QEX 11 December 1982

The ARRL Experimenters' Exchange

QEX Begins New VHF+ Technology Column

In this issue you will see a new column entitled "VHF+ Technology" written by Geoff Krauss, WA2GFP. He has contributed articles on vhf thru microwave devices in QEX issues 1 and 3 as well as other publications. The column will cover not only vhf-microwave devices but will include information at the system level as well. The present plan is for the column to be a bi-monthly feature. As in the case of other column writers, it would be helpful for you to write him and give him any additional information as well as suggest topics for his consideration.

QEX Renewals

By now, you should have received your QEX expiration notice. We are happy to report that the basic cost of $6 for ARRL members and $12 for non-members has been maintained at its initial level. However, the postal rate increases for First Class Mail in Canada, Mexico and the U.S. as well as air or surface mail are passed along in the renewal rates. If you haven't yet renewed, please do so today to insure that you don't miss anything.

Some Thoughts on Radio-Frequency Interference

Over the past several years, I have been reading articles and letters in the personal and professional computer magazines about radio-frequency interference (RFI). Most of it was in reference to the Federal Communications Commission (FCC) Docket 20780, which was initiated in April 1967 to update rules concerning restricted radiation devices (i.e., Part 15 of the rules). The new rules went into effect, in steps, in July, 1980 and March 1981. These new rules caught many manufacturers of computer or other digital devices by surprise. Many had not dealt with radio reception or the FCC. The result was that most manufacturers of computer hardware had to begin a crash program to reduce RFI in their equipment to the new limits or stop manufacturing the items which didn't pass. It turned out that some were able to add shielding, bypasses and chokes to make their equipment acceptable.

Nearly all of the published articles tended to characterize the FCC as the "heavy" in this matter. The reasoning went that "here we were producing this lovely computer, then the big, bad FCC came along and made us add some useless emission-control devices which only raised the price of the product." I don't remember reading anything like "what took the FCC so long to clarify limits on computer-generated RFI?"

All the FCC is asking of manufacturers is not to interfere with a neighbor's TV reception 10 meters away from the computer. Reasonable? For your neighbor, maybe, but not for your own radio or TV reception. Probably the worst case is a TV receiver used with a personal computer. Many will operate without interference. But, have you seen computers, still being sold, that produce displays with "worms" (wavy lines)? That likely is due to the use of a channel 3 on the TV to receive the computer-generated signal; harmonics of the transients in the computer show up on vhf TV channels.

As hams, we are interested in the interference that a computer might cause to Amateur Radio reception. In some cases, the computer could be in a room other than the shack for use by other members of the family. Then there's the computer in the shack. The FCC rules are not doing us too much good here, possibly just keeping the RFI down to a dull roar.

Some time ago, I tried to operate a pre-RFI-rules personal computer with a 2-meter transceiver which had a rubber ducky antenna. That was a disaster. The computer and the TV receiver got into the radio, making reception almost impossible except on very strong signals. The radio transmitter got into the computer and/or TV set, wiping out the display. The RFI ring-around was largely reduced by using an external antenna some 60 feet away from the equipment. Still, strong birdies were noted on numerous frequencies throughout the hf and vhf bands.

Then, I sold the computer, plastic box and all and started acquiring a new computer system. The first acquisition was a CRT terminal, in kit form, which happened to come with a plastic enclosure. Before assembling the case, I took it to a company near Philadelphia to have it sprayed with RFI shielding. It worked, to some extent. Interference to a TV receiver using rabbit ears some six feet away was noticeably reduced when the cover was closed on the terminal. However, a birdie in the 2-meter band could be heard 150 feet away. Nothing was done to reduce radiation through the CRT screen, and signal lines were not filtered. However, power-line filtering had been added. There is still work to be done on the terminal, but the shielding and filtering done thus far was worthwhile.

The new computer is in a metal box, as are the two 8-inch disk drives, a "must," because the computer is located in the shack. Cables between units have not yet been shielded or filtered, but that's in the plans. For the moment, it is at least acceptable with medium-strength birdies only a few places throughout the ham bands. No attempts have been made to search for and destroy any specific leaks.

I'm sure that QEX readers would be interested in articles on making computers safe for the ham shack. We need to have information on how to reduce emanations from personal computers which were not built with RFI reduction in mind (except to squeek by the FCC rules). It would also be useful to know how to design equipment for home-brew projects in order to eliminate RFI. I've seen some articles on pc board layout to minimize RFI in trade journals but very little on this subject in amateur literature. Are there any specific tests that one can perform to tell whether or not a digital device will cause unacceptable RFI to amateur equipment? Should there be any standards or design goals for digital equipment for the shack? The long data cables which interconnect computers, printers, terminals and radios make great antennas — can anyone design an RS-232-C cable using optical fibres? - W4RI.

