

Armed Forces Day on RTTY

The Annual Armed Forces Communications Tests will be held on May 18-19, 1974. The RTTY receiving test will be sent from WAR-on 4030, 6997.5, 14405 N.SS on 4012.5, 7385, 14385. AIR on 7315, 13997.5 and NPG on 4010, 7347, 13992. The RTTY message will be at 60 wpm at 0335 GMT on May 19th. A ten minutes CQ will precede the test for tuning purposes.

ceived" along with the call sign of the station copied and the call, name, and address including zip code of the station submitting the entry. Send to Armed Forces Tests, Chief, Navy - Marine Corps MARS. 4401 Massachusetts Ave. N.W. Washington, D.C. 20390 Mail Stop 394. Certificates will be issued to all that qualify.

Transcriptions should be sent "as re-

Address Correction, Requester
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Royal Oak, Mich. 48068

FIRST CLASS MAIL



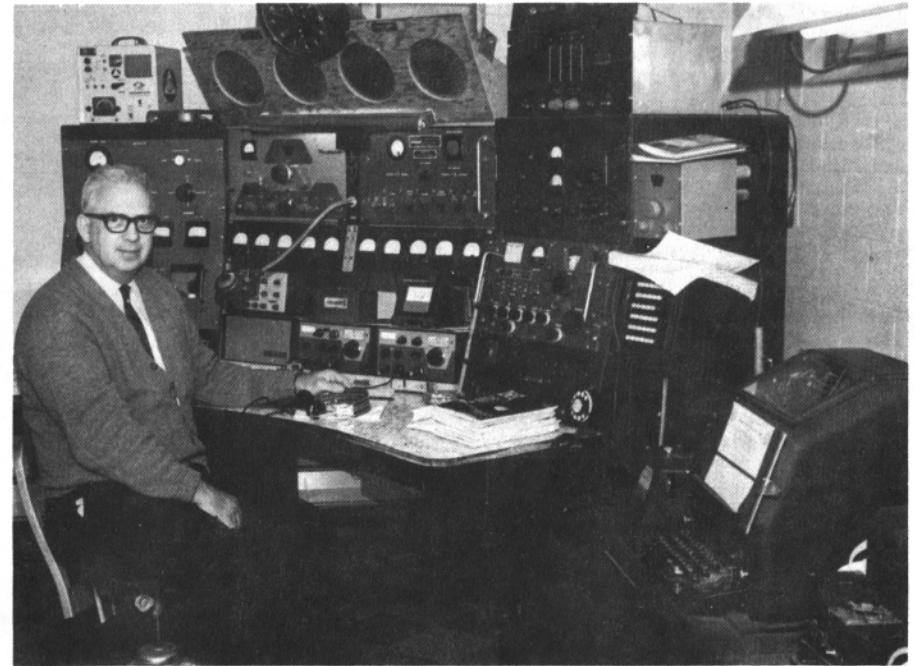
RTTY JOURNAL

MAY 1974
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Scooped again by Hoff

WINNERS--

Giant FLASH DX Contest.

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WHITESTONE, N.Y. 11357

Hoff has done it again. (Reference 1). We had hoped to publish the first article featuring UART. We knew that it would be only a matter of time before others would recognize its potential applications to amateur radio, but were naive enough to think that we were first.

We had noticed the UART when its description first appeared in the trade magazines in 1971. In fact we had been watching the Digital Equipment Corporation's catalogs which were listing the boards which UART replaces. The 1969 prices were \$175 each for the two required boards.

Our first application of the UART is a direct use for which the unit was designed, parallel to serial and serial to parallel date conversion. We had salvaged some computer peripheral equipment and started the process of interfacing it with the station teletype. The tape reader and punch could be used in place of the reperforator and TD (with the fringe benefits of regeneration and speed changing). The equipment was in pieces so the project is not yet complete. W6FFC builds faster, writes faster (our club Cessna 172 goes only 100 knots).

A technique used to convert from parallel to serial operation is to hold data in memory. It is no secret that the Model 14 TD has a memory (K4EEU had to know it -- reference 2). Closures of sensing pins (parallel) are sent to the commutator-distributor segments (still parallel). Each bit is held there momentarily (by virtue of the length of the segments until it is picked up by the brush and transmitted serially) on the dc loop.

With W6FFC coordinating and reporting UART projects, the UART can revolutionize amateur radio teletype. We can be in a new era with small, quite, digital devices replacing the old, noisy, analog machines. Even the dc loop will disappear.

WB2CZL

References:

- Hoff, "UART", RTTY JOURNAL, April 1974
- Kelley, "A Digital Tape Distributor", RTTY JOURNAL, December 1971

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1	i6NO	4.609.548	29	K7MJC	132.192
2	i1BAY	3.769.116	30	WAQFPF	130.152
3	W3EKT	3.432.780	31	DL8QP	119.064
4	i5WT	2.880.630	32	PAQWDR	109.956
5	W1GKJ	2.366.640	33	i2KD	98.040
6	OZ4FF	2.332.000	34	DK3NH	92.416
7	iT9ZWS	1.610.092	35	W7BCT	81.396
8	ON5WG	1.564.200	36	SL5AR	72.520
9	iQZAN	1.417.780	37	SM7BNL	68.510
10	K6WZ	1.338.474	38	G3RDG	35.424
			39	i1KG	33.040
11	DM4PL	1.172.234	40	PAQWDR	30.856
12	HA5KFB	1.098.981			
13	9Y4VU	1.068.756	41	OK2BJT	30.720
14	i5CW	658.440	42	UA9PP	28.329
15	ZL2TQV	635.562	43	DK1AQ	23.730
16	DK3MG	522.480	44	VK51F	22.239
17	OK1MP	386.672	45	SM5BCF	21.600
18	DJ1QT	373.980	46	i3CKN	18.343
19	SM6EZD	357.840	47	VE4SC	14.580
20	OE50EL	311.040	48	SMQKV	12.078
			49	VK3KF	9.264
21	HB9HK	310.464	50	LX1JW	6.240
22	HG5A	278.300			
23	SM6AEN	247.500	51	W3KV	6.048
24	DK2XV	208.449	52	CE3MA	2.125
25	CE3EX	185.625	53	W8TCO	987
26	SM5BVF	162.240	54	SM6EDH	816
27	i1PXC	140.712	55	OZ4XR	560
28	DL1VR	133.056	56	OZ4EDR	54

S.W.L.

1	NL-687	3.949.400
2	P. MENADIER	1.825.460
3	KILPS/i8	1.808.480
4	R. GIARNELLO	1.041.624
5	BALLENBERGE	983.710
6	MARCHESINI	790.320
7	BRS. 25676	639.000
8	SCHMIDT. H	190.650
9	i3-14258	180.044
10	BRS.27239	134.464
11	S. HUTCHESON	131.328
12	HE9HUC	690

DID YOU KNOW?

That binders for the RTTY JOURNAL are available. Dark Red, hard cover with Gold printing. Holds issues for one year with some space left over. Priced at \$3.50 each PP. (that figures at \$7.00 for two) Order from the RTTY JOURNAL..

We hear one group on 100 wpm, state that anyone that wanted to break and could not work 100 wpm to break and they would come down to 60 wpm. Now if the guy on 60 can't work 100 how is he going to print all this information?

IRVIN M. HOFF, W6FFC
HOWARD NURSE, W6LLO
PAUL SATTERLEE, Jr. WA5IAT

REVIEW:

UART stands for Universal Asynchronous Receiver Transmitter. A synchronous signals are those transmitter serially with start and stop pulses, such as Baudot and ASCII.

The UART receives such a signal, sees if there is a valid start pulse or not, then in the case of Baudot converts the serial code pulses to parallel and stores the character in a shift register until it can be used. The transmit section accepts this character, adds a start pulse and stop pulse and feeds the signal out as a serial character.

The device was made primarily for computer purposes, to allow the computer to receive and later transmit asynchronous signals. Hams will find interesting uses for the UART - the most simple being a regenerative repeater. This allows reception of highly distorted signals which are then converted into perfect signals for the Teleprinter to use. By merely adding a second clock speed, and up or down converter is obtained, allowing use of a 100-speed machine to copy any incoming Baudot signal. By adding a silo register such as the "FIFO" chip, a down-converter with memory buffer is obtained.

AVAILABILITY:

The AMI S-1883 chip is not yet available, and indications are it might not be ready during 1974. The AMI S-1757 is considered obsolete. Western Digital Corp. has no general distributor setup as yet, and due to a rash of individual orders has now adopted a \$50 minimum order. Primarily for other reasons, we regard the TR1602B (Western Digital) as a poor consumer investment.

Although the TI TMS6011NC should be readily available at any TI (Texas Instruments) distributor, arrangements have been made in the San Francisco area for individuals to mail order either the TI or the GI (General Instruments) AY -5-1013 chips, postage-paid for \$1 over normal single-unit cost. The \$1 will cover the postage and handling charges. California residents add sales tax.

The TI unit may be gotten from: The R. V. Weatherford Company
3240 Hillview Avenue
Palo Alto, Calif.

TI TMS6011NC \$11.00 plus \$1.00 for handling and postage.

The GI unit may be gotten from: Intermark Electronics
1020 Stewart Drive
Sunnyvale, Calif. 94086

GI Ay-5-1013 \$16.00 plus \$1.00 for handling and postage

Part of the difference in cost is due to the TI being in black plastic while the GI is only available in the more expensive ceramic. Except for cost, the GI unit would be preferred -- however the TI is considered the better buy at the difference in price. The TI is good for more than 10,00 Baud -- maximum legal amateur speed at present is 75 Baud! (Slightly over 100 wpm.)

