

Additional ads on page 15

WANTED: GEAR SET for 100 WPM operation of Kleinschmidt reperforator - transmitter, J.P. Taylor, K9ZYS, 3222A N. Julia St., Milwaukee, Wisc., 53212

WANTED: All models of teletype machines, new teletype parts and Northern Radio Converters, type 107. Let me know what you have; I plan on traveling throughout the country and will stop in. Telemechanics, Inc. 85 Shields Ave., Williston Park, N.Y. 11596

MODEL 28KSR, 60 WPM, Sync motor, Good condition, \$300.00. Model 28 typing reperforator, 100 WPM, Sync, no cover, \$75.00, Warren Dunning, WA3IV1, 2828 S. Simpson, Philadelphia, Pa. 19142.

FOR SALE: MODEL 28 ASR. Equipment set up for amateur use and in excellent condition. Ed. Wagner, WA9SZH, 6307 East Gate Rd. Monona, Wisc. 53716. Phone 608-222-9689

ATTENTION RTTY GROUPS and CLUBS: Have a large quantity of model 15 equipment available. Consists of Model 15 ROs, M 15KSRs, M 19KBDs, (interchangeable with M15 KBD to enable manual send or tape perforation) M 14 type reperforators, M 14 TDs. All less tables and rectifiers. Write or call - K9PSX, E.J. Hokanson, 6517 N. Atwahl Dr., Milwaukee, Wisc. 53209 - (414) 352-2336.

RTTY CONVERTER-CV.278. 450-500 IF input. Will copy wide or narrow shift. Small size, only 5x8x15 D. Need 28VDC power supply. Only \$10.00. Joe Caswell, 2610 Castello Way. Santa Clara, CA 95051

FOR SALE - 2 MAINLINE ST-4 - SASE for details. Also HT46 - near perfect - few hours - \$60.00. Jack Heady - Box 538 - Brookings, S.D. 57006.

RTTY JOURNAL

WANTED: DX100-FSK. Boehme model 5C or W2-JAV TU, rack mounted-OK. Will trade 2 Johnson mess 109. Mint condition. Michael Jones, Ret. 1, Box 532. Fortson, GA, 31808.

J & J DELUXE SOLID STATE AFSK GENERATOR. Ultra stable, stability within plus or minus 5 Hz, short term stability plus or minus 1 Hz. Choice of high or low tones, microphone output for SSB has approximately 230mv output into a high impedance load with less than 1% distortion at full output, line output for low impedance source into 500 or 1K load is better than 1 volt, and 1.25% depending on load, precision resistors and mylar capacitors used in all frequency determining circuits, basic oscillator is a stable unijunction oscillator with an RC circuit using precision resistors, contains a 5 pole Butterworth filter with a cut off above 3,000 Hz which removes harmonic content and assures sine wave output, no frequency shift with line voltage variations between 105 and 125 volts, all adjustments tested at 115 volts, features high output with more than ample drive for transmitters and line output is high level and can be used to test TUs or other RTTY gear. Choice of desk top cabinet or rack mounted. J & J Electronics, Canterbury, Conn. 06331

TYPEWRITER RIBBON REINKER. Hand operated model now only \$3.00. K575 or K764 ink available at all National Cash Register Co. stores at 75c per tube. Walter Nettles W7ARS-8355 Tanque Verde Rd, Tucson, Ariz. 85715.

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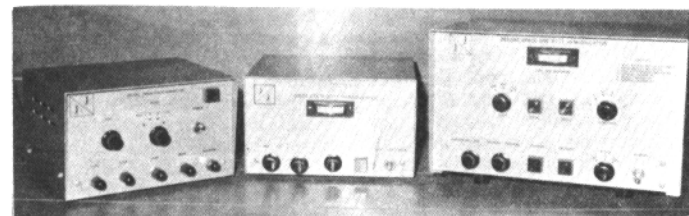
RTTY

MAY 1971

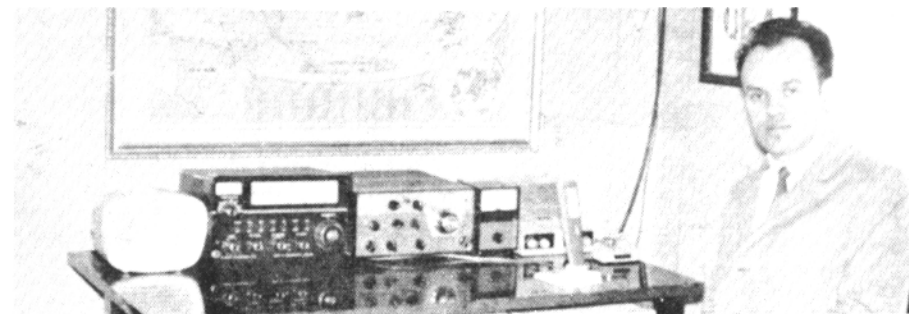
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Volume 19 No. 5

30 Cents

New RTTY Lineup from J & J Electronics

Left to right -- J & J Deluxe Solid State AFSK Generator. Space-One Basic Unit. Space-One Deluxe RTTY Demodulator.

**'Gene' YO2AFB****CONTENTS:**

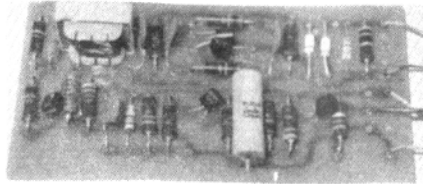
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First Class Mail --

Address Correction Requested
RTTY JOURNAL
 P O Box 837
 Royal Oak, Mich. 48068

Loop Isolation for I.C. Projects --

Dr. FRANK STEWART, K5ANS
Physics Dept. N L U
MONROE, LA. 71201



Introduction

Recent Motorola Resistor Transistor Logic (RTL) projects such as the Digital Autostart (1), Regenerative Repeater (2), crystal controlled AFSK generator (3) and the Selcal (4, 5, 6) require a method of obtaining mark-space information from the RTTY loop. These units require an input which is "high" (defined as greater than plus one volts) during marking and "low" (defined as less than plus 0.3 volts, or even negative) during spacing. One popular method of obtaining these voltages is to use a resistor (typically either 33 or 47 ohms) in series with the 60 ma loop. The fact that one side of this resistor must be grounded often presents serious switching and modification problems. In addition, one might be plagued with noise and transients.

The Regenerative Repeater obtains its mark-space information through a resistor connected to the keyer driver stage of an ST-3 demodulator. The method requires internal connections to the demodulator, but then the whole project was designed as a demodulator modification. One could drive other RTL projects by this method just as well as the repeater.

It appears to the author that the most convenient way to drive most logic projects is to use an interface that plugs directly into the 60 ma loop anywhere, somewhat as a reperforator, T.D., or even as a second printer. A logic project with such a built-in interface could plug into anyone's loop anywhere, and would be universally useful. The Automatic Printer Control (7) of K3NIO has such a built-in interface, which requires both plus 12 and minus 12 voltages, and uses germanium transistors. An adaptation of this circuit built from surplus computer-board parts, is used in the author's Digital Autostart and Selcals. It requires only a plus 3.6 volt supply.

Sufficient interest has been generated recently in the interface that it was redesigned, using only commonly available standard parts and silicon transistors.

Theory of Operation

The interface is plugged into virtually any 60 ma loop by means of any standard plug. (If a 20 ma loop is used, the 47 ohm resistor should be changed to 100 ohms; this is the only change necessary.) The direction of the loop current through the interface is important; the voltage drop across its input terminals should be about 1.3 volts and of polarity as shown in the diagram.

The first stage is a non-locking stable multivibrator which generates pulses of frequency approximately 14 KHz. These are transformer-coupled to amplifier Q3. The output of the transformer secondary should be a rather rounded square wave with an amplitude of at least 0.1 to 0.2 volts, peak-to-peak.