Correspondence

Dish Construction Advice

Thank you for the opportunity to answer the questions in the referenced letter pertaining to N7CQP's antenna. (Ref. QEX October, 1982, p.6) I submit the following response with the qualification that my experience with dishes is somewhat limited.

Question 1 -- Relative to a galvanic reaction between copper and aluminum:

Aluminum is positioned very near the corroded ("least nobel" or "anodic") end of the galvanic series, copper, the bronze, brasses, etc. are near the middle of the series, and stainless steel is very near the protected ("cathodic" or "most noble") end (Ref. ITT, "Reference Data for Radio Engineers," 4th ed., page 42). In an ocean environment, the aluminum will corrode where it makes contact with bronze or stainless steel parts. This corrosion will appear in a relatively short period of time.

As I understand N7CQP's antenna description, the entire structure will be aluminum except for the copper tees at the end of each spoke around the circumference of the dish. I do not know to what extent the aluminum/copper corrosion will affect the efficiency of the dish.

Antenna efficiency is defined as the ratio of the gain to the directivity, i.e.,

Eff = G/D.

In order to obtain the directivity of an antenna, one must integrate the pattern of the antenna over the sphere.

My **GUESS** is that the corrosion will have some effect on the pattern. However, I cannot quantize the effect. I would also guess that it would be difficult to quantize any efficiency changes attributable to this corrosion without redifining the antenna directivity.

Question 2 -- The idea of installing the feed horn, LNA, LNA power supply, etc., in a 5 inch x 12 inch PVC pipe and suspending it from the dish on an adjustable tripod:

To me, installing equipment such as the mixer and/or transmitter in a manner that minimizes coaxial cable and/or waveguide losses is always a good idea. In other words, if I understand his description, I believe that installing these parts as N7CQP describes is a good idea. I would assume that the susceptibility of the electronics to RFI would increase, e.g., coupling of rf energy into the input power circuitry. - Ed Kane, W6ONT, ARRL Technical Advisor.

More on Pi-Network Formulas

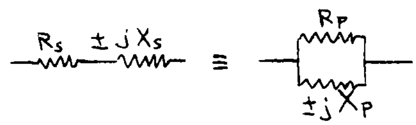
In his remarks regarding the "Pi-Network Formulas," by Elmer Wingfield, W5FD in the September 1982 QEX, he mentions the parallel-to-series and series-to-parallel equivalent circuit equations. There are many interesting relationships usefull for transforming such two-element networks, some of which are not well known.

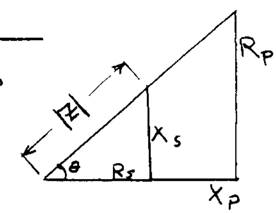
Attached is a list of the ones I have had occasion to apply, which you might like to use. The trigonomitric relationships are thrown in for good measure. The equations are generally arranged to convert from parallel to series, but obvious rearangements give the reverse conversion.

Many of the equations use the factor 1/(1+Q^2) in one way or another. (Ed. Note: ^ means raise to the power of. Q is squared in this case.) I had a table for this factor calculated 50 years ago for Q from 0.001 to 100, using unit steps in the third significant figure. It is 8 pages in length. I would be glad to send a copy if you would like to have it, although with everyone now having a calculator, there is less need than when only a few Monroes were around.

Incidentally, I believe there is a typographical omission in W5FD's article in the first equation for XL, four lines below the figure. In the denominator of the second fraction, the X2 term also should be squared. - Mason A. Logan, K4MT, 1607 Monmouth Drive, Sun City Center, FL 33570.

TWO ELEMENT NETWORK TRANSFORMATIONS





$$Q \equiv \frac{X_S}{R_S} = \frac{R_P}{X_P} = \tan\theta$$

$$|Z| = \sqrt{R_S^2 + X_S^2} = \sqrt{R_S R_P} = \sqrt{X_S X_P}$$

$$= R_S\sqrt{1+Q^2} = \frac{R_P}{\sqrt{1+Q^2}}$$

$$R_S = R_P\frac{1}{1+Q^2} = R_P\cos^2\theta$$

$$X_S = X_P\frac{Q^2}{1+Q^2} = X_P\sin^2\theta$$

$$\frac{X_S}{X_P} + \frac{R_S}{R_P} = 1$$

$$\frac{R_S}{X_P} = \frac{X_S}{R_P} = \frac{Q}{1+Q^2} = \sin\theta\cos\theta$$

The Case of the Missing References

Here are the references which were inadvertently omitted from I4MK's article in QEX 10:

[1] D. Norgaard, W2KUJ, "A New Approach to Single Sideband," QST, June 1968, p.41.

[2] B. Goodman, W1DX, "The Basic Phone-Exciter," QST, January 1949, p.12.

[3] J. V. O'Herrn, W2WZR and T. Sly, K2QCX, "Balanced Modulators for VHF and UHF Sideband," QST, November 1964, p.14.