EXPERIMENTATION:

The Western Digital unit exhibits an unusual peculiarity in addition to a potential latch-up. We shall mention the latter first, as it is relatively unimportant. If the input signal is low (space level) and the plus five volts is initially brought up prior to the -12 volts, the TR1602 unit will latch up. This is easily remedied by merely turning the plus five volts off momentarily and then back on again. Or the latchup will not occur if you are requiring a valid stop pulse with pin 14 connected to pin 21, instead of grounding pin 21.

There is another peculiarity of the TR1602 however. (The TR1602A is the ceramic version; the TR1602B the plastic version.) If characters are received with no stop pulse, the internal flags are not reset properly and an additional letters character is transmitted after the character with no stop pulse. Even when requiring a stop pulse, superfluous characters are transmitted at irregular intervals, in presence of no stop pulses.

While it is possible this trait would not produce any harmful effects, neither of the other two brands act in this manner.

A Datapoint 2200 computer was programmed to transmit characters with no stop pulses, but with a mark pulse later added to allow the UART to know the character had been completed. The TI and GI units copied normally, the Western Digital unit copied primarily garbled. Of course a normal teleprinter garbled

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in the worst possible way, as each character allowed the machine to lose synchronization, having no stop pulse. All three UARTS were then tried with required stop pulse. As expected, the GI and TI did not print anything at all, as though the printer had been placed in standby. The Western Digital continued to print occasional random garble. At this time, the computer was programmed to print one character per second with no stop pulse at all. The GI and TI copied normally, the Western Digital tripped off an additional letters character after each character received. This was reminiscent of the action mentioned last month on receipt of a long space tone, where we mentioned it would trip off a blank after the tone came back to a mark level, when requiring the stop pulse. The 'blank' we mentioned was in fact a letters character.

The above tests were run with and without required stop pulse. The TI and GI units passed with flying colors, the Western Digital was rated unsatisfactory. Whether this test has any valid counterpart in normal, marginal conditions is uncertain. We think it does.

While working with this test, an universal circuit was developed by WA5IAT that allows any of the three brands to be interchanged as a simple regenerative repeater -- or with a second clock speed added, as a speed converter. Both WA5IAT and W6LLO are using UARTS together with buffer memory. The teleprinter runs only at 100 speed, with the UART operation being an up-speed converter on receive and a down-converter for transmit.

THE SCHEMATICS:

The schematic entitled "USING THE UART" shows a simple hook-up for a regenerative repeater. This is arranged for transmitting a single-unit stop pulse, so that 7.0 code can be received. The usual 7.42 code then is no problem.

Since it is unlikely you would have 2-3 different brands of UARTS, you may prefer to use the supplemental hook-ups shown for the TI or GI instead of the universal arrangement. You will notice how very simple the GI unit is to install, due to its unique internal reset of the reset data available flag on pin 18.

Pin 17 shows how a second clock would be added rather than hooking it to pin 40. This second clock would make the unit into a speed converter.

Use of a polystyrene capacitor gives very good stability. W6FFC reports a variation from 727-729 Hz. -- which would be less than 0.4 per cent. The clock runs at 16 times normal Baud rate and

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is then divided internally by the UART.

If the operator does not have a digital counter, it might be a bit difficult to set the speed properly. One way is to build the clock as shown and then vary the pot until normal copy results. Another way is to use a crystal-controlled clock.

THE XB-6 UART CLOCK

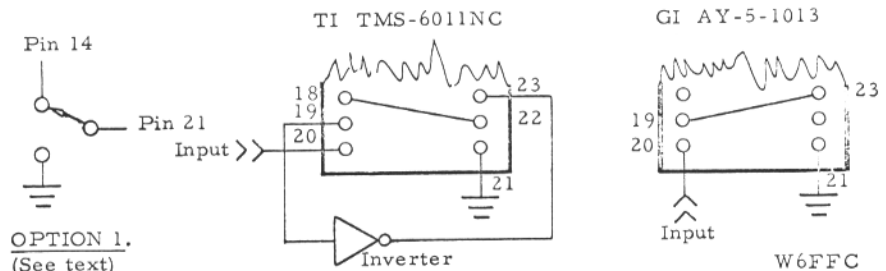
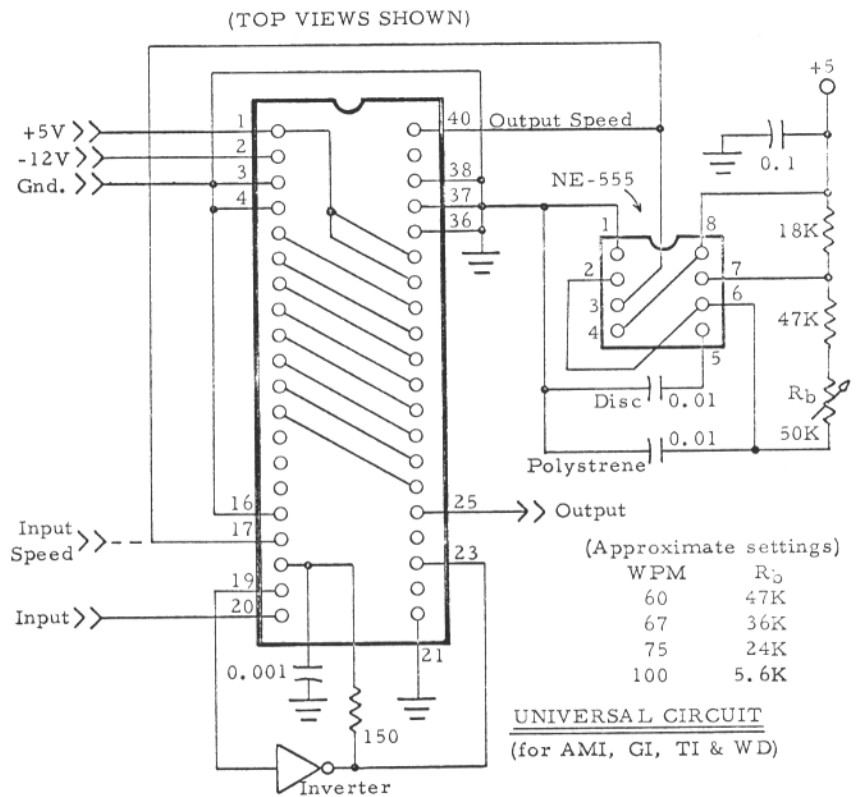
The easiest way to get an accurate speed for the UART is to use a high frequency crystal. This is then divided down to the correct speed. Even a crystal of very poor quality would give an error so insignificant as to be meaningless. The XB-6 UART clock uses a 4.5 MHz. crystal of low cost (\$3 from Jan Crystals in Florida) plus some programmable dividers to give any of six different common Baud rates. The Datapoint 2200 computer was put to work selecting a crystal frequency that would give an extremely low maximum error on any of the Baud rates.

The fan-out of the 7490 decade divider is suitable for driving another identical set of dividers -- thus a second switch would give control over the input speed (first switch) and the output speed (second switch) for a up or down speed converter. Discussion of the manner in which the synchronous counters are programmed is beyond the present scope of this article. This same technique is being used for several other projects including a crystal AFSK unit and shall be discussed more at that time.

Although not shown on the XB-6 drawing it is a good idea to by-pass the plus 5 volts at each IC with a 0.1 capacitor.

TRANSMITTING WITH THE UART:

Older teleprinters in particular, such as the 15 and 19 have rotating cams for the keyboard signal generator. These often get dirty or out of adjustment and transmit large quantities of distortion. Using the UART between the demodulator and the radio transmitter will normally insure the highest quality of transmitted signal -- assuming a decent R.F. capability exists. The device will also put out a good signal from a poor t.d. when used in the same loop. Even the model 28 signal generator may be out of adjustment or burned contacts. The UART might be considered by some as "overkill" to present a good transmitted signal, but the capability is there for you to use if you desire that perfect signal for others to copy more readily. If using a crystal FSK, you may wish to add an op amp such as a 741 between the UART output and the R.F. transmitter in order to get plus-minus voltage swings. The circuit shown works satisfactory on most FSK and AFSK circuits.



USING THE UART

HOOKING TO THE ST-6:

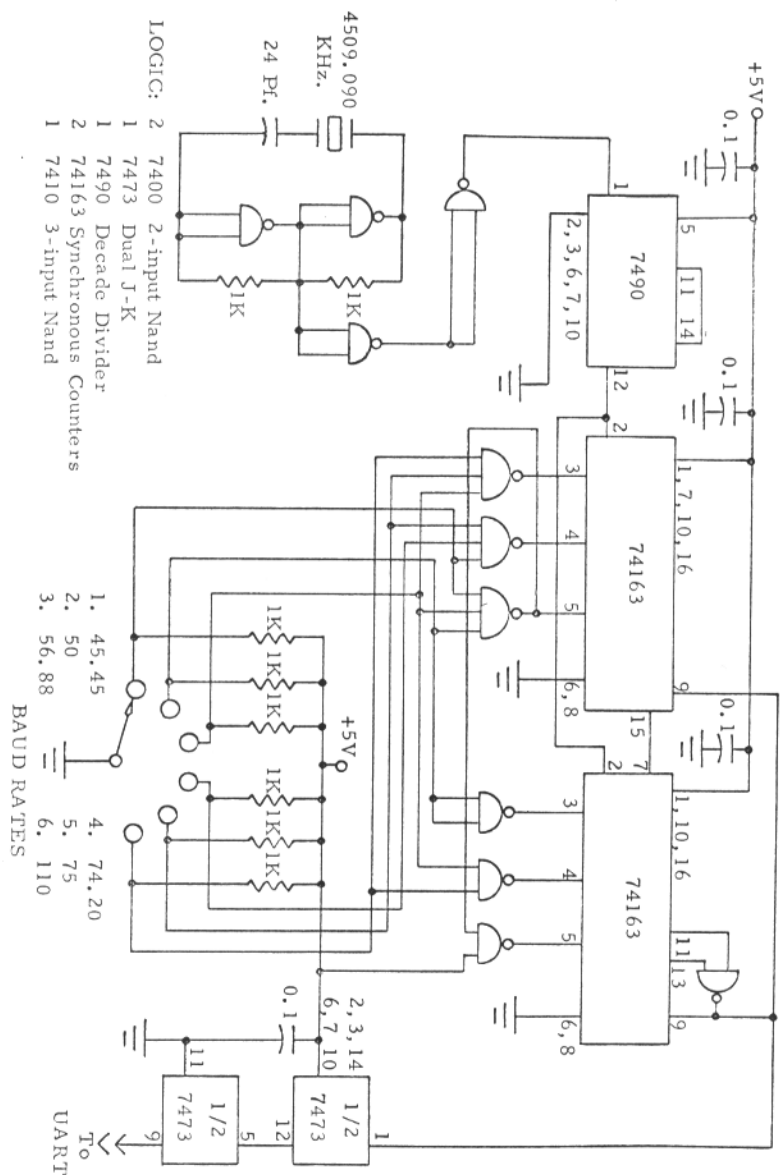
The ST-6 has a 2200 ohm resistor between the slicer and the keyer transistor. Remove this resistor, and the empty holes make a convenient place to hook the two wires to the external circuit. However many printed circuit boards already bring these two terminals out to the plug-in connector, making the installation very

simple.

Various possibilities exist. The picture in the first section of the article shows a plug in board having 12 terminals on either side of a dual-12 pin card connector. Suggestions have been made to incorporate the UART in a separate cabinet together with its own power supply, loop supply and opto-isolator. Such

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MAINLINE XB-6 UART CLOCK

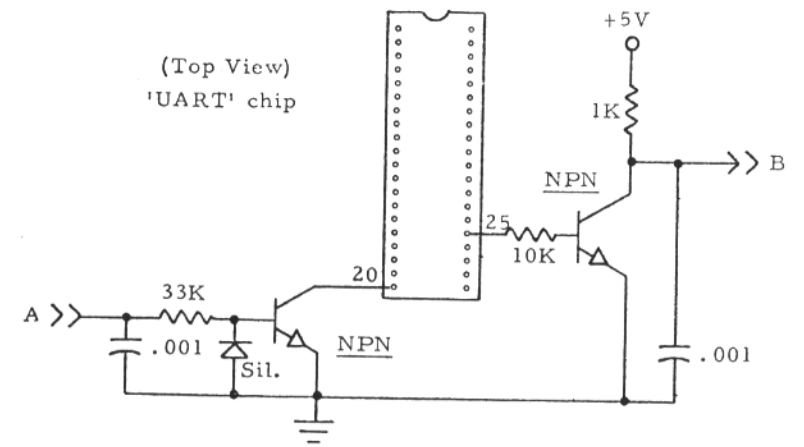


W6FFC

a unit would be completely independent of the ST-6 and thus could also in most cases be used instantly on ANY demodulator. Such universal adaptability may/may not be a requirement for you. Again for some people this sounds like a bit of overkill since the demodulator normally already has a loop supply, and in many

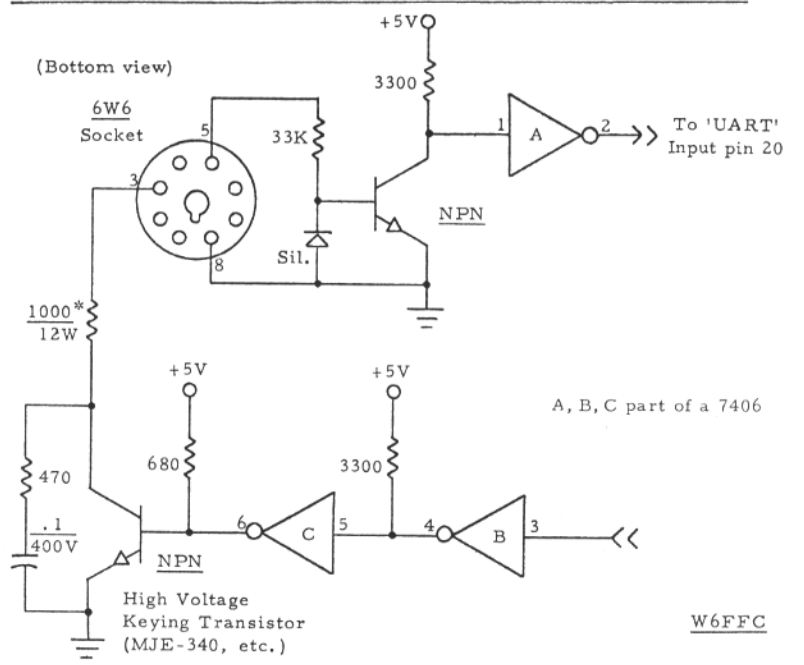
cases the teleprinter has its own internal loop, being controlled through an isolating polar or mercury-wetted relay.

HOOKING TO THE TT/L:
The easiest way to adapt the UART to the TT/L is to get a male octale plug with cover and then remove the 6W6



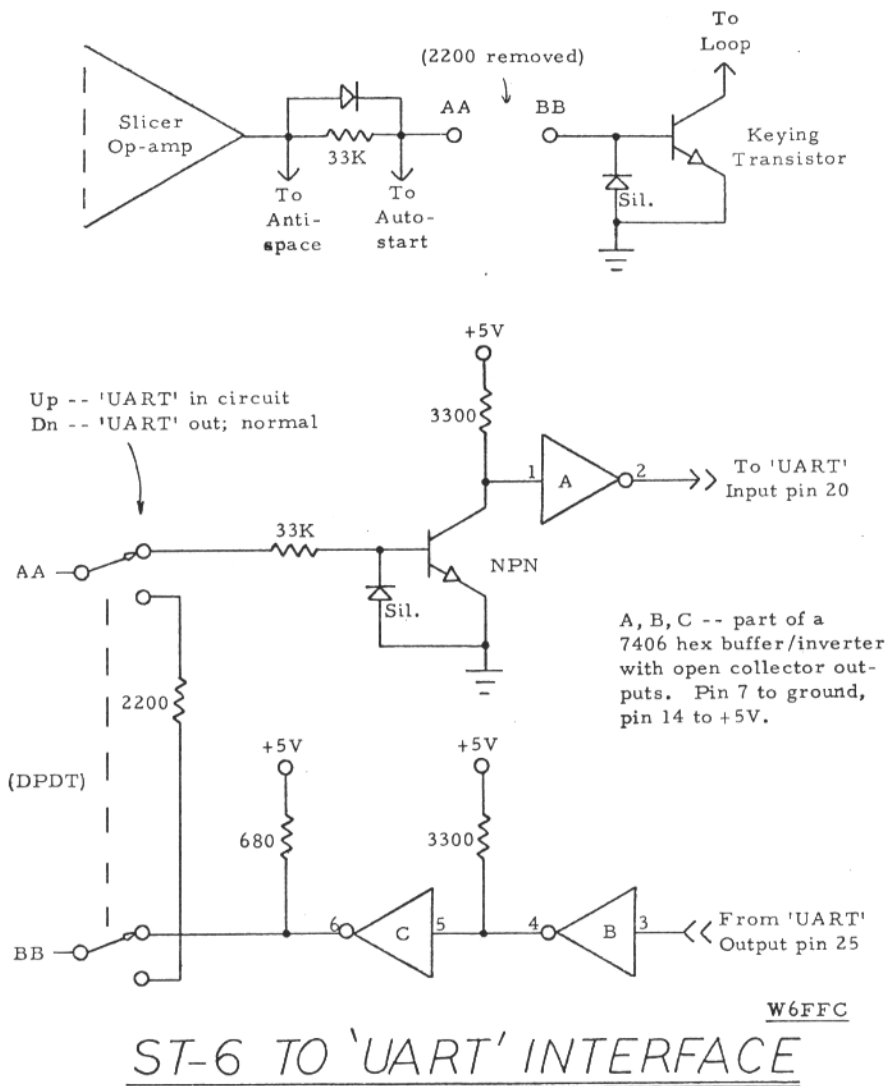
A -- F.S.K. driver from TT/L, ST-5, ST-6, etc. Needs positive voltage on space, negative or zero on mark
B -- to AFSK, or F.S.K. keyer in transmitter W6FFC

TRANSMITTING WITH THE UART



W6FFC

MAINLINE TT/L-'UART' INTERFACE



ST-6 TO 'UART' INTERFACE

W6FFC

keyer tube. The male plug with the three connecting wires is then inserted, giving good versatility. The 1000 ohm resistor takes the place of the voltage drop normally furnished by the 6W6.

A simple "in-out" switch may be added if desired. Use a single-pole double-throw toggle switch. The output of inverter "A" (pin 2) would then go to the wiper arm of the toggle switch and the input (pin 20) of the UART would hook to one side of the toggle switch. The other side would connect to the base of the MJE-340 keying transistor. For this simple circuit, the UART would continue

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to be powered with its plus 5 and -12 voltages.

If using the TT/L-2, the diode from the grid of the 6W6 tube to ground must be removed. This will not affect the normal operation if the 6W6 is replaced.