Following Q3 is a germanium diode which acts as a DC restorer, or diode clamp; only positive pulses are applied to the base of Q4. These pulses are integrated at the collector of Q4 to give a ramp waveform of low amplitude - approximately one-half volt. This occurs during a RTTY marking condition; during a spacing condition when the astable is not operating there are no pulses at the base of Q4, and the potential at its collector rises to over three volts. Transistor Q5 acts as a switch. During marking its collector is high; during spacing its collector is low. The output of the interface (collector of Q5) drives logic projects directly, and should be connected to their input of "In" terminal.

The Transformer

The most suitable transformer among the dozen the author tested seems to be a miniature audio output transformer with a primary impedance of 500 ohms, and a secondary impedance of 3.2 ohms. The turns ratio equals the square root of the impedance ratio, or 12.5-to-one in this case. Both Radio Shack and Callectro offer this transformer for less than a dollar. Other transformers with a turns ratio between six-to-one and fif-

teen-to-one proved satisfactory. These had primary coil windings with a DC resistance between ten-to-40 ohms, and a secondary winding of less than two ohms.

A 1200:8 ohm transformer worked fine. Only barely satisfactory was a 10K:2K transformer, which has a turns ratio of only 2.24-to-one. If the turns ratio is too low, the secondary waveform is very distorted with much "ringing". If the turns ratio is too high, the output voltage is too low.

Discussion

Here are some interesting facts about the interface. Its overall response time is less than one-half millisecond. Therefore, it may be used with 100 wpm RTTY as well as with 60. In addition, the circuit works well with any supply voltage between three and twelve volts; in addition to RTL it can directly drive transistor-transistor-logic (TTL) pro-

jects with require 5 volt supplies. The circuit draws approximately 20 ma at 3.6 volts. Only a 2 inch by 3 inch circuit board holds all parts, including the miniature transformer. The interface will permit much greater versatility in the use of the builder's solid state projects, as well as in providing much greater noise immunity. Although the Schematic calls for readily available MPS3393 transistors, practically any low power audio NPN silicon transistor could be used. The cost of all components, if purchased new, is approximately seven dollars.

References

1. RTTY Journal, Nov., 1970
2. RTTY Journal, July-August, 1970
3. RTTY Journal, June, 1970
4. RTTY Journal, May, 1967
5. RTTY Journal, July-August, 1967
6. 73 Magazine, May, 1968
7. RTTY Journal, July, 1964

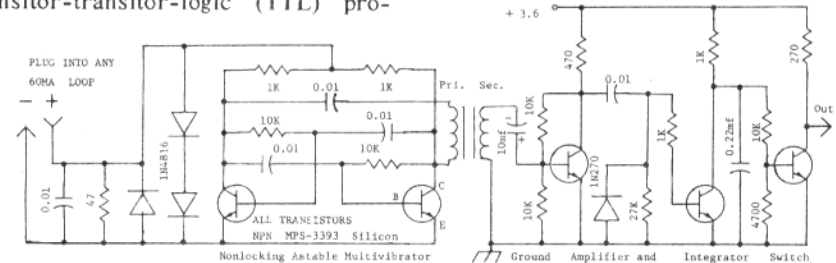


Figure 1. Loop isolation circuit suitable as an interface between RTTY loops and low voltage RTL or TTL projects.

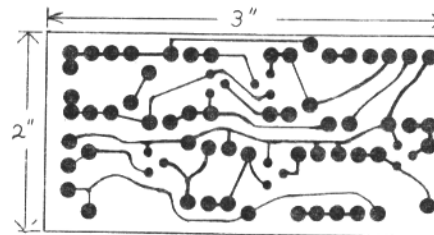


Figure 2. Bottom view (copper foil side) of a suggested printed circuit board layout. The figure is full sized and may be used as a template.

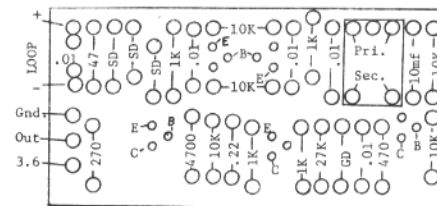


Figure 3. Parts placement for the circuit board. Circles correspond to the foil pads in fig. 2. Components are mounted behind the board as it is viewed here. "SD" denotes any of the three silicon diodes; "GD" denotes the germanium diode.

DX NEWS--

Continued from page 11

Bob, H18XRM, has a stateside QSL manager as follows --
Vince Buccellato, WA2RSX
927 Brinsmade Ave.
Bronx, N.Y. 10465

A few of the fellows have been fortunate to contact Heinz, TA5KL, on RTTY. He has a very good signal but does not appear to be too active. Nothing further on this one at the moment.

The WAE Contest ought to be happening just about now and we hope that the conditions are improved for this one. It will be the last event until October so you will now have an opportunity to do a thorough maintenance job on those over worked printers. The WAE Contest, with the unique "QTC" message is the only contest that allows utilizing the full capabilities of a complete RTTY system. That is, punching out messages, holding them in storage, and then sending them out at machine speed at a later time.

Good Luck in the Contest.

73 de John

*** MAY 1971 3

RTTY Station Control and Automatic 'WRU'

IRVIN M. HOFF, W6FFC
12130 Foothill Lane
Los Altos Hills, CA. 94022

PURPOSE --

This circuit allows those using Model 28 teleprinters to have certain automatic station features that offer a tremendous amount of versatility. In addition, it offers automatic "WRU" (who are you?) which is particularly useful on unattended autostart frequencies. It tells the inquiring station if you are copying them, gives them a propagation check to see if the band is open in your direction and is always of immense interest to "visiting firemen" at either end. Protective circuits are included for automatic shut-down in the event something goes wrong.

STATION CONTROL --

This assumes you have a Model 28 printer that you will use. The stunt box will have certain coded sequences in it that will open electrical switches. If you do not use the "WRU" feature, then only S3 and S6 would be used in the stunt box. S3 would be coded to open an electrical contact momentarily upon the completion of the three characters: "Figs Blank H". This would turn the station off the air automatically, as will be explained.

If the two characters "Figs LF (line feed)" are received, this would trip the automatic C.W. identification device.

If the "WRU" feature is added, then an additional seven slots in the stunt box would be used, the completion of which would turn on the auxiliary T.D. with the "WRU" tape in it. That series of seven slots would be programmed with your call letters so it would not operate except when somebody specifically asked for your station. In my case the seven would be: "Ltrs F F C Figs Blank H". (You could even get fancy and have the "C" in this case hit a chimes or bell as it went by, informing you that somebody typed your call -- this would work whether they then added the rest of the sequence or not -- a nice feature if across the room, etc.)

THE CIRCUIT --

The schematic shows 120 VAC for the T.D. magnets. This can be D.C. from the loop supply if you prefer, but this method normally allows you to operate the motor and clutch simultaneously on the auxiliary

T.D. used for "WRU".

You can think in terms of only the left-half of the circuit for the moment.

We use 120 VDC relays for this, which receive their current from the internal loop supply that the 28 machine normally has. If you do not add the remote WRU, it is possible to use a normal 120 VAC relay for K1.

So here we go. To come on the air, you tap the momentary push button S1 -- this puts voltage to the K1 relay coil, which then closes that relay. At this time, the contacts K1a then put voltage through S2 S3 K3a and K1a to the coil, so that the relay becomes a "self-holding type" and stays locked down.

This in turn places the demodulator (T.U.) in standby via K1b and turns the transmitter on via K1d. A manual "off" switch S4 is provided so you can keep the transmitter from turning on in order to run the T.D., etc. for local work.