[4] R. Taylor, W1SAX, "A Direct-Conversion SSB Receiver," QST, September 1969 and in ARRL "Single Sideband for the Radio Amateur," 5th ed., 1970.

[5] See Ham Radio, January 1978, p.59.

[6] G. W. Horn, I4MK, P. Rapizzi, I1RPZ, "The Synchronous Detection," EBU/Working Party A Com.T(A), Geneve, September 1971. See also the receiver AN/FRT-29 (XW-1) in Proc. IRE, December 1956, p.1716.

RTTY Send Program & Interface for the Sinclair/Timex ZX81

By Brian Davis,* W9HLQ

One of the things in operating RTTY with non-electronic gear has been the nuisance of identifying. There is a lot of repetition such as the other station's call, my call, my name and QTH. I often envied those that had the new fancy "glass TTY" units that had all of that built in. Well it wasn't long after I got the Sinclair ZX81 that I realized that here was my answer. Following is an outline of a program that will send blocks or buffers of text at 60-wpm Baudot. Additionally I hope this will encourage others to dig into their Sinclair/Timex computers and put them to work on the ham bands.

The purpose of this article can be summarized:

1) Provide an automated way to assist in RTTY i-d sequences.

2) Use as a learning tool for building a simple interface for the ZX81.

3) Learn the connection between BASIC, machine language (ML) and the hardware.

4) Provide a basis for the higher-performance UART to be done later.

The method:

1) Build a simple two-TTL-chip interface with LEDs driven by a simple BASIC program. This will familiarize us with the system of entering ML programs into a REM statement and verifying that the interface is working. (This step is optional.)

2) Enhance the above program with the full ML TTY logic, add a relay to key the TTY loop and add the full BASIC support code.

A look at Fig. 1 will reveal the simplicity of the interface that we will be using. The LEDs are optional and for use in the preliminary checkouts. The system that I use is called "partial address decode" which means that only enough address lines are brought out of the interface to do the job. The address decode is done by a 74138 IC which is just made for our application. It is listed as a "1 of 8 decoder/demultiplexer." It will provide 8 different functions or signal lines when wired as shown. Note that due to a limitation of the Sinclair, only odd addresses are allowed. **Even** addresses will cause the computer to crash. I believe that this is due to the use of some addresses for video generation and sync. Anyway, all that we need is two for our application. The output of the 74138 consists of short pulses that, of course, are not suitable as is. The output is sent to a 7400 IC wired as an RS flip-flop. The output of the RS flip-flop (or latch, if you prefer) then drives LEDs and a relay via the 2N2222 NPN, or equivalent, transistor. The relay keys the TTY loop. An opto-isolator would be a natural application here, but the relay that I have in service has survived many dozens of QSOs.

The operation of this system is such that an "OUT 3" from the program will cause a pulse out of pin 12 of the 74138 to flip the 7400 RS flip-flop to the "on" state. An "OUT 5" will reverse the above sequence. The toggling of the 7400 will cause the transistor driver to cause the relay to pick up and drop. Therefore, the whole key to this system is to properly time the issuing of the OUT instructions. This is done in ML code that is called by BASIC. In this version, the ML code is kept to a minimum, and as much as possible is done in BASIC. This will aid in what is going on in the program. A later implementation could move some of the logic currently in BASIC to ML. This should speed up the sending rate which is currently about 30 wpm or about half speed. This is due to the relatively slow speed of BASIC.

The technique of using REM statements for storing ML programs is well documented in the available Sinclair literature (SYNC and SYNTAX), so I will not go into the reasoning for using this system except to say that I have found it to be the best system to isolate ML code. Those who check this program closely will note that the code in REM #1 is not used in this application. This ML code will be discussed later (another article) as it is part of my monitor program that will print your programs on your TTY machine. I chose to leave the REM in so that all of the addresses would match what I am using here. This will allow me to assist anyone who runs into trouble by comparing directly to my system. Also later, I bet that most of those who have the TTY machines will want to list their various programs on their TTY machines for hard copy. This will simplify doing it later. Anyway, the 1 REM will just be a "place holder" for this program.

Notes on the BASIC portion of the program:

Lines 1 - 3 (not shown with data as most of it is unprintable characters).

Line 108 requests input from the operator.

Line 110 - 230 check for special conditions and set up the shift.

Line 250 POKEs a bit configuration into a work byte for the ML program. This character is determined by using the internal code value of the character (see ZX81 manual) as an index value into a translation table that begins at 16616.

Line 260 is the call to the ML code.

Line 270 strips off the current character just sent off the string so that the next character can be sent.

Line 290 and lines 110 and 115 are for character counting to provide automatic CR/LF.

Instructions for Using this Prgram

1) Load the BASIC program as provided. The number of entries in the REMs is important. As you enter, a good idea might be to SAVE several copies as you progress. It is sure annoying to have to reenter a bunch of statements after a system crash!

