catalog to Al Perkins, 217 N. Cedar St., Galesburg, IL. 61401.

**DOVETRON TSR-100 TELEPRINTER SPEED CONVERTER-REGENERATOR** is a 6" by 7" PC card designed to mount inside of any MPC Series Terminal Unit and is intended to provide signal regeneration and UP-DOWN speed conversion. The 18 socket-mounted CMOS devices include a Uart, two FIFO Ripple Memories (80 characters), a programmable crystal-controlled Dual-Clock, and a bilateral steering section that permits solid-state switching between Transmit and Receive. All Uart functions including Parity are switch-selectable. Both sections of the Dual-Clock are programmable for 60, 67, 75, 100 WPM Baudot and 110 Baud ASCII codes. All 8 parallel data lines are available at the output of the Memory section. The TSR-100 also offers Variable Character Rate, BLANK Diddle and memory functions of Preload, Recirculate and Reset. The BLANK Diddle is Uart-generated (Tri-state mode) and does not contribute time delay or first character errors. A unique Memory Unload circuit prevents character over-runs and provides a TD Inhibit. A pair of LEDs indicate Memory status. All signal input and output ports are fully buffered for easy interface to other terminal units. Power requirements: +5/+15 volts at 85 mils and -12/-15 volts at 10 mils. TSR-100: $195.00. POSTPAID Continental USA. Delivery: 30 days or less. DOVETRON, 627 Fremont Avenue, South Pasadena, California, 91030. 213-682-3705.

**SALE: HAL'S COMM.** TV Phone include RVD 1002 & KBD1 with 9" monitor used about 2 years, extremely good condition - $800 or best offer. Write Jerry Craig, Ph 317-352-8785 or/340 Paddock Dr. West., Savoy, IL 61874.

**TELETYPE EQUIPMENT** - Still time to get machines before the holidays. Model 28 Delta ASR $800. Model 28 Sprocket RO, $120. 28 RO/KSR Cabinets, $25-60. 28 ASR Cabinet, $35-100. Late Model 28 Mark II Typing Unit - 99% complete - for parts or can be repaired, $25. Excellent 28 LXD stand alone TD, $125. SASE for list. P. Andersen, 115 Boyken, Rochester, MI 48063. 313/652-3060.

**DOVETRON MPC-1000 (E Series) MULTIPATH-DIVERSITY RTTY TERMINAL UNIT.** The new E Series represents the sixth generation and adds Automatic CRT Intensity Control, Keyboard Actuated Autostart, Automatic Threshold Control for unattended operation, Fast-Slow Autostart, and Autostart Delayed-Timeout to the MPC's MULTIPATH CORRECTOR, IN-BAND DIVERSITY MODES, and the continuously variable Mark and Space channels. All IC's, transistors and Cmos logic elements are mounted in low-profile sockets for ease of servicing and maintenance. Interfacing to the TSR-100 or UT-4 speed converter/regenerator is accomplished by removing two jumpers at the rear panel. Your QSL brings full specifications. MPC-1000 (Amateur) $495.00. MPC-1000C (Commercial) $795.00. Shipping and Insurance: $7.50 Continental USA. Delivery: 30 days or less. DOVETRON, 627 Fremont Avenue, South Pasadena, California. 91030. 213-682-3705.

**MOD-U-LINE CABINETS**, ST-6 style MCP 3-17-12 $27.97. Now shipping gray color in 24 hours. All Sizes available, but some not stocked. 1 day to 6 weeks deliv ery on some special sizes in tan or blue. Special sizes in gray or black 2-6 weeks. UT2 and UT4 Components available. Send stamp for our free catalog. NuData Electronics, Dept. B, 104 N. Emerson St., Mt. Prospect, IL 60056.

**DOVETRON TELEPRINTER IDENTIFIER TID-100.** Mounts inside of all Dovetron MPC Series (and ST-6) terminal units. CMOS circuitry requires less than 1 mil standby and 8 mils functioning. May be programmed for CW, Baudot or ASCII. 128 bit capacity. Two LEDS indicate CLOCK RUNNING and CODED OUTPUT for easy visual verification of programmed code. All four CMOS chips are socket-mounted and programming instructions are etched right on the circuit board. Includes 50 programming diodes: $34.95 postpaid. Factory programmed with DE and your call: $39.95 postpaid. DOVETRON, 627 Fremont Avenue, South Pasadena, California, 91030 213-682-3705.

**THE DOVETRON DCM-100** is a poly-phase Direct Conversion Modem employing BASEBAND techniques that completely eliminate the need for input bandpass filtering and channel filters, permitting the error rate to approach the theoretical minimum. A high degree of selectivity is not required in the companion receiver, since this technique also eliminates all the image windows. The Mark and Space channels are both continuously tuneable from 1200 to 3000 Hertz and a dual LED display on each channel permits fast and precise tuning. Full IN-BAND Diversity provides automatic single channel copy during deep selective fades. Auto Markhold, anti-space and anti-CW are standard. FSK and MARK Autostart is offered, and the MARK Autostart is adjustable for Fast or Slow response. The high level loop supply is strappable for either 60 or 20 mil operation. The phase-continuous AFSK tone keyer may be preset with two different Mark-Space-Shift tone combinations, which are operator selectable from the front panel. Rear panel connectors permit plug-in interfacing of the speed-changing regenerators (including the Dovetron Microprocessor and the UT-4). The TSR-200 and TID-100 may be mounted internally. Twenty of the 25 integrated circuits are identical and all are socket mounted. All digital circuits are high noise-immunity CMOS. Availability: January 1977. Amateur list price: $295.00. FOB. DOVETRON, 627 Fremont Ave., South Pasadena, Ca. 91030.

**FOR SALE:** 28ASR. Used 2 hours, $2,000. R. Koistinen, 1513 Excelsior Ave., Oakland, CA 94603 415-530-7961.

**Additional Classified See Next Page -**