K1c then puts voltage to the T.D. clutch, allowing it to automatically come on "flying" whenever you push the "start" button (S1). Thus if you have a tape ready to run, all you need do is tap S1 and the transmitter is on the air with the T.D. flying, and no further switches are needed.

We now assume that at the end of the tape we typed a "Figs LF" -- when the tape comes to this point, S6 closes in the stunt box momentarily, starting up the C.W. identification device. That in turn has a relay that holds down until it is finished, one set of contacts on the C.W. relay then opening the voltage to the T.D. via S8 -- turning off the T.D. automatically while the C.W. device (usually a motor-turned code wheel with notches) completes its work. When it has, the T.D. starts up again. At the end of the tape you have typed: "Figs Blank H" and this then operates the stunt-box switch S which interrupts the voltage going to the relay coil K long enough to allow it to open. This turns off the transmitter, puts the T.U. in receive and stops the T.D. as well.

You can use this same set-up without the T.D. necessarily. You would tap S1 to come on the air -- then go ahead and type manually. You could then either type Figs LF to start up the C.W. device, or tap the manual C.W. tripoff, S5 when the C.W. device was finished, you could then

go off the air by touching the momentary switch S or typing "Figs Blank H" to do it via the stunt box and S3.

So much for the station control. All this would only take one relay. It offers in particular the advantage of being able to start a tape by merely touching S1, and at the completion of the tape it would automatically insert the C.W. and then turn the station off the air back to receive. Thus you can start a tape and go mow the lawn or walk in the other room or whatever and it will automatically finish by itself.

This system also gives a "one-switch" control that includes automatic T.D. features.

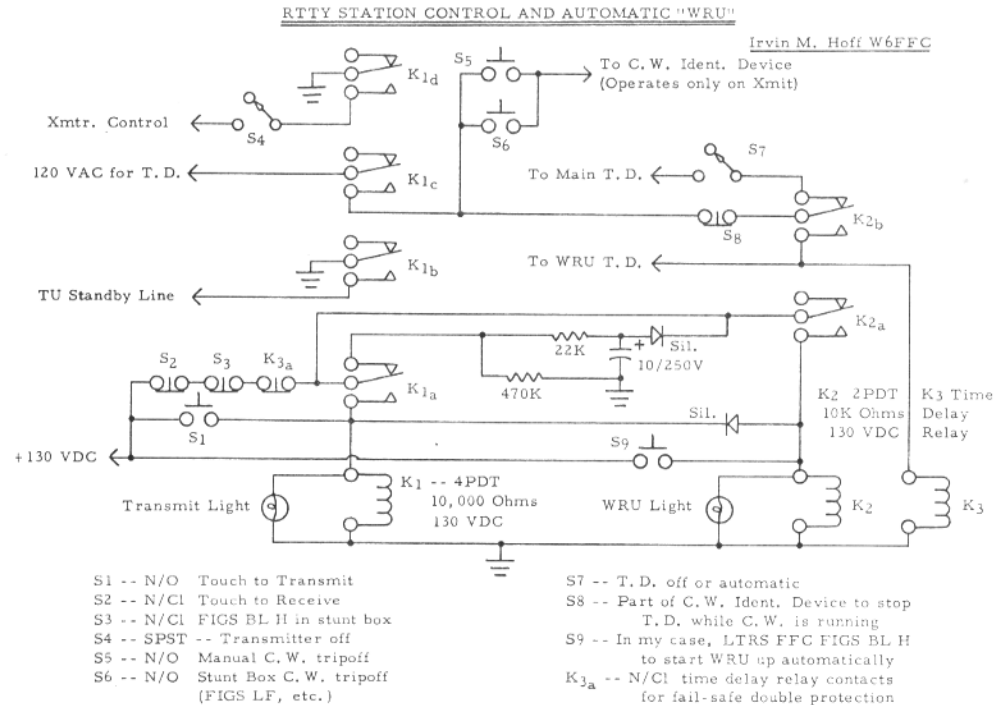
THE WRU PORTION --

We assume only a limited number of people would bother using this feature, since its purpose would necessarily do with unattended autostart either on 80-

10M or on MARS or on 2M, etc.

For the moment we will ignore the capacitor and resistors.

This time we are not on the air, but receiving via autostart. Somebody sends the sequence of characters (in this case the seven characters of "Ltrs F F C Figs Blank H" -- and now the stunt box switch S9 closes momentarily putting voltage on the relay coil K2 -- at the same time this voltage now goes back through the silicon diode and activates relay K1 at the same time, so they both close. K2a holds the second relay down automatically and K1a holds the first relay down, so now both are closed and locked down. Thus the transmitter comes on, the T.U. is in standby and the voltage to the T.D. now is shuttled to the "WRU" T.D. via K2b. (This circuit for "WRU" assumes you have a second T.D. whose sole purpose is for WRU purposes.) At the same time, voltage is now being introduced to K3



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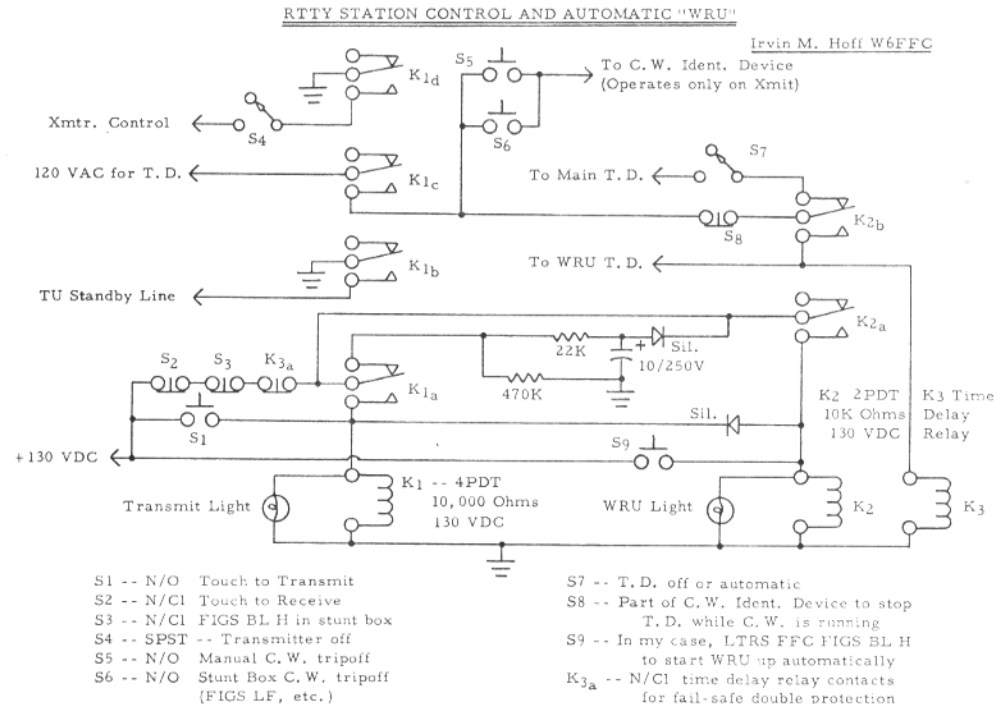
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which is an inexpensive normally closed Amperite thermal delay relay of the 60 second variety although literally any amperite normally-closed type will work adequately. You can also use the more expensive solid-state instant-resetting relays if you prefer. Either type run from either 120 VAC or 120 VDC in a majority of cases.

Thus if the T.D. was not working for any reason at all, you did not have a tape in it, or the tape broke, the delay relay gives a fail-safe back-up.

On the continuous tape in the T.D. you would have maybe 30 "Letters" characters to allow the various receivers on the frequency to come out of autostart, then a new CR-LF-LTRS to turn them up a new line and play your littly ditty. Like: "THIS IS W6FFC near San Francisco, California copying you." Following that would be your Figs Blank H to automatically shut things down once more. (Via S₃ which would open the voltage holding both relays closed.)