2) Enter the translation table, 3 REM, from the table shown. It might be useful to verify it for accuracy by using the ML table provided and the program at "RUN 2000."

3) The TTY ML instructions can be entered also by typing "RUN 2100" and entering the proper values from Chart 1. Note that for now, noting has to be placed in the 1 REM except place holder

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"01234567890123..etc." The REMs each will have exactly the following number of entries. The number is critical since the system will be branching to this code as ML instructions.

1 REM -- 40 entries (can be any value since this isn't used)

2 REM -- 50 entries (ML instructions for send)

3 REM -- 65 entries (send tranlation table, this can be edited to vary your keyboard preferences)

4) SAVE several copies of your program **before** you attempt to run it. A USR call to ML may not return to BASIC if there is any error in the ML program. If the system is running (looping) in the ML portion, there is no way to BREAK and regain control of the system. Your only solution is to reset the system: power off and on again.

5) Edit lines 1xxx, the canned message area, for your needs.

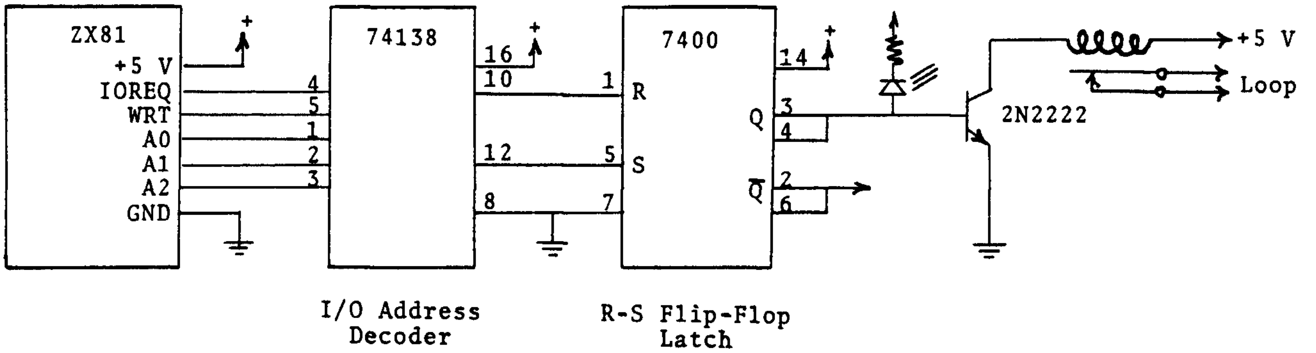
6) RUN. The prompt will direct you to enter several words or several lines of data. Press ENTER to send this text. After it has been sent, the prompt will reappear.

The following list of references will be handy if you are going to do any modifications to the ML portion of the program:

Zaks, "How to Program the Z80," Radio Shack.

Nichols, et. al., "Z80 Microprocessors, Programming, and Interfacing," Sams & Co.

Ciarcia, "Build Your Own Z80 Computer," Byte Books, McGraw-Hill.



RTTY Send Program Interface

Notes:

1. No UART is needed. Use simple circuit shown above.

2. The 74138 provides partial address decoding. It will provide signals for port addresses in the range of 0 thru 7; plenty for our small computer. Pin numbers shown will respond to OUT 3 and OUT 5 (port 3 and port 5). This corresponds to the BASIC and ML programs. Any two port addresses may be used. There are 4 OUT instructions that must correspond to output pins of the 74138.

3. The 7400 is wired as an R-S flip-flop. Any equivalent chip and circuit should work (it's going to be hard to beat the price of a 7400, though).