POWER SUPPLIES:

A nice 5V power supply capable of 500 mills or so is available in kit form for \$10 from RGS sales in Santa Clara, Calif. See their ad in 73 magazine. The -12 volts may be obtained directly from the ST-6, and will be around 10 mills.

The -12 volts may also be obtained from the TT/L via a 5W dropping resistor and a 12 volt zener (be sure to use the -150 supply and orient the zener properly).

NEW DEVICES:

Western Digital recently announced two new chips, the PT1472b (synchronous and asynchronous receiver) and the PT1482B (synchronous and asynchronous transmitter). These new chips will offer additional versatility, particularly at a later date if the FCC allows amateurs to use more advanced techniques. National has a MM5221 TM/D chip that converts Baudot to ASCII and ASCII to Baudot plus a MM5740 AAE for keyboard encoding with N-rollover. These last two will be of interest to people wishing to convert surplus computer keyboards to RTTY purposes. Motorola has also recently announced a keyboard encoder chip.

ACKNOWLEDGEMENTS:

More interest has already been shown

CLEAN RTTY Signals- -

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LA Canada, CA. 91011

Probably the majority of amateurs actively using radioteletype, do not spend any major part of their time observing signals, and may never hear anything except an on-frequency transmission. On the other hand, the ARRL Official Observers, upon whom FCC relies a great deal to perform a self-policing service -- and, presumably, save funds for policing the Citizens' Bands -- may not be broadly qualified to check upon F1 signals and their associated key clicks, noise, buzzes, and other defects. Furthermore, should they do so, they may find many signals impossible to identify from their morse ID's, what with the peculiarities of some ID's, plus the many signals that have essentially zero shift during the morse ID.

For my part, perhaps as many as half of the RTTY signals, on many days, are not identifiable, although I have sometimes gone to the trouble to write to the station worked, asking for help.

Key clicks are not new. However, separate noise transmissions from 1 to 15 kHz from the F1 desired signal, are more difficult to identify, and there are many of these now. Buzzing, white-noise,

in the UART device than any development in RTTY for several years. The comments in these two articles are a composite of ideas, thoughts and experiments conducted by a large number of people. We should like to mention some of these: John Souvestre WA5NYY was especially interested in the development of the XB-6 and materially aided in setting up the programmable counters. Fred R. Scalf K4-EID was quite interested in the computer program chosen to select the crystal frequency and was most helpful in making copies of the initial circuits available to all concerned for study and comment. Paul Van Wie aided in determining that the Western Digital TR1602B did indeed have a peculiarity that needed additional investigation.

W6OXP, WA5PTR/7, WA4VYL, W6JFY, WB6WPX, W6BXR and others have all been most helpful. Our thanks to Dusty for giving us the room to present this information.

separate F1 signals nearby in frequency, are heard frequently. Lately, there have been many spurious signals farther removed from the intended F1 transmission, such as up in the 14 MHz phone band, particularly around 14220 kHz. Several of these have been found to be SB-101, SB-400 and SB-401, apparently due to harmonic generation in the first mixer, similar to the problem of a Japanese equipment when the traps are mistuned, which produces phone spurious signals in the 14 MHz CW band. Many of these have inverted-sideband spurious signals and changing one frequency causes the other to go in the reverse direction.

With such problems, I do suggest the F1 RTTY stations use at least a 100-Hz shift when keying, or preferably the full shift used, or even go to on/off keying on the mark frequency. Also, they should have a critical check of the accuracy of the morse I.D. Unless FCC Monitoring obtains an I.D. from a printer, I don't know whether they can do any better than I can with the zero-shift ID's, (which may be more difficult at a distance than near the transmitter), but it might be helpful for the stations to receive O.O. cards instead of FCC citations. -- K6KA

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RTTY theory & applications.

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ADA OHIO, 45810



RTTY for Beginners- Part 13

Gears and This ;

This month, we will discuss the consequences of the Baudot code as related to machine operating speeds.

Unlike the code used for hand-keyed telegraphy with its variable-length characters, the Baudot code used with amateur printing telegraphy (Teletype) has a fixed-length format; i.e., all characters be they the letter E or the letter Y, are of the same length. This fixed-length format is related to operating speeds within the machines.

Teletypers, when arranged to communicate with each other, are connected in a series circuit called a loop. That is, the keyboard contacts and the selector magnets are in series. Power is supplied to this series circuit by means of a dc power supply of at least 130 volts. A resistor is inserted into the loop to limit the current to 60 mA.

A character is sent by depressing a key on the keyboard. When the key is depressed, contacts within the machine open and close in a predetermined pattern at a fixed rate. (See RTTY JOURNAL, 1972 March, p. 8 or any of the RTTY Handbooks for the code format).

The actual character is composed of five time intervals during which the circuit is either open or closed. The condition when no current is flowing (contacts open) is referred to as a Space (S). When current is flowing, it is called a Mark (M). Each M or S is approximately 22 milliseconds (ms) long. Each character is preceded by a Space, called the Start pulse. Each character is followed by a Mark, called the Stop pulse.

With Bell System machines running at so called "60 Speed", the Stop pulse is 31 ms long. The Start pulse and the five character elements are 22 ms long. Therefore, it takes 163 ms for every character. A "word" is defined as 5 characters and a character space. Therefore, it takes 6 times 163 ms or 978 ms (0.978 seconds) for one word. The number of words per minute is

60 (1 minute equals 60 second) divided by 0.978 which equals approximately 61.3 words per minute (WPM). Therefore, a Bell System teleprinter operating at its maximum speed will print 61.3 words per minute; this is called "60 Speed" operation.

With Western Union machines, the code is the same as for Bell System machines (the only difference being that the apostrophe and bell are interchanged). However, the Stop pulse is only 22 ms long with a Western Union machine (vs. 31 ms with a Bell System machine). Therefore, a W. U. machine character takes 7 times 22 ms equals 154 ms. A word takes 6 times 154 ms equals 924 ms or 0.924 seconds. Dividing 60 (seconds per minute) by 0.924 gives 65 words per minute.

In spite of the different operating speeds in words per minute, the two machines are perfectly compatible.

The next item to consider is the speed at which various things within a teleprinter operate.

In the U.S., commercial ac power is generated at exactly 60 Hz. Therefore, an 1800 RPM synchronous motor will operate at exactly 1800 RPM. Ditto for a 3600 RPM synchronous motor.

Because the transmitting shaft (the keyboard shaft), the receiving shaft (the selector shaft), and the motor are geared, they must always revolve at constant relative speeds. So long as a synchronous motor is used, they also rotate at constant absolute speeds. Because gears must have an integral (whole) number of teeth, only certain speed ratios are allowed. One revolution on the transmitting (keyboard) shaft corresponds to one character. If you lift the lock loop on the transmitting shaft or depress the repeat key, the machine will continuously transmit a character at machine speed. On a Bell System machine, one character takes approximately 0.163 seconds; therefore, the transmitting shaft should rotate at $1/0.163$ revolutions per second or $60/0.163$ RPM which equals 368.1

RPM. Assuming that the motor is a synchronous motor operating at 1800 RPM, the gear ratio from the motor to the transmitting shaft must be close to $1800/368.1$. The closest integral ratio is $1800/367.5$ which is $30/7$ times $24/21$; 367.5 RPM is 367.5 characters/minute which equals exactly 61.25 WPM. (The reason for a double ratio such as $30/7$ times $24/21$ will be explained later; it is related to the mechanical power train sequence within a machine.)

On the Western Union machines, the ratio desired is $60/0.154$ or 389.61 RPM. The closest gear ratio to $1800/389.61$ is $30/7$ times $13/12$. Therefore, with a motor speed fixed at 1800 RPM exactly, the transmitting shaft will revolve at 387.6923077 RPM which will give a speed of 387.6923077 characters/minute or 64.61538 WPM or Mark and Space time intervals of 22.10884 ms.

When receiving a RTTY signal, the receiving shaft operates continuously. However, the "decoding" mechanism on that shaft does not run until the Start pulse is received; the mechanism on the receiving shaft then rotates until the code elements have been received. Because the receiving cam does not have to rotate for the entire character interval, but only during the start pulse and the five intervals that contain the character code, the receiving shaft can run faster than the transmitting shaft.

There is a subtlety involved here. If the two machines are not running at exactly the same speed, then the receiving shafts must run faster than the transmitting shafts. If they did not, the receiving machine that was running slower would fall behind. Machines had to be designed to run at slightly different speeds because when the machines were first designed and built, governor-controlled motors had to be used because either only dc power was commercially available or the commercially available ac power was not frequency stable. (This leads into a long, perhaps, interesting, discussion about electric clocks, synchronous converters, constant voltage transformers, etc.) Also, if machines are operating at exactly the same speeds, and the transmitting and receiving shafts are also operating at the same speeds, and one machine gets out of step with the other, they can never get back into step. However, if the receiving shaft is running faster than the transmitting shaft and stops at the end of each character, then if they get out of step, they can resynchronize within a few characters.

Anyway, the receiving shaft has to

run faster than the transmitting shaft. The receiving shafts in both Western Union and Bell System machines run at exactly 420 RPM. With an 1800 RPM synchronous motor, a gear (actually a pinion-gear combination) ratio of $30/7$ will give exactly 420 RPM from 1800 RPM. Not only do W. U. and Bell machine receiving shafts run at the same speeds, but the selector mechanisms are identical. Hence, the machines are perfectly compatible because their selectors are identical!