That's just about the entire circuit except for the capacitor. You see, when you send the "WRU" turn-on of "Ltrs F F C Figs Blank H" this not only closes S₉ but actually the "Figs Blank H" over at S₃ also thinks it's his turn and opens S₃. The capacitor holds a charge for a short time and keeps the voltage on both K₂ and K₁ until this situation passes -- small matter of time sequencing here. The 470K resistor then bleeds off the 10 Mfd. capacitor so that when the "Figs Blank H" next appears at S₃ it will allow both relays to open turning the transmitter off and putting the station back to receive. The blocking diode by the capacitor prevents the voltage from charging the capacitor once K_{1a} contacts are opened.

THE LAMPS --

It is assumed these would be neon lamps with suitable 100K or more, dropping resistors. You could use incandescent lamps, but they would pull too much current to be placed as shown -- in that event, put the one showing the K relay is operational, on the bottom of the K1c section, as this will be pulling a substantial amount of current anyway. The WRU lamp would then go on the bottom of K_{2b}.

CONCLUSION --

This relatively simple circuit shows how with one 4PDT 10,000 ohm coil 120 VDC relay (cost typically \$4 or less) you can have a tremendous amount of versatility. By adding a second relay (2PDT) with similar coil, you can have automatic remote features that tell your friends if you are "getting through" to

you, have hit your frequency, and something to really impress the visiting firemen with. If you tell somebody "I am copying you, try my WRU if you want to keep typing and are not sure if we are still here" it goes a long way toward making RTTY a lot more enjoyable. As mentioned it is particularly useful for those interested in autostart.

It does tie up a second T.D. although it is possible to use the main station T.D. for this purpose, but could make the "fail-safe" time delay system marginal.

Since this is relatively simple to do with the model 28, it is a further illustration of things that can be done with the stunt box.

As for the legality, this is not a repeater or remote control system in the sense that the rules mention these things. Since you are not turning the station off the air by remote means, or controlling it in any way when it is on the air. It is in a "gray area" for legality, but one of those topics that the ARRL says is beneficial but possibly not covered directly by the rules. They suggest in instances of this sort we do not "rock the boat" by insisting on an official interpretation of the legality involved.

To be reliable for "WRU" of course the transmitter needs to be left "on" but in standby. Many people are leaving their KWM-2 units, DX-60As, and others, run 24 hours a day, now. My DX-60A has not been turned off in over a year. All I did was add a 3/4 amp slo-blow fuse to the high-voltage A.C. secondary for added protection.

P.S. The stunt box contacts are only rated at a maximum of 100 mills, and only stay shut approximately 50 milliseconds or so at 60 speed. Thus we suggest you do not consider other types of relay coils, such as 24 volt surplus units, etc. They pull too much current, the 120 VDC 10,000 ohms relays pull about 10-11 mills each. Be careful also on the C.W. device that its relay is about 120 volt device for similar reasons.

--Irvin M. Hoff W6FFC

(PPS -- If you are a "purist" you can add a resistor in series with the relay coil to hood the current to 10-11 mills with whatever loop voltage you are using.)

(NOTE) Automatic transmitting operation of an amateur station without the operator being present is illegal. When using automatic answering equipment the operator should be on the premises.

RTTY JOURNAL

Modification for the 'Simplex' Auto CR - LF.

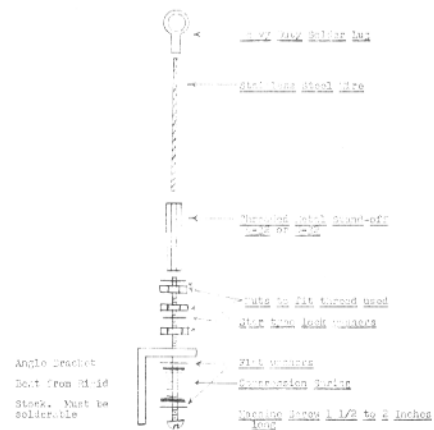
JIM STUDER, W9RYI

12808 S. May St.
Calumet Park, Ill. 60643

Irv Hoff W6FFC wrote his original article in the July-August 1968 issue and wrote the modifications up in the October 1969 issue. See the original articles for complete details.

I could not get the Auto CR-LF to function per the original article and had the same binding problem which Irv experienced. However, my solution was somewhat different than his, and less critical in adjustment.

Briefly here is the problem: The finger on the spring housing pulls on the wire and raises the line feed bar, which is stripped off by the reset bail. However, on two separate machines, adjustment of the reset bail was such that when the platen was in upper case the line feed bar would be stripped off, resulting in an automatic



DRAWING NOT TO SCALE OVERALL ASSEMBLED LENGTH APPROXIMATELY 8-1/2". Start with 9" and adjust length of top wire as necessary by removing, cutting off and resoldering. Screw should be about half way into metal stand off.

If possible use a machine screw which has no threads on the part which will move through the bracket. Otherwise, use a file to take off the sharp edges of the thread to assure that the screw will not bind.

RTTY JOURNAL

CR-LF function which caused all figures to be typed vertically at the left margin, and then all letters to start typing normally 'Very Interesting!' The solution as outlined in Irv's second article did not prove to completely correct this problem, as any upward tension on the line feed bar is to be avoided except when pulled by the finger on the spring housing.

The modification as outlined herein permits adjustment of the wire length independent of the tension required to cause operation, thereby allowing enough latitude for the platen to go into upper case without operating the Auto CR-LF function.

Assemble as per the blow up. The angle bracket is soldered to the line feed bar where the solder lug was in the original article. If stainless or other non-solderable wire is used, first fray the end of the wire before inserting it into the hole and filling with solder-this will lock the wire in place even though there is no solder bond. The double nuts are run down against the upper bracket with a lock washer between them. The compression spring should be compressed approximately one quarter of its length. This will vary with the type of spring, which should be very light and readily compressible between thumb and forefinger, and be about three quarters of an inch long. I have a few more of the type of spring which I utilized and will furnish one free for a SASE.

With the platen in upper case, adjust the overall length to the point where the line feed bar is not pulled upward. This can be done with the machine mounted on its base by using two small wrenches. Small ignition wrenches will fit all of the nuts and adjustments found on this machine.

The Auto CR-LF should now function when the hook on the hose clamp pulls the wire. Watch the operation of the wire. If there is too much slack or not enough tension on the compression spring the typing basket will go against the right margin and not come back. When adjusting the compression on the spring, if you get to a point where the spring is fully compressed, the spring is not heavy enough, on the other hand if any compression of the spring causes binding of the

Continued on page 12

MAY 1971

RTTY theory & applications.

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



RTTY TUNING INDICATORS

There has been some call for a discussion of tuning indicators. The following is not meant to be exhaustive, but it will give some thoughts about ways to indicate the tuning status when receiving a RTTY signal.

There are at least three ways to indicate tuning of a receiver when trying to copy a RTTY signal: 1) A display on an oscilloscope of the demodulated signal versus time, 2) A cross as viewed on the face of a cathode ray tube, and 3) A zero indicating meter.

Before discussing how to connect a tuning indicator, a brief discussion of TUs is in order. The figure shows the "heart" of most audio-type TUs.

Basically, the operation is as follows. The tones coming from the receiver are run thru a limiter and amplifier. The audio output from the limiter/amplifier is coupled thru the two resistors, R, into two tuned circuits. The resistors are made fairly high in value to preserve the Q of the tuned circuits and to isolate them as much as possible. One of the tuned circuits is tuned to the Mark frequency and the other to the Space frequency.