4. Wire loop to "NC" relay contacts so that loop is intact even if power is off.

5. Radio Shack's 275-216 relay works fine.

6. I found that removing the keying relay away from the computer kept loop keying transients out of the computer.

7. Some sort of transient suppression across the relay contacts will be necessary.

ZX81 RTTY Send Program

```
1 REM 01234567890123456 7...(40 ENTRIES-  NOT USED FOR RTTY SEND)
2 REM 01234567890123456 7...(50 ENTRIES-FOR RTTY SEND "ML" CODE)
3 REM 01234567890123456 7...(65 ENTRIES-FOR TRANSLATE TABLE DATA)
 10 REM ZX-81 "RTTY SEND PROGRAM"  (C)COPYRIGHT 1982 BRIAN DAVIS
 70 LET B$:" "
 80 LET T:0
 90 LET X:63
 95 REM -------CHECK FOR SPECIAL CONDITIONS/FUNCTIONS------
100 PRINT AT 10,1;"ENTER YOUR MESSAGE"
101 PRINT AT 12,3;":1 CALL AND MY ID"
102 PRINT AT 13,3;":2 MY ID ONLY"
103 PRINT AT 14,3;":3 CQ AND MY ID"
104 PRINT AT 15,3;":4 DATE"
105 PRINT AT 16,3;":6 K K K (OVER)"
106 PRINT AT 17,3;":8 CR/LF"
107 PRINT AT 18,3;":9 ENTER NEW CALL...."
108 INPUT A$
110 IF T>70 THEN GOSUB 400
115 IF T>63 AND CODE A$:0 THEN GOSUB 400
120 IF CODE A$:20 THEN GOTO 600
125 REM -----CHECK SHIFT OF CHARACTER-------
130 IF CODE A$38 OR CODE A$YR THEN GOTO 160
140 IF X:63 THEN GOTO 250
150 GOTO 210
160 IF CODE A$:0 OR X:59 THEN GOTO 250
190 LET X:59
200 GOTO 220
210 LET X:63
220 POKE 16561,X
230 LET U:USR 16560
250 POKE 16561,PEEK (16616#CODE A$)
260 LET U:USR 16560
270 LET A$:A$(2 TO )
280 IF A$:"" THEN GOTO 100
290 LET T:T#1
300 GOTO 110
399 REM ----------AUTO CR/LF ROUTINE------------
400 LET C$:"      "
410 POKE 16561,PEEK (16616#CODE C$)
420 LET U:USR 16560
430 LET C$:C$(2 TO )
440 IF NOT C$:"" THEN GOTO 410
450 LET T:0
460 RETURN
599 REM -------CANNED MESSAGE ROUTINE---------
600 LET A$:A$(2 TO )
610 LET L:(CODE A$)-28
620 IF L:0 THEN LIST 1040
630 GOTO 1000#L10
1010 LET A$:B$# ":2"
1012 GOSUB 400
1015 GOTO 110
1020 LET A$:"DE W9HLQ -BRIAN- IN TINLEY PARK, ILL."
1025 GOTO 110
1030 GOSUB 400
1032 LET A$:"CQ CQ CQ CQ CQ CQ DE W9HLQ W9HLQ W9HLQ "
1035 GOTO 110
1040 LET A$:"DATE-OCT.24, 1982 "
1045 GOTO 110
1060 LET A$:" K K K K"
1065 GOTO 110
1080 GOSUB 400
1082 LET A$:""
1085 GOTO 110
1090 PRINT "INPUT CALL"
1092 INPUT B$
1093 CLS
1094 GOTO 100
1999 REM ------TEMPORARY MAINTENANCE PGMS-----
2000 PRINT "ML LISTING"
2010 PRINT "INPUT START ADDRESS"
2020 INPUT A
2025 CLS
2030 FOR I:A TO A#10
2040 PRINT I;":";PEEK I
2050 NEXT I
2060 GOTO 2000
2100 PRINT "ML UPDATE"
2110 PRINT "INPUT START ADDRESS"
2120 INPUT A
2123 CLS
2125 PRINT "ENTER DATA (IN DECIMAL)"
2130 FOR I:A TO A#10
2153 PRINT I;":";
2155 INPUT D
2160 POKE I,D
2170 PRINT PEEK I
2180 NEXT I
2190 GOTO 2100
```

NOTES:

: IS AN EQUAL "=" SIGN
IS A PLUS "+" SIGN

ZX-81 RTTY TRANSMIT TRANSLATE TABLE TABLE 1 -USE WITH "3 REM"-
(THE "GRAPHIC CHAR" HAS THE REQUIRED BIT CONFIGURATION TO PRINT "PRINTED CHAR" ON THE TTY MACHINE. THE "DECIMAL VALUE" IS TO VERIFY VIA A "GOTO 2000" SINCE THE GRAPHICS CHARACTERS ARE SOMETIMES DIFFICULT TO EDIT.)

LOC.	DECIMAL VALUE	GRAPHIC CHAR.	ZX-81 KYBD CODE	PRINTED CHAR.
16616	132	:	0	SPACE
17	4	■ (GR)	1	
18	59	V	2	
19	62	Y	3	
16620	61	X	4	
21	47	J	5	
22	49	L	6	
23	45	H	7	
24	192		8	
25	40	C	9	
26	50	M	10	
27	49	L	11	"
28	27	.	12	FIGS
29	41	D	13	$
16630	8		14	CR
31	57	T	15	?
32	47	J	16	(
33	50	M	17	)
34	31	3	18	LTRS
35	43	F	19	
36	46	L	20	: (=)
37	52	O	21	# (+)
38	131	G6	22	-
39	45	H	23	!
16640	61	X	24	/
41	2		25	LF
42	44	G	26	,
43	60	W	27	.
44	54	Q	28	0
45	55	R	29	1
46	51	N	30	2
47	1	G1	31	3
48	42	E	32	4
49	48	K	33	5
16650	53	P	34	6
51	39	B	35	7
52	38	A	36	8
53	56	S	37	9
54	131	G6	38	A
55	57	T	39	B
56	46	I	40	C
57	41	D	41	D
58	1	G1	42	E
59	45	H	43	F
16660	58	U	44	G
61	52	O	45	H
62	38	A	46	I
63	43	F	47	J
64	47	J	48	K
65	50	M	49	L
66	60	W	50	M
67	44	G	51	N
68	56	S	52	O
69	54	Q	53	P
16670	55	R	54	Q
71	42	E	55	R
72	5	SR	56	S
73	48	K	57	T
74	39	B	58	U
75	62	Y	59	V
76	51	N	60	W
77	61	X	61	X
78	53	P	62	Y
79	49	L	63	Z