One further note on the gear ratios. Within a TTY machine such as the Model 14 and 15, the motor drives the receiving shaft. For "60 speed" (61.25 WPM, Bell; 65 WPM, W.U.), the receiving shaft must run at 420 RPM. Therefore a gear ratio of $30/7$ is always used between an 1800 RPM synchronous motor and the selector shaft. The transmitting shaft is run from the receiving shaft. (A jack shaft may be used between the receiving shaft and transmitting shaft.) The gear ratio between the receiving shaft and the transmitting shaft is fixed dependent upon whether the transmitting shaft has a 7-unit cam for W.U. format or a 7.42 unit cam for Bell format. The ratio is $39/36$ on a W.U. machine and $24/21$ on a Bell machine. With a Model 28 for Bell System operation, the 3600 RPM motor has a 14-tooth pinion driving a 96-tooth gear on a jack shaft. The jack shaft has a 48-tooth gear which drives a 60-tooth gear on the selector shaft. This combination gives a $60/7$ ratio which results in a selector shaft speed of exactly 420 RPM from the 3600 RPM motor. The selector to keyboard shaft gear ratio is the same $24/21$ as on Bell System Model 14 and 15.

Because the gear ratio between the receiving shaft and the transmitting shaft is set according to the cam format on the transmitting shaft, these gears should never be changed. However, if the motor speed or operating speed is to be changed, then the gear ratio between the motor and the receiving shaft is to be changed.

When changing speeds while still using the Baudot code, only the motor or selector shaft speed is to be increased because the transmitting shaft speed will change accordingly. However, a sad fact of life is that essentially no one except amateurs are using the Baudot code. Commercial operation is now at 100 or 150 WPM. You cannot speed up your machine to 100 or 150 WPM op-

eration and expect to copy the commercial stations because they use an entirely different code! The trouble with the Baudot code is that it contains only 5 code elements and that means only 32 characters are possible without shifting. The commercial users are using the ASCII (American Standard Code for Information Interchange). This code contains 7 code elements, giving 128 characters without shifting (and twice that many with shifting).

The ASCII code and its details can be found in the IT&T Handbook (Reference Date for Radio Engineers, 5th ED., Howard Sams). It is a 7-element code, plus a start pulse, a stop pulse, and a parity pulse. For 100 WPM operation, the stop pulse is two units long, resulting

in 11 units per character. The units are 9.09 ms long. The 150 WPM version is the same except the stop pulse is only one unit long, giving a 10 unit character with 6.66 ms long units.

See RTTY, 1969 JUL-AUG, p. 4 for speed information on the amateur Baudot code and p. 11 for motor-selector shaft gear information.

We would like to acknowledge the assistance of Clarence Kersker, WA8AYS, and Dave Goodman, WA8UIT, who dug into the innards of machines to count gear teeth.

That's it for this month. Keep the questions coming! 73 ES CUL, RG.

Automatic CR and LF on Model 15-19

EVERT HAWLEY, K8JTT
709 S. Oxford Rd.
GROSSE POINTE WOODS, MI. 48236

The method of automatic carriage return and line feed described here was developed several years ago by K8JTT and K8JND to solve several serious problems not covered by any other methods available, including both the Teletype

Corporation and Simplex kits. First, it seems important that neither the original carriage return and line feed functions be completely deactivated since there are many situations in RTTY reception where it is highly desirable to have the carriage return on incoming signal so that copy shows appropriate answers or data in vertical sequence such as in contests, message handling and various other activities, including

CONTINUED ON PAGE 17

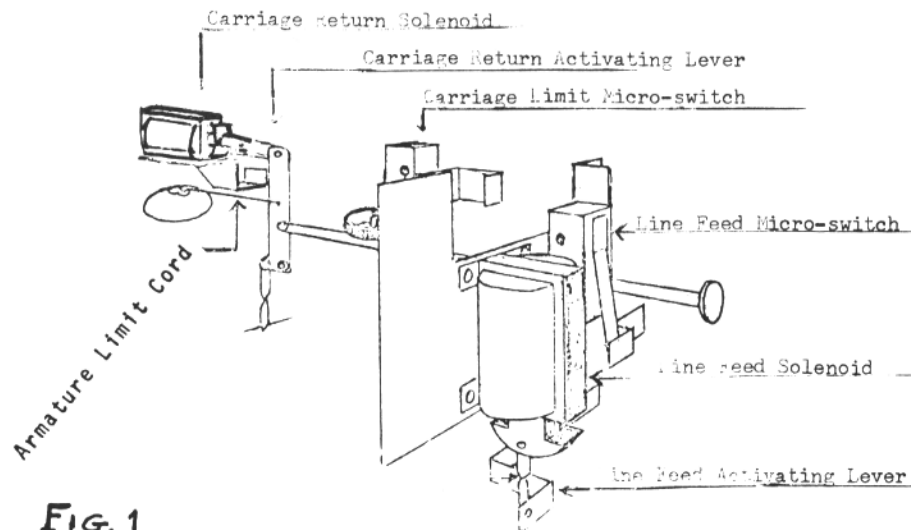


FIG. 1

RELATIVE LOCATION OF PARTS

AS VIEWED FROM REAR OF MACHINE

RTTY-DX

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



Hello there . . .

The coming of the Vernal Equinox usually means the BARTG Spring Contest is in the wings waiting to come on stage. With a roll of the drums and a flourish of QRM the proceedings commenced at 0200z 23 March and continued for the next 48 hours. While conditions had their bad moments activity was at a high level as it always is in this event. In a Contest that offers WAC as a multiplier the name of the game naturally is to track down those elusive Continents and get them in the log. Some of the possibilities were as follows. North America-Really no problem, from KZ5 to KL7 all the islands of the Caribbean plus W and VE. South America-A wee bit harder but with 9Y4VU, 9Y4RB, HK3PB, OA4RL, PY2CYK, LU2ESB, and YV5CMQ giving out numbers you surely connected with one. Europe-Again no problem with a score of countries active. Africa-A real challenge but thanks to ZS6BBK and 5T5LO a contact was very possible. Oceania-KH6AG a five band possibility. Amazingly, CQ's by KX6LA and FO8BO going unanswered. VK3KF available on 80, 40, and 20, but where was Barney, ZL2ALW this year? Asia-Always the toughest because of limited activity and fickle conditions but this year the Western World had a choice of JA1ACB and JH1TFF while the boys in Europe and the East were getting thru to VU2KV. As for multipliers there were of course many "rare" ones available in addition to those mentioned above. A few brought to our attention were, VP2MKH (more latter), PJ2CR, FG7XT, FM7AA, HP1AH, VP1MT, LX1JW, UK2GAX, XE1LL, KL7HFV, KL7GCM, KZ5BH, KZ5NG, HA5G, HA5KFZ, OK1MP. Logs go to Ted, G8CDW, and must be received by 31 May to qualify.

As mentioned, Sid, VP2MKH, was QRV from Montserrat during the Contest using a vertical hastily erected. He is getting squared away in his new house and expects to be there for at least six months. A beam will follow shortly to strengthen his signal to all points. You

can QSL directly to ---

Sid May
Crown Agents
P.O. Box 175
Plymouth, Montserrat W.I.

Sid says that a machine and TU were left on St. Kitts with Keith, VP2KF and we should be hearing from him as soon as his transmitter is repaired.

The scheduled operation from Grand Cayman commenced on 5th March with excellent signals from ZF1TV and continued until 9th March when the boys folded the tent and took off for points north. Dave, WA2EXP was at the keyboard while George, W2JNO dispensed the pictures on SSTV. You have probably already noticed that between their previous Dxpeditio to FP0SS and the present one to ZF1TV it all adds up to SSTV!!! QSL's go to the same QTH listed in the November column. We understand that the boys still have a good supply of maps of exotic places so we may be hearing more of this duo before the year ends.

You have got to believe what follows, as it is all true. We usually write the rough draft of this column in the shack with an occasional twisting of the receiver dial between thoughts. During one of these short listening sessions we were amazed to print out a CQ from TF3IRA asking who would like to be the first to contact Iceland on RTTY. We needed no second invitation and we were soon in contact with Kris in Reykjavik making his first transmission on 29 March. We requested a later sked at 2300z for the stateside boys and another for the following day for Europe, alerting both areas in the meantime. While Kris showed up for both skeds the one at 2300z was not successful due to poor propagation but the one at 1330z the following day really had things hopping on 14095 khz. ON4BX was the first in Europe to make contact and was followed by many many more with practically each contact a new country for Kris during that operating session. The machine was a Model 15 and Kris was using 850 hz shift which he has

perhaps narrowed by this time. QSL to--
Iceland Radioamateur Club
P.O. Box 1058
Reykjavik, Iceland

Kris' home call is TF3KB. Many thanks to OZ4FF, President of SARTG and his Group for getting this rare country on RTTY as promised some months ago.

Willy, HB9HK, tells us that he has a machine that he would like to set up on the Island of Maderia if he can find a ham there willing to use it. These possibilities are presently being investigated and Willy will go along to set up the equipment. So in the not too distant future we may very well have activity from that rare CT3 prefix.

Since the RTTY-DX standings were published just one month ago we are extremely pleased to announce the latest addition to the 100 - RTTY - DX Club.

Nr. 14 Arden "Hop" Hopple W3DJZ
Hop is no newcomer to RTTY having been on the mode for the past 18 years and on RTTY this certainly classifies him as an "old timer". He was first licensed in 1930 as W3BOC, a call which he still holds at the Penna. Turnpike Communications Center. Always an avid DXer in all modes Hop is on the ARRL DXCC Honor Roll with 317/331, WAC RTTY Nr. 34, also WPX, WAZ, and WTW Nr. 2. He is presently Director of Communications for the Penna. Turnpike Commission and as such supervises the operation and maintenance of 471 miles of multiplex microwave and VHF communication in which Teletype plays an important role. Hop retires in April after 24 years with the Commission and plans to devote more time to amateur radio in general and RTTY in particular. Congratulations Hop.