Because the tuned circuits are parallel resonant, an audio voltage appears across only one tuned circuit at a time, and only when the frequency of the signal is at or near the resonant frequency of that tuned circuit. Thus, when a Mark tone is received an audio voltage will appear across the Mark tuned circuit and none (or very little) across the Space tuned circuit. When a Space tone is received, just the opposite will occur.

The voltage appearing across a tuned circuit is rectified using the same type voltage doubler commonly used in power supplies. The diodes connected to one tuned circuit are reversed from those on the other tuned circuit. In this example, a Mark tone results in a voltage across the upper tuned circuit and this voltage

gives a positive dc voltage at point X. A Space tone results in an audio voltage across the Space tuned circuit and this results in a negative dc voltage at point X.

The voltage at point X will be a replica of the signal in the transmitting loop at the sending station and will be in polar form. The voltage at this point is used to key the output loop thru a dc amplifier ("keyer" tube or transistor) in a simple TU, or it can be processed thru various circuits such as a low pass filter, a level decision making stage, etc., before keying the output loop.

1) Perhaps the best tuning indicator from the standpoint of obtaining the maximum amount of information about the signal being received employs an oscilloscope arranged to give the demodulated signal as a function of time. For this you will need a dc coupled oscilloscope with a low sweep rate capability and a triggered sweep. The signal displayed will, ideally, be that pictured in a handbook showing a RTTY character. You can obtain such a display by connecting the scope input to point X in the figure. At this point, the signal has not been cleaned up by the circuits within the TU that prepare it for keying the output loop. Therefore, all noise and other forms of trouble making voltages will appear on the display. Perhaps the least desirable feature of this method of tuning is that it will provide a lot of information about the signal, and perhaps too much! One of the most interesting features is that it shows all the "crud" the transmitting station.

2) An oscilloscope can be connected to a TU in such a way that a "cross" pattern results when a RTTY signal is received. Adjust the scope for use with an external horizontal input. Connect the frame of the scope to the "ground" or common point on the TU, the vertical input to point "M" in the diagram, and the horizontal input to point "S".

Because the internal sweep is dis-

abled, an ac voltage applied to the vertical input will give a vertical line; an ac voltage connected to the horizontal input will give a horizontal line. Ideally (for the purpose of scope display), the Q of the tuned circuits in the TU should be as high as possible. When a Mark signal is received, a vertical line will appear on the oscilloscope, because an ac voltage will appear across only the Mark tuned circuit. When a Space tone is received, a horizontal line will appear. If the oscilloscope is properly adjusted, the height of the Mark vertical line will equal the length of the Space horizontal line.

When a RTTY signal is received, the scope will show the horizontal and vertical lines alternately and this will appear as a cross. Once the scope is adjusted to give a proper cross on a properly-tuned signal, you can then use the scope as an aid in tuning a signal.

Several things can cause the pattern on the scope to be other than ideal. The Q of the tuned circuits should be low enough to give proper operation of the TU. This will mean that even when a Space tone that is on frequency is being received, a small voltage will appear across the Mark tuned circuit. Consequently, the horizontal line will actually appear as an ellipse; ditto for a Mark (vertically-oriented ellipse).

When a signal is being tuned in, size, position and shape of the ellipses will change. Once you are familiar with such a tuning indicator the pattern will tell you how well tuned the signal is as well as such things as the shift of the signal being received in relation to the shift to which your TU is adjusted, etc.

3) Because the signal at point "X" is a polar signal, a zero-center meter connected from point "X" to ground will

read approximately zero when a RTTY signal is received and properly tuned. This is somewhat analogous to the zero-center tuning indicator used on some FM receivers. When a steady Mark or Space is being received, the meter will not read zero. Therefore, this type indicator is best for use when a steady, machine speed (tape) signal is being tuned in. A VTVM adjusted for center zero can be used very satisfactorily in this application.

Further information about RTTY tuning indicators can be found in the following references:

RTTY FROM A TO Z, Durward J. Tucker, W5VU, Cowan Publishing Co. (CQ), 1970. p. 180 (Fig. 14.10). pp. 194-198.

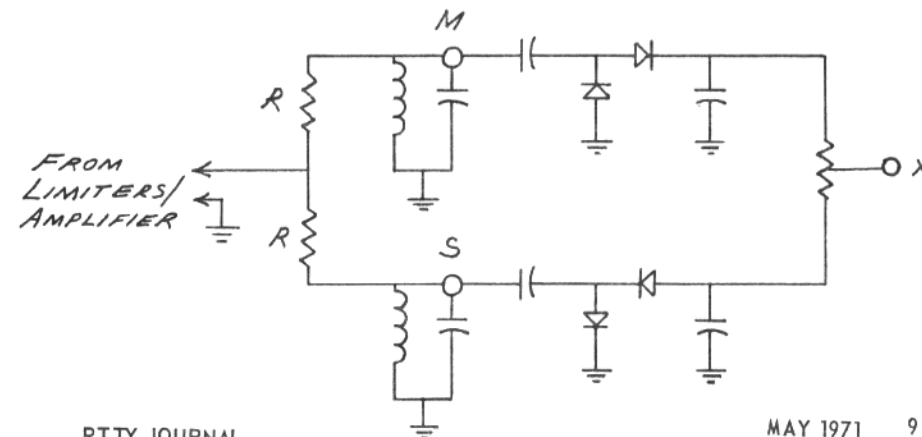
THE NEW RTTY HANDBOOK, Byron H. Kretzman, W2JTP, Cowan Publishing Co. (CQ), 1962, pp. 145-156.

HAM - RTTY W2NSD/1 & W4RWM, 73 Inc., 1963. p. 60. pp. 76-77.

It should be noted that there are two types of "cross-indicators." One type is as described above. The other was omitted because it required some (although very little) additional circuitry. Some of the references cited show how to build a complete RTTY tuning indicator that is independent of the TU. If you do not own an oscilloscope, you can build a special purpose oscilloscope just for RTTY tuning indication. Such a scope is included in some of the references cited.

Another somewhat curious note: The three largest, and best-known amateur handbooks were checked for tuning indicator circuits - there were none!

73 ES CUL (at Dayton?) RG



RTTY-DX

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



Hello there

The big event last month of course was the Annual Spring Contest sponsored by the BARTG. Activity was quite good as all Continents were represented, however, conditions left something to be desired and were down quite a bit from previous years. Larry, K1LPS, monitored WWV during the Contest and the "official" verdict on conditions was that they started out good at N-7, but then fairly rapidly deteriorated to U-5, where they remained for the duration of the Contest. At this location the only DX contact we made in the first eight hours was with Barney, ZL2ALW, as he was the only station outside the USA that was coming through. Things livened up somewhat later on 20 and 15, but 10 was pretty much of a lost cause except for fairly close-in skip. On this band we never did print Europe, or anything else, for that matter except a short opening directly to the South. If there is a prize given for causing the most frustration, nail biting, rug chewing, or what have you, it should go to Fred, WB0AAO. Those of you that got a crack at him really had a time getting a number and also contending with the fact that Fred could apparently copy only reverse shift. While most TU's have facilities to copy reversed shift or one flips the BFO to the other sideband, sending in reverse is another thing. Anyway, it was great fun while it lasted. A newcomer to RTTY, JA1FFX, was in there to give out numbers from Asia and did a fine job for his first Contest, and considering the fact he was only running about 20 watts input it was really outstanding. Another Contest first was Gerhard, ZS3B, in South-West Africa. Jan, ZS6BBK and Roger, ZS6BKK, made sure that you fellows got a South African contact. From way "down under" you had a good selection from VK3KF, VK3DM, VK2FZ, and ZL2ALW. Henri, FO8BS was in there for what may be one of his last Contests before he leaves Tahiti. South America had a good representation with CE3EX, PY2CBS, PY2DDS, and OA4BR. The bulk of activity of course came from Europe and North America, with a score