S means shifted character

G means graphic character

```
RTTY TRANSMIT USING MACHINE LANGUAGE TIMING LOOPS(ZX-81|TS/1000)
     -BRIAN DAVIS, W9HLQ 5/19/82

402B 0E00     OUTPUT  LD    C,0     LOAD BIT PATTERN INTO REG C
402D 0606             LD    B,6     SET LOOP CONTROL
402F D303             OUT 3         SEND START BIT
4031 CD4B40           CALL DELAY    LET IT GO FER A WHILE
4034 AF               XOR A         CLEAR THE CARRY FLAG
4035 CB39             SRL C         SHIFT RIGHT BIT INTO CARRY
4037 3004             JR NC,SP      NO CARRY=====>NO SPACE
4039 D305             OUT 5         SEND MARK
403B 1802             JR ENDCHR     JUMP AHEAD +2
403D D303         SP  OUT 3         SEND SPACE
403F 05       ENDCHR  DEC B         REDUCE LOOP COUNTER BY 1
4040 20EF             JR NZ,LOOP1   GO BACK IF ALL BITS NOT SENT (-17)
4042 D305             OUT 5         SEND STOP BIT
4044 CD4B40           CALL DELAY    DELAY FOR TWO DELAYS
4047 CD4B40           CALL DELAY
404A C9               RET           GO BACK TO BASIC
404B 1612      DELAY  LD D,18       SET OUTER LOOP COUNT
404D 1EF5      LOOP2  LD E,245      SET INNER LOOP COUNT
404F 1D        LOOP3  DEC E         COUNT DOWN BY 1
4050 20FD             JR NZ,LOOP3   INNER LOOP CONTROL ( GO BACK -3)
4052 15               DEC D         NOW THAT E IS 0 DEC D BY -1 AND GO BK
4053 20F8             JR NZ,LOOP2   OUTER LOOP CONTROL
4055 C9               RET           RETURN TO CALLER
```

Poke this is at 16560 (2REM) for the simple test interface.

16560	211	OUT 3	FLIP-ON
16561	03		
16562	201	RETURN	
16563	211	OUT 5	FLIP-OFF
16564	05		
16565	201	RETURN	

```
ZX-81 RTTY TRANSMIT MACHINE LANGUAGE
      (ENTER DECIMAL VALUES INTO THE "2 REM" VIA ROUTINE
       AT "GOTO 2100")
```

"CHART 1"

```
ADDRESS HEX DECIMAL
            (ENTER THIS VALUE)
16560 0E 14 <----
16561 00 00
   62 06 06
   63 06 06
   64 D3 211
   65 03 03
   66 CD 205
   67 D0 208
   68 40 64
   69 AF 175
16570 CB 203
   71 39 57
   72 30 48
   73 04 04
   74 D3 211
   75 05 05
   76 18 24
   77 02 02
   78 D3 211
   79 03 03
16580 05 05
   81 20 32
   82 EF 239
   83 D3 211
   84 05 05
   85 CD 205
   86 D0 208
   87 40 64
   88 CD 205
   89 D0 208
16590 40 64
   91 C9 201
   92 16 22
   93 12 18  (ADJUST TO FINE TUNE PULSE TIMING)
   94 1E 30
   95 FE 245
   96 1D 29
   97 20 32
   98 FD 253
   99 15 21
16600 20 32
  601 F8 248
  602 C9 201
```

```
1 REM 01234567890123456 7...(40 ENTRIES-NONOT USED FOR RTTY SEND)
2 REM 01234567890123456 7...(50 ENTRIES-FOR RTTY SEND "ML" CODE)
3 REM 01234567890123456 7...(55 ENTRIES-FOR TRANSLATE TABLE DATA)

  10 REM ZX-81 RTTY FLIP-FLOP TEST PROGRAM 1982 BRIAN DAVIS
 100 PRINT "FLIP-FLOP TEST PROGRAM"
 110 PRINT ":::::"
 120 PRINT "SELECT OPTION"
 130 PRINT
 140 PRINT "(1) REPEAT CHARACTER"
 150 PRINT "(2) ONE TIME ONLY"
 160 PRINT "(3) SLOW FLIP FLOP"
 190 PAUSE 40000
 200 LET I:CODE INKEY
 210 POKE 16437,255
 220 GOTO 2000#100(I-28)
 260 LET U:USR 16560
 270 LET A:A(2 TO )
 280 IF A:"" THEN GOTO 3360
 300 GOTO 110
2100 PRINT "INPUT THE CHARACTER YOU WANT REPEATED"
2110 INPUT A
2120 POKE 16561,CODE A
2130 LET U:USR 16560
2140 GOTO 2120
2200 CLS
2205 PRINT "INPUT YOUR CHAR"
2210 LET A:INKEY
2220 PAUSE 400
2230 POKE 16437,255
2240 POKE 16561,CODE A
2250 LET U:USR 16560
2260 GOTO 2200
2300 CLS
2310 PRINT "THIS IS THE SLOW FLIP-FLOP ROUTINE"
2320 REM THIS WILL -FLIP-
2340 LET U:USR 16560
2350 REM PAUSE FER A WHILE
2360 FOR I:1 TO 100
2362 NEXT I
2370 REM NOW -FLOP-
2380 LET U:USR 16563
2390 FOR I:1 TO 100
2400 NEXT I
2410 GOTO 2340
3000 PRINT "ML LISTING PGM"
3010 PRINT "INPUT START ADDRESS"
3020 INPUT L
3025 CLS
3030 FOR I:L TO L#10
3040 PRINT IV":";PEEK I
3050 NEXT I
3060 GOTO 9700
3100 PRINT "ML UPDATE PROGRAM"
3110 PRINT "INPUT START ADDRESS"
3120 INPUT L
3130 CLS
3140 FOR I:L TO L#10
3150 PRINT "INPUT VALUE "
3160 INPUT K
3170 POKE I,K
3180 PRINT IV":";PEEK I
3190 NEXT I
3200 GOTO 9800
```