In the past month WAC Awards were issued to --

Nr. 222 DARC DX Referat DKØDX
Nr. 223 Jack W. Hudson W9KDX
The present WAC certificates are of a completely new format and we hope to announce additional Award(s) in the near future.

As the saying goes, "Patience is a Virtue." Well, most of the Patient (and all of the Virtuous) were rewarded with a QSL from Rudolph, 8R1W recently when he released acknowledgements for his brief but well attended operation back in 1972. Rudy says that his machine is in need of repair but hopes to be active again in the near future.

After noting the results of the 1973 Volta Contest I am sure we all join in extending congratulations to Norm, W1GKJ, for winning the event with the

14 MAY 1974

amazing score of over 14 million points. For a single operator this was a tremendous effort and one that will be hard to beat for some time to come.

Henri, LU2ESB, says that he will be transferred to Brazil toward the end of the year. For Henri this will add another call to his ever growing list, and another language to master, when he is already so proficient in French, English, and Spanish. Henri says that there is a good possibility that Claude, TR8MC, in the Republic of Gabon may be on RTTY in the near future, we hope to have more on this at a later date.

In closing the column it is with extreme sorrow that we must report the "Silent Keyboards" of Carl, HB9P/HBØP, and Andre, F9RC. Both men will be very much missed on the bands.

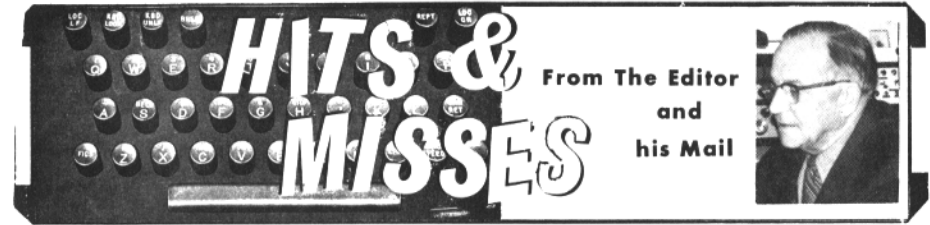
DX-RTTY May/June 1964

Jean, FG7XT planning a DXpedition to St. Martin and in fact did operate as FG7XT/FS7. Bruno, IIRIF, has been using narrow shift on the bands. HZ1AB can be printed from time to time around 2200z. Clyde, KB6EPN recently put Canton Island on RTTY. DL1VR reports that VQ9HJB in the Seychelles has gear available and hopes to be Qrv soon. Many thanks to K6WZ, W3DJZ, ON4BX.

73 de John



"SID", VP2KH, PRACTICING NARROW SHIFT-MARK & SPACE TONES ON HIS FAVORITE MUSICAL (?) INSTRUMENT



Until we became bored with the tirade, we have read about the unfair actions of the Internal Revenue bureau in one of the amateur radio (?) magazines for the past several months. So when we got a letter from the IRS about three weeks ago saying they would like to audit my 1972 returns and made an appointment to come to the house we called our accountant and gathered all the papers together.

1972 happened to be the year we retired, sold the business and dispersed a profit sharing plan so the return was quite detailed with a lot of extra schedules and a pretty good sized tax.

The agent arrived, dove into the papers, asked a few questions and seemed to know exactly what she (Yes, a real pleasant gal) was looking for. She asked about the Journal and was shown the dirty basement office, shown the rig and what equipment had been charged to the magazine, shown some awards that had been charged to expenses and the only comment was "it sure looks interesting". To close our rebuttal we ended up with a \$340. refund. 30 years in business taught us early to get competent people to handle taxes and auditing. We admit that doing business with the bureaucrats can be exasperating but believe me they are not all bad . . . many times they have to deal with impossible people too.

Last call for Dayton. As usual a group will be going to eat about 7:30 PM. See us in the "South Room" at the Imperial North Motel Friday and sign up if you can make it. The hospitality room will be open from 4 PM Friday until the wee hours, with time out for dinner, and on Saturday from about 5 PM until closing again. Meet John and Ron and some of the gang you have met on the Green Keys.

At Muskegon we had a chance to see the new RTTY handbook published by the RSGB and distributed in this country by HAM RADIO. 3 years in the making, it

covers just about everything including all the popular USA machines. We hope to have a complete review of the handbook next month.

BACK ISSUES

New subscriptions and classified ads are cash in advance as we have no method for 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. Back issues - if available - may be ordered at 30¢ each at time of subscription. The JOURNAL is mailed about the 20th of the month preceding the dated month. May and June are a combined issue and July-August is a combined issue.

The ONLY back issues available are listed below. 30¢ each.

1966--Oct.-Nov. - [2]
1969--Oct. - [1]
1971--May-June-Sept.-Nov.
Dec. - [5]
1972--Apr.-May-July-Sept.
Oct.-Nov.-Dec. - [6]
1973-- Complete - [10]
1974-- All to date.-----

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Royal Oak, Mich. 48068
Editor & Publisher - 'Dusty' Dunn, W8CQ

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Handy Chart for Great Circle Bearings .

WILLIAM JOHNSTON, WB5CBC
1808 Pomona Drive.
Las CRUCES, N.M. 88001

(Reprinted from "Radio Communication", November 1972, by permission of the Radio Society of Great Britain)

The correct aiming of directional antennas is neglected by all too many of us, primarily because it is often difficult to visualize the shortest path between two widely separated points on the earth's surface. That path, of course, follows an arc of a great circle, and the angle that the arc forms with a line running due north is called the great circle bearing. When the antenna is positioned at that angle, both the transmitted and received signals between the two stations are at their strongest (neglecting, of course, unusual and isolated atmospheric disturbances).

Charts centered on several of the big cities of the United States have been available for a number of years, but these were accurate for only a very few amateurs, and usually provided nothing more than a simple bearing to each of the locations on the chart. During the last few years, a number of commercial versions which are "made-to-order" have become available. These charts are made individually, being centered on the amateur's own QTH, and in general have included the distance in addition to the bearing to each of the entries on the chart. Unfortunately, these versions have not been the complete solution, as they have invariably been expensive, clumsy, and contained information for too few locations.

There is now available a chart which has the following advantages over anything previously in use:

1. Cheap: \$1.00 postpaid worldwide. \$1.75 airmail worldwide.
2. Handy Size: Pages are 8-1/2 x 11 inches, a perfect size for the operating table.
3. Bearings to many (660) locations throughout the world.
4. Contains sufficient data: Bearings, distances in miles and kilometers, and return bearings.
5. Accurate: Bearings to the nearest degree, distances to the nearest mile and kilometer.

The original work on this project was done about six years ago, using a digital computer to generate the charts. The computer program, written in FOR-

TRAN IV, uses the spherical triangle method of analysis. Charts centered on more than three thousand cities and towns throughout the world are on file (They've been on file in my attic for six years), and copies are available for immediate shipment. For locations not already on file, a nearby research institute has been contracted to do the work, so these charts can be shipped within a few days.

A few notes are in order concerning the data on the charts (see the figure for a small excerpt from a chart). First of all, the bearing from your QTH to each of the 660 distant locations is given in degrees from true north. The magnetic bearing is not mentioned since the magnetic declination at any given location varies from year to year, sometimes by as much as 10 degrees. So it's easier to zero your antenna on true north once (using the star Polaris, or whatever), and forget it. Next, the distances in both miles and kilometers are displayed. And finally, the return bearing from the distant location to your QTH is given. The return bearing is not a simple 180 degree difference from the outward bearing, but must be derived as part of the spherical triangle solution. Your ability to give the other station his correct bearing for you will produce results which are nothing short of amazing. When the chart indicates a distance greater than, say, 10,000 miles, you can consider the "long path" which is simply 180 degrees opposite the indicated bearing. The same is true for the return bearing.

Since the chart consists of six pages, I mounted my own back to back in three plastic "document protectors" which I then fastened together with a plastic spiral binding. That way it never takes up more room than one page, and I can quickly flip to the desired entry. After six years, my chart is still like new. You might want to use a similar method with your own, or perhaps mount the pages on the wall, in a 3-ring binder, or simply staple them together.

Charts are available for any location in the world. To order your chart, you will need to send the following:

1. Your name and mailing address.
2. The city for which you want the chart. (Include State and/or Country.)
3. If the population of the city is less than 10,000 or if the location is a rural area, also include the latitude (indicate North or South) and longitude (East or West) in

degrees and minutes.

4. Include payment of \$1.00 (postpaid worldwide) or \$1.75 airmail (worldwide).
5. Send to: Great Circle
1808 Pomona Drive

Las Cruces, New Mexico 88001
U.S.A.

If you have any questions you want answered, please send along a self-addressed stamped envelope, or a self-addressed envelope and an IRC.