10 MAY 1971

DX HONOR ROLL

1. FG7XT	106/98	38. CE3EX	43/34
2. ON4BX	103/97	39. SM4CMG	60/33
3. 11KG	96/90	40. VK3NR	51/33
4. ON4CK	92/86	41. HB9ADM	43/33
5. W3KV	92/84	42. IICGE	42/33
6. K8YEK	76/74	43. W7VKO	35/33
7. W8CQ	74/70	44. VE4BJ	33/33
8. W4YG	72/66	45. WB6QFE	37/31
9. K8QLO	68/61	46. LX2BQ	36/30
10. VE3AYL	63/59	47. K9BJM	32/30
11. W3ISE	63/57	48. HB9AKA	40/29
12. W5QCH	61/57	49. K6EV	33/29
13. KJ6ZBA	75/55	50. WB6ADY	39/28
14. WA6WGL	63/55	51. W3ABT	37/28
15. W1GKJ	62/52	52. VE4FG	34/28
16. 11ROL	60/51	53. W5EUN	33/28
17. W2LFL	59/51	54. ZM2ALW	37/27
18. W4EGY	57/51	55. EI5BH	37/25
19. G6JF	55/51	56. G3IYG	33/25
20. K8JTT	51/47	57. KG6NAA	32/25
21. K4VDM	48/47	58. FY7YQ	29/25
22. W6CG	51/46	59. HK3SO	28/23
23. DJ8BT	51/46	60. PJ2CR	31/22
24. WA2YVK	60/45	61. W2IDX	42/21
25. W9AE	47/42	62. W1KQY	32/21
26. WA8BOT	51/41	63. K6YUI	24/20
27. DK3CU	51/41	64. OZ6OB	33/19
28. W5VJP	42/41	65. W0HAH	32/19
29. SV0WO	47/40	66. W9BT	37/17
30. 11CAQ	43/40	67. DL3NO	20/17
31. W8CAT	41/40	68. WA3IKK	32/16
32. VK3DM	44/38	69. WB6TLA	24/16
33. XE1YJ	41/37	70. CR6CA	28/15
34. VE5LG	42/35	71. HP1XHG	24/15
35. DL8VX	42/35	72. 11THB	22/15
36. WB6RXM	44/34	73. K1LPS	25/12
37. 11WT	43/34	74. WA8SJJ	15/ 3

of multipliers available. I suppose that we will not be able to look forward to much better conditions in future Contests. In fact, they should tend to get worse, especially on the higher frequencies as the Sun Spot cycle goes through its natural change. Perhaps this means trying to figure out larger and more efficient sky wires for 80 and 40 meters in the not too distant future.

Early in March the long awaited activity from Roumania commenced with the signal of Eugen, YO2AFB, on RTTY.

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He is putting out an excellent signal and I am sure that many of you have him in your logs by this time. We all certainly appreciate the efforts of Uli, DK3CU for getting Eugen started. You can send QSL's direct to --

Eugen Badea
P.O.Box 14
Hateg, Roumania

By the time you read this, Fanie, ZS2MI, will have closed down and returned to South Africa. Whether his replacement will take an interest in RTTY remains to be seen, and if so, it will be some time before we hear from this spot again. We certainly appreciate the efforts of Jan and Joey, ZS6BBK/BBL for their assistance in giving many of the RTTY boys an opportunity to make a contact with Marion Island. Jan tells us that ZD9BR, a new chap on Gough Island, is one to keep a lookout for these days. Be prepared for 50 baud operation for this one.

QSL's have been coming thru from FH8CE in recent weeks to you fortunate ones that had a contact with Hugues in his somewhat brief operation from the Comoro Islands. We are now happy to report some future RTTY possibilities from the same general area. We are indebted to Jerry, K1PLP, Ass't. Technical Editor, ARRL, for passing us the following information. Andre, FR7ZX, Reunion Island, presently has a TU and AFSK generator and with an old Creed machine, (receive only) borrowed from the local broadcast station he can receive RTTY when he has use of the machine. He is extremely interested in getting on the mode but of course there are no machines available in the area. If anyone has a serviceable machine gathering dust I'm sure that Andre will put it to good use. You can get in touch with him as follows:

Andre Delmarle, FR7ZX
Chemin Crepu
Bras Panon, (97.4) Reunion Is.

Dusty writes of a letter from Colex K5OLU, stating that he has arrived at Kwajalein and has also received all his gear including a 28KSR and should be ready to go as soon as his new KX6 call arrives. Watch for him especially on Sundays as he is working on a 6 day a week job.

Those of you that have been on RTTY for a few years well remember Cas, KA9AK, when he was the only station active from Japan and at a time when the only authorized activity for RTTY was above 29 mhz. Cas was always active in the Contests and at that time was, more

RTTY JOURNAL

often than not, the only Asian station on RTTY. From Eric, VK3KF, who maintained skeds with him in those days, we hear that Cas is now stationed at Fort Bragg, N.C. and at the moment is trying to get set up on RTTY. Eric plans to maintain weekly skeds at 1300z, Sundays, On about 14090 khz. I'm sure that there are many of you that would like to BK and say hello to Cas again after these few years.

Congratulations are in order to the following stations upon receiving the W A C Award this month.

Nr. 154 Mark Thompson W5EUN
Nr. 155 Lucien Vuilleumier HB9ADM

For Mark, this comes right on the heels of his W A S achievement of last month, and for Lucien it is a double honor. Our records show that he is the FIRST Swiss station to have WAC-RTTY.

Lucien also tells us that the Swiss Amateur Radio Teleprinter Group (Swiss ARTG) was founded on January 17, 1971. Chairman, HB9P, and Secretary, HB9GS. We will be happy to pass along information on future activities of the Group as we receive them.

In mid-March Bud, W2LFL, has short but enjoyable contacts with OZ6OB and SM5QV, but with out the usual QRM and QSB. Both Ole and Gunnar were in New York briefly on their way to the West Coast and Bud was fortunate to have a chat with both of them. The visits were about a week apart so I don't think that the two had a chance to meet. It would be an interesting story if their paths did cross. Ole was in the San Diego area for a week but we are not sure as to where Gunnar was at. Anyway, we hope that both had a pleasant visit to the States.

Although there has been no activity from Liberia in recent months, the next best thing would be a contact with EL0Y/MM. He was recently printed while about 300 miles west of the Azores with an excellent narrow shift signal.

You Canadian boys may be interested in knowing that Gerhard, ZS3B, is looking for a VE contact. He has been very active the short path around 2000z and also via long path at about 12-1300z, real landline copy too.

Dave, 3A2CZ, has been showing increased activity lately and puts a good signal into the States from a Heath HX-10 and a TA-33 Jr. Dave is with Trans-World Radio in Monte Carlo and QSL's can reach him at --

David E. Fisher
"Le Continental"
Monte Carlo, Monaco

Continued on page 3

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HITS & MISSES

From The Editor
and
his Mail



We left for Florida the middle of March and had a daily schedule with a friend at home via the mobile rig. Everyday we chortled with smugness as we enjoyed hot, sunny weather while we listened to the constant snow storms, cold and rain at the home town. Toward the end of our stay however we started ordering better weather for our return. The home town had it's revenge, we arrived back in a snow storm.

As we expected the mail was stacked up and we had to get back to work. We checked first for classified ads so we could get copy to the printer and then started in at the top. By the time you read this we should be caught up. If there was a long delay in an answer forgive us. We also ran out of binders about a month ago, they arrived while we were away and orders will be filled as soon as the mail is taken care of.

Dr. James Clifton, W7GMJ/6, of Torrence California, phone 213-320-5026 has a model 26 and a Western Union model 100 that he will be glad to give to anyone not having any printers at present. Only restriction is that the machines must be picked up.