FLIP-FLOP

Notes

: is an equal "=" sign
is a plus "+" sign

3040 PRINT I;"=";PEEK I

3180 PRINT I;"=";PEEK I

ADDR	DEC.								
16500	129	16501	144	16502	000	16503	000		
16504	000	16505	000	16506	000	16507	139	16508	065
16509	000 "1" →	16510	001	16511	042	16512	000	16513	234
16514	042	16515	123	16516	064	16517	205	16518	069
16519	007	16520	042	16521	123	16522	064	16523	035
16524	035	16525	078	16526	035	16527	070	16528	035
16529	009	16530	034	16531	123	16532	064	16533	070
16534	035	16535	078	16536	201	16537	042	16538	012
16539	064	16540	035	16541	068	16542	077	16543	201
16544	028	16545	029	16546	030	16547	031	16548	032
16549	033	16550	034	16551	035	16552	036	16553	037
16554	118	16555	000 "2" →	16556	002	16557	052	16558	000
16559	234	16560	014	16561	055	16562	006	16563	006
16564	211	16565	003	16566	205	16567	208	16568	064
16569	175	16570	203	16571	057	16572	048	16573	004
16574	211	16575	005	16576	024	16577	002	16578	211
16579	003	16580	005	16581	032	16582	239	16583	211
16584	005	16585	205	16586	208	16587	064	16588	205
16589	208	16590	064	16591	201	16592	022	16593	018
16594	030	16595	245	16596	029	16597	032	16598	253
16599	021	16600	032	16601	248	16602	201	16603	031
16604	032	16605	033	16606	034	16607	035	16608	036
16609	037	16610	118	16611	000 "3" →	16612	003	16613	077
16614	000	16615	234	16616	132	16617	004	16618	059
16619	062	16620	061	16621	047	16622	049	16623	045
16624	192	16625	040	16626	050	16627	049	16628	027
16629	041	16630	008	16631	057	16632	047	16633	050
16634	031	16635	027	16636	046	16637	052	16638	131
16639	027	16640	061	16641	002	16642	044	16643	060
16644	054	16645	055	16646	051	16647	001	16648	042
16649	048	16650	053	16651	039	16652	038	16653	056
16654	131	16655	057	16656	046	16657	041	16658	001
16659	045	16660	058	16661	052	16662	038	16663	043
16664	047	16665	050	16666	060	16667	044	16668	056
16669	054	16670	055	16671	042	16672	005	16673	048
16674	039	16675	062	16676	051	16677	061	16678	053
16679	049	16680	061	16681	061	16682	008	16683	008
16684	018	16685	018	16686	025	16687	018	16688	027
16689	027	16690	027	16691	118	16692	000	16693	010
16694	056	16695	000	16696	234	16697	063	16698	061
16699	022	16700	036						

CHECK LIST - DECIMAL LISTING OF 1 REM, 2 REM, 3 REM

1 REM - ML FOR DISPLAY FILE (NOT USED HERE)
2 REM - RTTY SEND ML CODE
3 REM - RTTY XLATE TABLE (CONVERT SINCLAIR CODE TO TTY CODE)

NiCads for the Azden PCS-2000

By Joe Pettengill,* N2BC

The Azden PCS-2000 is a fine 2-meter rig, but it eats silver-oxide batteries like they were candy. So, when the PCS-3000 appeared, the designers had seen the problem and put in NiCads. I haven't seen the new rig, so I don't know what kind of NiCads they are using. No matter, I checked out the PCS-2000 control head and found that since the pc board was designed to be used for more than one rig, ther are some extra holes and connections available for use, and installing NiCads is easy.