GREATLY REDUCED SAMPLE OF CHART

	BNG	MI	KM	RBNG	*	DA-DL	W. GERMANY, ESSEN	BNG	MI
ROTSWANA, KANYE	98	8272	13313	306	*	DA-DL	W. GERMANY, ESSEN	47	4018
STKKTIM, GANHTOK	8	7579	12198	354	*	DA-DL	W. GERMANY, FRANKFURT	48	4127
TIBET, LASA	5	7433	11963	356	*	DA-DL	W. GERMANY, FREIBURG	50	4173
SHITAN, PAPO	7	7578	12195	354	*	DA-DL	W. GERMANY, GELSENKIRCHEN	47	4020
BANGLADESH, DACEA	6	7819	12715	355	*	DA-DL	W. GERMANY, GOTTINGEN	46	4123
PAKISTAN, WEST, KARACHI	28	7405	11918	337	*	DA-DL	W. GERMANY, HAGEN	47	4038
TAIWAN, TAIPEI	337	7508	12084	19	*	DA-DL	W. GERMANY, HAMBURG	44	4053
CHINA, PEKING	345	6609	10536	14	*	DA-DL	W. GERMANY, HANNOVER	45	4085
CHILE, TOCCOPIILLA	157	4536	7299	350	*	DA-DL	W. GERMANY, HEIDELBERG	49	4154
CHILE, VALPARAISO	170	5267	8476	351	*	DA-DL	W. GERMANY, HERNE	47	4023
CHILE, SAN-MIGUEL	169	5367	8541	351	*	DA-DL	W. GERMANY, KARLSRUHE	49	4156
CHILE, SANTIAGO	169	5304	8536	351	*	DA-DL	W. GERMANY, KASSEL	46	4114

Auto CR - LF .

CONTINUED FROM PAGE 12

matching of reper copy to the page. While it is true that inadvertant carriage return may still be triggered by a false signal from QRM, QRN or just weak signals. It is therefore essential that the line feed operate whenever the carriage returns, whether from received command, false interpretation or from reaching the seventy-third letter with no signal to return. Secondly, additional line feed should be automatically prevented at the beginning of a new line because of possible different timing of belated line feed signal from the transmitting station. Last, but most important, we felt the need for ability to disable the system for copying say RTTY pictures with planned overprint, and columnar information such as satellite predictions and weather information, especially when the signal strength made the automatic system unnecessary. We had to avoid the so called "butchering" of the machine as most every other method does.

Since the first prototype in 1965 (still operating beautifully on my own model 19) some two hundred applications of the system have been made from our scale drawings and instructions. The system provides automatic CR and LF functions completely independent of each other but allowing the normal CR and LF to continue to function on received signal. A flick of a switch inside the little door on the front of the case disables the system allowing the machine to operate normally as before modifications.

Only four major commercial parts are required: two micro-switches and two small solenoids. Only one small original lever is replaced and all brackets and levers can be quickly fashioned from medium aluminum or light steel from scraps. The entire mechanical system mounts on the typing section with power fed through the base contacts and the

control switch fed through two keyboard contacts.

Figure 1 shows the relative placement of the component parts on the printer section looking from the rear of the machine. The carriage return solenoid is activated at the seventy-third letter position when a small tab held by an existing screw on the top of the carriage spring and strap reel triggers the related micro-switch. The line feed solenoid is activated when a tab lever under the existing screw of the carriage stop plunger triggers the related micro-switch as the carriage reaches its return position. The line feed solenoid remains charged as long as the carriage remains in the first and second letter positions and no addition line feeds may be made. This prevents double or triple line feeds from late received signals after there has been either an inadvertant carriage return or an end of the line automatic return. This is very important in copying certain continuous commercial transmissions where no letters key signals are used before comencing the next line of copy.

The following parts are typical and will work well: Guardian, Type 18, Solenoids, 115VAC (145 oz) (Newark No. 24F093) and Robertshaw, Type BRD2-5L-1S, Micro-switch (Newark No. 23F-402). Space does not permit the reproduction of the lever and bracket design and specifications with this article. For anyone interested in a seven page set of instructions and scale drawings, a supply is still available. See classified section.

- In answer to a number of requests the author has prepared a detailed 7 page instruction sheet and scale drawings to make this modification easy. \$2.00 brings them all postpaid from Ev. Hawley, 709 S. Oxford, Grosse Pointe Woods, MI. 48236.

CLASSIFIED ADS- 30 words \$2. Additional words- 4¢ ea.**Cash with copy, Deadline 1st of month.**

MORE RTTY! ONLY HAM RADIO MAGAZINE consistently brings you more RTTY articles and better RTTY articles than any other general amateur magazine. You need RTTY Journal, but you need HAM RADIO also. \$7.00 per year, \$14.00 for 3 years. Ham Radio, Greenville, NH 03048.

FOR SALE OR ??; Model 15 with table. Also new typing unit (extra). W9MDG, 4975 N. Hopkins, Milwaukee, Wisc. 53209.

NEWS-NEWS-NEWS - Amateur Radio's Newspaper, "Worldradio", Trial subscription - Two issues for one dollar. "Worldradio", 2509-F Donner Way, Sacramento, Calif. 95818.

"GET A TABLE FOR YOUR TELEPRINTER. Designed for Kleinschmidt ASR with 40 x 23 x 27 dimensions. Great for either a single printer or printer and reper. \$17.50 FOB (compare at \$34.95) WB5HGQ, 2117 Westlake Drive, Plano, TX 75074"

M32RO, M33RO TELETYPES: Prices from \$150 to \$275 FOB. Also fast parts service on all 32/33 K1YCM Les Veenstra, ACTON TECHNICAL SERVICES, 919 Crystal Springs Ave., Pensacola, FL 32505. 904-434-1297

METRIC SYSTEM EXPLAINED, 500 Physical Measurements Converted. Booklet \$2.00 H. Morgan, 883 Diana, Akron, Ohio 44307.

CIRCUIT BOARD SET for "Low Cost Rty Counter" Oct 73 Journal. Includes two counter modules, FET front end, 60 hz time base, and a bonus scaler board. Scaler will operate to at least 220 mhz. Boards are G-10 epoxy, plated, undrilled, with full size photos showing each assembly. Necessary info included. Set \$10 postpaid in US., add \$8 for Universal Frequency Standard Board. Bert Kelley, 2307 S. Clark Ave., Tampa, Florida 33609.

WANTED: TELETYPE MACHINES also parts and accessories for Models 28, 32, 33 & 35. Call or Write: A.D.M. Communications, 1265 Simpson Way, Escondido, Calif. 92025 (714) 747-0374

HAL COMMUNICATIONS CORP. can provide you with the proven video display system, the RVD-1002. When coupled with the RKB-1 keyboard, you will have the ultimate in noiseless, reliable reception and transmission of Baudot coded TTY. The RVD-1002 receives TTY pulses from the HAL ST-6 or any other demodulator, and generates a 1000 character display. Copies at all four standard speeds with selectable unshift on space. The RKB-1 features a high quality commercial keyboard, reliable solid state circuitry, and a rugged, attractive cabinet. BankAmericard and MasterCharge now accepted. HAL Communications Corp., Box 365RJ, Urbana, Ill. 61801. Phone 217-359-7373.

PHOTOSTAMPS OF YOUR STATION with gummed backs for your QSLs. Mini stamps \$2.50 - 100 Midi stamps \$2.00 50 Maxi stamps \$2.00 Samples 25¢ Morgan 883 Diana Akron, Ohio 44307

HAL COMMUNICATIONS CORP.: HEADQUARTERS for MAINLINE Solid State RTTY Equipment. In demodulators, choose from the incomparable ST-6 or, for a low cost beginning in RTTY, the ST-5. Tailor either to your requirements by selecting the 425 Hz press discriminator, the AK-1 AFSK oscillator, and table or rack mount cabinets for the ST-6, or the AK-1 AFSK and the ST-5/AS autostart for the ST-5. Full details available in our current catalog. Charge your purchase to your BankAmericard or Master Charge account. HAL Communications Corp., Box 365RJ, Urbana, Illinois. 61801. Phone 217-359-7373.

18 MAY 1974

WANTED - 33ASR, B. A. THUNMAN, W8ISG, 71 McCollum Street, Galesburg, Michigan 49053. Phone 616 665-7071 or 731-5164.

THE AD FOR GORDON WHITE in the April issue had the wrong Box number - Will any who wrote to Mr. White regarding the ad and whose letters were returned please try again. The correct address is PO Box 3067, Alexandria, VA. 22302.

CHICAGO AREA RTTY OPERATORS; Expert repair work performed at reasonable prices. Cleaning and lubrication; printers \$10.00, keyboards \$5.00, reperfs \$7.00. Repair work \$15.00 plus parts, any Teletype apparatus. Rebuilding by estimate. Phone 312-392-2358, ask for Neil.

FAX PAPER: For Desk-Fax, new (not surplus), precut (not rolls), \$15 per thousand sheets, postpaid worldwide. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

FOR SALE: MITE EQUIPMENT. TECHNICAL MANUALS. TM-03315-15, \$9.95. Navships 95898, \$13.75. Navships 0967-170-8010, \$12.50. Navships 0967-066-1020, Simplified Preventive Maintenance Procedures for TT-298s and TT-299s, \$4.50. Shipped postpaid, No CODs. Allow 3 to 4 weeks for delivery. Harry F. March, 200 Fox Drive, Winchester, VA. 22601.

UNIVERSAL AFSK, AUDIO, AND VLF SYNTHESIZER delivers phase-continuous output from 1 to 99,999 Hz with accuracy, calibration, and resolution of one Hertz. Use it to operate AFSK between any two frequencies you program, as a precision audio generator, or as a frequency source in an autostart frequency synthesizer. Kit of all parts, \$135. Write for information. Petit Logic Systems, Box 51, Oak Harbor, Wa. 98277.

MODEL 28 LESU's: BELL TYPE, LESU-8. Complete wiring for 28KSR, contains loop supply, casting with 4 "horns", polar relay socket less relay, etc. \$15.00 each plus shipping. L. Pfleger, 10615 W. Ridge Rd., Apt. 54, Hales Corners, WI 53130.