Simplex Modifications

Continued from page 7
stripper bail, the spring is probably too heavy.

Adjustment of the stripper bail may be needed, if so proceed as follows: with the platen in figures, loosen the right hand screw on the function bail blade (this can be done from the rear with the machine mounted on its base. TURN OFF THE MOTOR AND DISABLE ALL CIRCUITS FEEDING THE TABLE, SUCH AS EXTERNAL LOCAL LOOPS ETC.) Adjust the blade downwards, slightly. Do so until you get a Auto CR-LF on EVERY Character typed. It is necessary to re-apply power to do this. Then adjust upwards until the Auto CR-LF does not pull. All this should be done after adjustment of the

wire link length so that the lind feed bar is not pulled upwards when the platen goes into figures position.

After final adjustments have been made, lubricate the spring and the screw where it passes through the bracket liberally with grease.

BACK ISSUES---

The only back issues available are listed below. Copies are 30c each.

- 1966 - Aug., Sept., Oct., Nov., Dec., (5)
- 1967 - None
- 1968 - Mar., May, June., Sept., (4)
- 1969 - Feb., May., June., July, Sept., Oct., Nov., Dec., (8)
- 1970 - Jan., Feb., Mar., (3)
- 1971 - Jan., Feb., Mar., April., (4)

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

RTTY JOURNAL
P.O. Box 837 Royal Oak, Mich. 48068
"DUSTY" DUNN - W8CQ
Editor and Publisher

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RTTY JOURNAL

Frequency Shift Keyer Notes -

D. E. CHAPMAN, W9DPY
670 N Elizabeth St.
Lombard, Ill. 60148

FREQUENCY SHIFT KEYER NOTES

In working thru one of Irv Hoff's XT-4 Crystal control units, it was found that the original unit was an excellent device. (RTTY Journal Dec. 1967)

There are a few notes that will help the fellows assemble the units and check them thru.

These notes apply to one frequency-14075.000 and one shift -- 170 cycles.

It is absolutely mandatory that the B+ be regulated. Using a DX60+B, the VFO voltage ran 285 volts -- far too high for the XT-4. A separate 270 ohm filter resistor and 40/450 volt filter was added off of the first low voltage filter section. This change was made as the original 270 ohm filter resistor was overloaded under conditions of high drive.

From the new filter section, the +B is taken thru the VFO B switch on the crystal switch thru a pair of 33K 2W resistors in parallel to an OB2 regulator tube.

The OB2 must be checked with varying currents 5-25 ma as a number of these tubes brand new do not regulate at all. Voltage should not vary more than 1 volt over this range.

Without the regulator the frequency changes about 3 cycles per line volt and with the regulator less than 1 cycle per volt. See Fig. 1.

In the actual construction of the XT-4 the 14 mc crystals were found to be so critical it was decided to go to 7 mc crystals and double to 14 mc.

Farther, it appeared wise to go to a grounded shift trimmer on the XT-4. The improved ease of adjustment justifies the added parts cost and time.

There is considerable difference between crystals. It may be necessary to change the 5 isolation capacitor to fit other crystals.

The shift diode is a 1N270, a diode that saturates very quickly. The shift then becomes independent of diode current (within reasonable limits), a very desirable situation.

Two RF chokes are necessary to complete the DC path to the 1N270. These chokes are almost any 1-2 Mhy pi wound chokes. Keying voltage comes from the +105 circuit thru the dropping resistors R1 and R4. Actually the unit will work with R1 only, but the voltage comes up to

55 volts on open keyboard, approaching the breakdown point of the 1N270. R4 was added to limit the voltage.

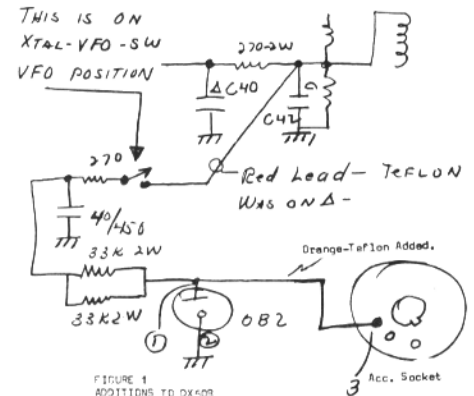


FIGURE 1
ADDITIONS TO DX60+B

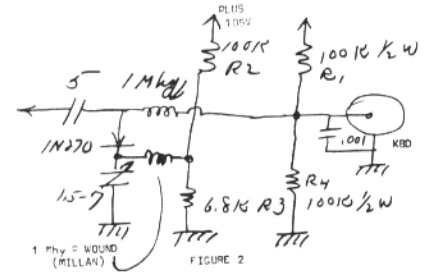


FIGURE 2

Since the 1N270 is a high conducting diode, with the KBD jack closed enough current would flow from the rectified RF to keep the oscillator shifted to space, resistors R2 and R3 were added to furnish a cutoff bias.

All filters must be removed from the machine keyboard as the keying point is a high impedance point.

The keyer presented has one side of the keyboard grounded, one side of the shift trimmer grounded, one side of the frequency set trimmer grounded.

A .001 ceramic capacitor is necessary to keep RF out of the keyer Keyboard circuit.

An unshielded 6EA8 was used as the oscillator tube and International HA-700 crystals employed. Hand movement near the oscillator tube varied the frequency less than 2 cycles. Complete shielding of the underside of the unit is an absolute must as are filters on all incoming leads.

The Unit described is a two fre-

quency job assembled in a 2x2x3 mini-box. It is far too tight for the average person to assemble. In a single frequency unit the size would be satisfactory but a

box twice this size would be more applicable as the switch takes up considerable room.

Revised from Original XT-4 (RTTY JOURNAL Dec.67)

40 Meter Xtal.

XT1- 7.037450 - Adj. OK.

XT2- 7.055000

14075.000 HA700

14074.828

.172 Shift

SM- Silver Mica

Keyer is wired like this...

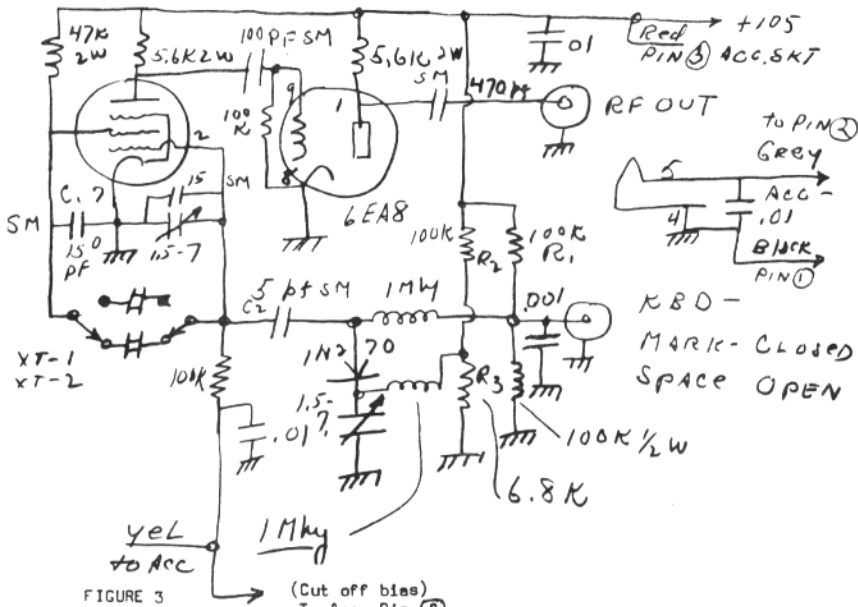


FIGURE 3

(Cut off bias To Acc- Pin 3) *****

Index of RTTY Articles in 'HAM RADIO'

Furnished courtesy of HAM RADIO, Greenville, N.H. 03048. Back issues when available 75¢ each.

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RTTY with the SB-300 (W2ARZ) p. 76, July
- 1969
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Synchrophase afsk oscillator W6FOO p. 30, Dec.
Teleprinters, new look in W6JTT p. 38, July
- 1971
Mainline ST-6 RTTY demodulator p. 6, Jan.
Short Circuit p. 72, April
Troubleshooting the ST-6 RTTY demodulator p. 50, Feb.
RTTY signal generator p. 23, March

Newt, K8QLO has a number of E15 QSL cards for stateside contacts. A SASE envelope to 572 Ludwig, Detroit, Mich. 48224 will bring you a card if you are looking for one.

RTTY JOURNAL

CLASSIFIED ADS Rates-\$1.- 30words. ADDITIONAL Words 3¢ ea.

CLOSING DATE FOR ADS- 1st of month.....

SB-401 w/crystals, SB-301 w/cw filter, \$500 for pair. Will sell separately. Very nice TT/L-2. Model 15 printer, 2 model 14 reperfs, model 14TD all on custom table with super station control. Many other non-RTTY items. S.A.S.E. for complete description. WB4RKA, R. Wanat, 443 Atlas Drive, Madison, Alabama 35758

PARTS - ALL MACHINES - fast service on all machines from 14s thru 35s. SASE for list. Sell Fred your surplus TTY for highest cash or trade. Typetronics, Box 8873, Ft. Lauderdale, Fla. 33310 W4NYF

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

TOROID COILS, 88 mh UNCASSED. 5 for \$2.00 postpaid U.S. H. R. Fasold, PO Box 375, Apple Valley, Cal. 92307

SALE: TELE-TYPEWRITER SIGNAL DISTORTION TEST SET TS2/TG transmits four test signals, R, Y, space or standard test message. Portable in wooden chest, manual and wiring diagram included. Used good, \$32.00 each. Telfax Facsimile Transceiver; desk type, W.V. model 600 SA, simple to wire back to back for landline use or over a VHF audio frequency shift hook-up. O A dim. 12x13x7 5 inch drum, synchronous drum motor, running condition, used good, \$11.00 each. Atlantic Surplus Sales, 580 3rd Ave., Brooklyn, N.Y. 11215

WANTED: INPUT FILTER FOR AN/FGC-29 multiplex channel 5 or 12 receiver, fre. 2125 cps. Also station and frequency lists of commercial and press services. Bruce Jaquish, 23333 Edsel Ford, St. Clair Shores, MI. 48080

HAL DEVICES - RTTY EQUIPMENT Now, a single-source for BOTH parts and circuit boards for Mainline RTTY Equipment. Recently added to the HAL/Mainline series - the HAL-AK-1 AFSK Oscillator parts kit for \$27.50. The HAL AK-1 features a new circuit board (same size and using the plug-in connector as in the ST-6) and 15 turn potentiometers for precise adjustment of the tones for 170 and 850 Hz shift. Other proven HAL Devices RTTY Equipment: HAL ST-5 TU Parts Kit - \$50.00 (with HAL circuit boards, meter, and meter components. HAL ST-6 TU Parts Kit - \$135.00 (Now supplied with meter, lamps, and associated parts). Screened, but not drilled cabinet for ST-6 - \$26.00. Wired ST-6 Terminal Units - write. HAL RT-1 Solid State TU/AFSK generator - \$51.50 (with cabinet) Write for complete details on these and other HAL products and parts - look for us at the Dayton Hamvention. HAL DEVICES, Box 365 RJ, Urbana, Ill. 61801

BACK ISSUES - RTTY JOURNAL - Have all issues from Vol. 1, No. 1, will reproduce any issue for \$1.00 PP. \$1.10 first class. John Isaacs, 3175 Val Verde Ave., Long Beach, Cal. 90808

WANTED: TECHNICAL MANUAL FOR TT-230 - FG, (part of an FGC-30) and miniature #28 typing reperf. Also need keyer module for CV-89 RTTY converter. FOR SALE, teletype oil and special purpose oiler with long flexible spout, \$1.25 postpaid. Haines B. Remmey, 1530 Bancroft St., San Diego, CA 92102

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

M2BASR 100 wpm \$825. M19 60 wpm \$135., other electronic odd lots. New list twice a month. Send SASE to CFP Enterprises, 10 Graham Rd., W., Ithaca, NY 14850.

SELLING OUT WAREHOUSE FULL of teletype & facsimile machines, parts and equipment. Loads of electronic equipment and computers. No fair and reasonable offer refused. No list or catalog available. Saturday or Sunday by appointment. Week days 10-4. Goodman, 5826 S. Western Ave., Chicago, Ill. 60636. (312) GR 5-8200.

POTTING COMPOUND FOR TOROIDS, etc. 1/2 pint kit includes dispensing tube, actuator, mixing tools. Hardens in a few hours 35¢ per kit. Amplifier Modulator AM879/FRC contains tubes, trans. pots, coils etc. Best buy on the market. Large quantity in stock only \$3.00 postpaid. Over 10,000 items in stock, write - all inquiries answered. Bob - Frank Electronics, 407 Ritter Rd., Harrisburg, Pa. 17109

FOR SALE: TMC CFA-1 TU, excellent, with manual, \$120 - ST-5 90% complete, 170/850, scope & meter, \$175 - ST-5, 95% complete, \$65 - 28LPR typing reperf, 3-speed, mint condition, with cover, \$150. - Eimac SK500 (4-1000) socket, new, \$15 - Vacuum variables, 375 pf/16KV, 1/4" drive, \$25 - All FOB - SASE for further information & equipment list. Wanted: Ham M & TH6DXX. L. L. Filby K1LPS, P.O. Box 47, Peacham, Vermont 05862

TOROIDS: LOWEST PRICE ANYWHERE. 40/\$10. POSTPAID, (5/\$2.00) 44 or 88 mhz center tapped. 32KSR Page printer, reconditioned, perfect; \$225. MITE UGC41KSR Page printer, perfect; \$250. Mod28 Sprocket to Friction Kit \$25. 28LBD TD \$70. 28LPR reperf with gear shift; \$170. 33 parity Keyboard with cables, excellent; \$38. Model 15KSR, reconditioned; \$65. Matching RA87 P.S., Unused; \$7. Lorenz 15KSR, newest, many features; \$75. Sync motors \$7. GEARS for most machines: List for stamp. 14TD \$20. DPE tape punch \$14. HP200CD Audio Oscillator \$95. R390URR receiver \$550. 11/16" tape; 40rolls/\$10.00. 33ASR, complete, excellent; \$700. Stamp for complete listing. Van W2DLT 302R Passaic Stirling, N.J. 07980

SPACE-ONE DELUX RTTY DEMODULATOR complete solid state. Choice of three shifts 850-170-425, sharp Butterworth bandpass input filters, linear discriminators, motor control, lowpass filter 60-75-100 wpm, anti space, choice of fast or slow auto start, meter tuning, mark and space indicator lamps, stand-by & receive lamps, AM or FM operation, proven heavy duty TT/L-2 loop supply (adjustable), regulated power supply, plus and minus FSK driving voltages (adjustable), provisions for disabling auto start & motor control, normal reverse switch, can be supplied with low or high tones. Desk type cabinet or rack mounted. Introductory offer \$250.00 FOB. Can be supplied with J & J delux AFSK generator low distortion-high output generator built into the same cabinet making the unit self contained at an additional cost of \$75.00 or a total of \$325.00 FOB. J & J Electronics, Canterbury, Conn. 06331.

SALE: Model 19 with no glare window, Model 14 reperf. and keyboard, Model 14 Tape Dist. audio TU & scope and meter indicators, line unit, everything \$200. W6JX, 14945 Dickens St., Sherman Oaks, CA 91403.

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