KLEINSCHMIDT TTY EQUIPMENT, Gears and parts available. TH-5 Converters @ 100 Cycle Shift \$49.95, Converted to 170 Cycles Transmit & Receive \$74.95. Model 14 Typing Reperfs, while they last \$29.95. Andy Electronics, 6319 Long Dr., Houston, Texas 77017 (713) 641-0576.

11/16 PERF. TAPE, 3.00 BOX OF 10, 8.00 per case of 40 rolls. New nylon ribbons, black only, 6 for 3.50, 12 for 5.50. Model 14 R.O. typing reperfs 10.00 ea. Model 28 TD, 3 heads, 45.00 ea, Model 28 typing reperf heads 20.00 ea, Hallicrafters SX-117 receiver \$110.00, Hallicrafters HT-37 XMTR \$110.00, P. Davis, 1830 Toepfer Rd., Akron, Ohio 44312

ST-5A Boards only \$5.25. Parts kit \$54.00 (includes boards) Mod. kit for up-dating ST-5 to an ST-5A, \$9.00. ST-6 boards only \$18.00 (8 original by Irv Hoff W6FFC). Pemco 50A frequency counter semi-kit \$125.00, Pemco SC250 frequency pre-scaler kit, \$30.00. ST-5A, AK-1, ST-6 boards are 12 pin plug-in. All boards etc. shipped postage paid. All boards G-10FR4 glass epoxy and plated, all boards are drilled. Please write for details. Pemco, 422 18th St N.E. Salem, Oregon, 97301.

OA-5 SOLID-STATE TERMINAL UNIT. See February "RTTY Journal". Drilled and plated boards, \$15.00; parts kit with board, \$100.00; complete unit ready for air, \$210.00. All F.O.B. Alliance. Ken Simpson, WA8ETX, 3700 Mountview, Alliance, Ohio 44601

CLASSIFIED ADS-

U.S. GOVERNMENT SURPLUS Typewriters, Jeeps, Walkie Talkies, Rifles, Binoculars, Hand Guns, Boats. Official Guide tells you how and where to buy. \$2.00 H. Morgan, 883 Diana, Akron, Ohio 44307.

RTTY VIDEO DISPLAY UNIT; 1000 characters, plugs into loop or logic circuits. ASCII or Baudot available. Works with any TV set. Leland Associates, 18704 Glastonbury Rd. Detroit, MI. 48219

TELETYPE - KLEINSCHMIDT - MITE -; gears, parts, manuals, tape (11/16, 7/8), toroids, SASE for list. Typetronics, PO Box 8873, Ft. Lauderdale, FL. 33310. Wanted; Tubes 122, 2BP1, Kleinschmidt TD, 60 speed gears, also Mite 75, and 74912 - trade 74913. W4NYF.

WANTED: MODEL 33 & 35 EQUIPMENT. Complete or partial units, any quantity. Will pay shipping. Terminal Systems, Inc., 11300 Hartland St., North Hollywood, CA 91605 (213) 769-6772.

WANTED: LTPE-1 Perforators; LRB-6 Under-dome reperforators - must have 3-speed gear box. Also interested in Models 28, 32, 33, 35 & 37s. Will pay top price. Amber Industrial Corp., Phone 201/824-1244.

TRADE HAVE EXCELLENT HQ-110A Hammarlund receiver. Want BC-348 with dynamotor and original wiring. No alterations. John Riley, 914 N. Cordova, Burbank, Ca. 91505. tel. 845-3880.

M15 & M19 WIRING DETAILS BOOKLET provides maximum flexibility of use. Schematic shows all terminal points; M15 schematic shows all wiring; detailed instructions for wiring M19 tables. \$1.95 per set, postpaid. TECHNICAL MANUAL on M14 Tape Distributor (description, adjustment, parts). New. \$8 postpaid. 11/16" perforator tape, 10 rolls/\$4, 40 rolls/\$12.95. Fax paper, RTTY supplies. Send for list. Jim Cooper, W2BVE, POB 73, Paramus, NJ 07052.

HAL COMMUNICATIONS CORP. announces the DKB-2010 Dual Mode Keyboard. Provides flawless transmission of RTTY and Morse Code with Standard 3 character buffer and optional 64 or 128 key buffer. Call letter identifier and "Quick Brown Fox" sequence standard. Write for detailed spec sheet. HAL Communications Corp., Box 365RJ, Urbana, Ill. 61801. Phone 217-359-7373.

TECH MANUALS - \$6.50 EACH. TT63A/FGC, CV-591A/URR, TS-2/TG, CV-116, following manuals \$8.50 Each. TT-47/48, R388/URR, FR114/U. USM-50, 51/4; Following \$10.00 each - R390A/URR, SRR-11, 12, 13, USM-32, USM-24, URR-35C. Model 14 TD manuals \$2.50 each. Thousands more in stock. Send 50¢ coin - for large list. W3IHD, 7218 Roanne Dr. Washington, DC. 20021.

WANTED - RTTY JOURNAL for 1969, 1970 plus January-April 1971. **SELL OR TRADE-** TS-1618 frequency shift converter tester with audio generator-counter \$200; Collins 70E-20 PTO \$40; Collins KY-45 FSKeyer \$75; 0-39 TRA-7 FSKeyer \$75; RME HF 10-20 Converter \$50; two PRC-40AX transceivers 132-152 MH FM \$35 each; RBK \$25; RBK \$50; RAK \$35; WRR3A vlf digital \$300; SX28A \$75; SRR13A \$125; GPR90 \$150; SRT-15 FSK transmitter \$400; GR signal generator 804-B \$100; GR audio frequency meter 834-A \$75; mint NC-300 with all converters in case and speaker \$250. All pick up San Diego. W6CRG 11007 Explorer Road, La Mesa, Calif. 92041.

RTTY - ST-5 BOARDS, all parts except transformers, \$25. Bird Milliwattmeter model 6250 250 mw. 30-500MHZ, \$20. Add \$1 each shipping. 100kHz xtal octal base \$2.50 ppd. Nat Stinnette, Tavares, FL 32778.

HAL COMMUNICATIONS CORP. will display the line of RTTY equipment at Dayton, Rochester, Starved Rock, Atlanta and Orlando, and other major shows. Phone your orders for pickup at the show. HAL Communications Corp., Box 365RJ, Urbana, Ill. 61801. Phone 217-359-7373.

FOR SALE: MODEL 28 KSR (floor model), HAL Communications Corp. Model ST-6 Terminal Unit with options and Beckman Counter Model 7350. Relay rack for ST-6 and counter. All manuals and equipments in mint condition and are operational. Price \$695. Prefer local sale. Irv Emig, W6GC, 737 12th Street, Manhattan Beach, California 90266. Phone (213) 545-5970.

PROGRAMMABLE RTTY DIGITAL STUNT BOX responds with switch closures and a return message when someone calls your station. 64-letter buffer memory (FIFO) plus choice of two types of keyboard input (32 homemade switch closures to ground or 100 w.p.m. loop) lets you type fast and error-free, yielding 60 w.p.m. output. End of line indicator for keyboard input helps prevent overprinting. Larger memory and other options available. Complete kit \$245. Write for information. Petit Logic Systems, Box 51, Oak Harbor, Wa. 98277.

#28 Reperforator-transmitter with 3 speed gear shifts ready to operate \$145. #28 Typing reperforator 60 or 100 WPM \$49. #32KSR - \$250. R-390A \$475.00. Alltronic - Howard Co. Box 19, Boston, Mass. 02101 (617-742-0048).

"RTTY SPEED CONVERTER" A drilled, fiberglass 4" x 6 1/2" printed circuit board now available for the WA6JYJ speed converter in the DEC 71 issue of HAM RADIO. \$6.50 postpaid. Complete parts kit including PCB, \$42.00, postpaid. Martex Corp., 519 South Austin, Seattle, WA 98108.

FOR SALE; MODEL 28 MACHINES, KSR, ASR/LXD, ASR/LCXD, ROTR with 3 speed shift, stand alone TDs. Model 14 FRXD, Typing reper. Model 28 machines repaired, stunt boxes coded. P. Anderson, 2448 N. Wilson, Royal ak, MI. 48073.

DETROIT AREA HAMS; NEED help with RTTY? Come and join us for help in locating machines and getting them on the air. Michigan Amateur Radio Club. Meets fourth Wednesday, 8:00 PM, Madison Heights Library.

TELETYPE CORP. MODEL 28KSR, in floor mount console cabinet complete with keyboard and typing unit, \$250. Teletype Model 28 ASR complete with typing perforator and transmitter distributor in floor mount cabinet, \$625. TT-192A/UG, perforator type with 3 speed gear shift, \$175. All Excellent condition. FOB Oakland. M. Booth, 2042 E. 14th St., Oakland CA 94606 415/534-1300

28KSR IN PERFECT CONDITION, Would like to swap for 2 meter gear or will sell for \$250. FOB Everett, Wash. . Please send list of equipment to - Thomas H. Watson, Rte 2 Box 277C, Monroe, WA. 98272.

GLAZED CERAMIC, 6-8 or 10" plate or tile. QSL, Nameplates, call or home. \$15, \$25, \$35. each. Margaret, 109 Mill St., N.E., Vienna, VA. (703)-938-6924.

WANTED; NORTHERN RADIO FS keyer type 105; model 6, or equivalent with manual. Also manuals for Northern demodulator type 104 model 3. Ray Brougher, W4IK, 2628 Highland Ave. Montgomery, AL. 36107, phone evenings (205) 264-6796.

WANTED TO BUY --- Used RTTY equipment in fairly good shape. Desperately need page printer and AFSK. Also have some "junk-box" equipment to swap. Interested in meeting other new hams in RTTY. Phil McGan, WN2MBQ, Box 47, Fredonia, N.Y. 14063.

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