To install NiCads in your PCS-2000, you will need the following:

1 1N4001 diode	1 1N4735 6.2-V zener diode
#22 wire, insulated	1 620-ohm 1/2-W resistor
Insulating tape, thin	4 NiCad cells, type CH150T

To install the cells, perform the following:

1. Disconnect power and microphone.

2. Remove control head from main assembly.

Caution: To perform the following 4 steps, make sure that the Phillips-head screwdriver that you use is a case-hardened one, and use as much pressure as you can when you try to start the screws. The screws were put in by machine and are very tight - avoid stripping the Phillips slots.

3. On the control head, remove the screws holding cover plate and remove the plate.

4. Remove the bottom plate, also.

*386 Montross Avenue, Rutherford, NJ 07070.

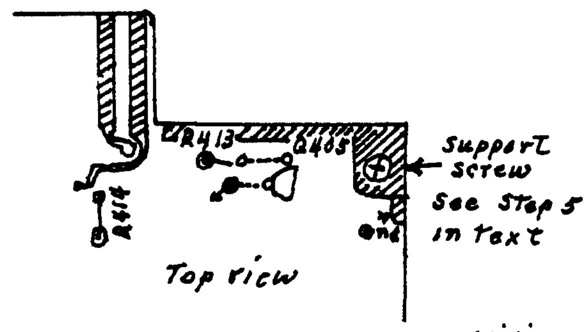


Figure 1. Control head before additions.

5. Remove the support screw shown in Fig. 1.

6. Remove the back plate and lay it down behind the control head - don't break the speaker jack wires.

7. In Fig. 1 you will see that holes were drilled for R413 and Q405, but were not used. Also note the connections (dotted) that are between the two sets of holes.

8. Solder the 1N4001 to the end of R414 and into one of the holes, as shown in Fig. 2.

9. Insert the 620-ohm resistor wire into the hole shown connected to the 1N4001 and one of the other holes as shown in Fig. 2.

10. The 1N4735 is inserted into the fourth hole shown in Fig. 2 and laid flat on the pc board to the ground shown.

(continued on next page)

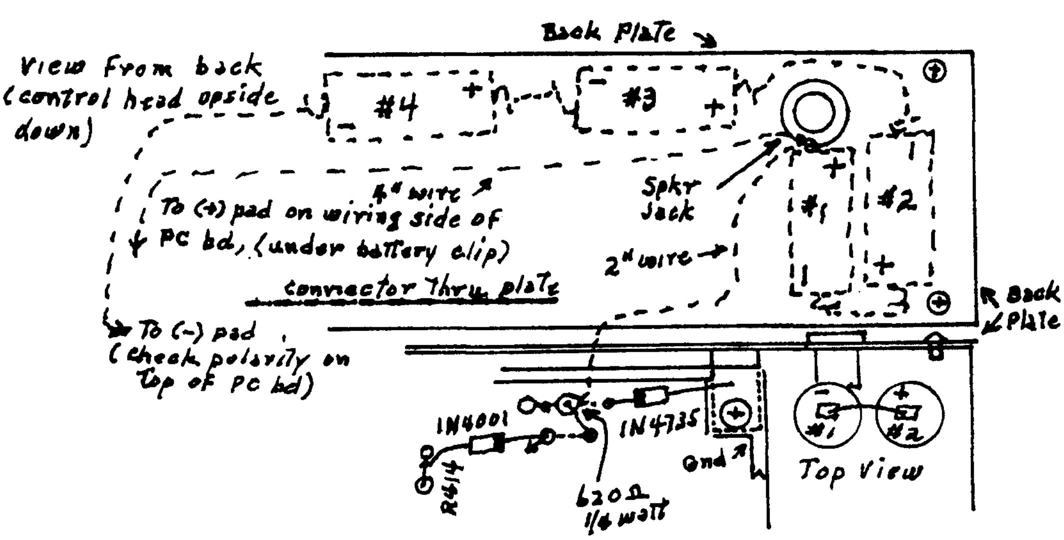


Figure 2. Added Component Locations.

VHF+ Technology

Conducted by Geoff Krauss,* WA2GFP

Hi, vhf+er!

I am very happy that I have been asked to write this bi-monthly column on technology for the vhf/uhf/microwave amateur bands. Normally, you might expect a column such as this to be devoted only to news of new active and passive components. However, it is apparent to me that the best part(s) in the world can be totally useless for the amateur service, unless a piece of equipment using that part can be built easily and at a relatively low cost. Therefore, I expect this column also to make available new ideas on circuitry and systems, as well as to stimulate your imagination and perhaps suggest future projects for my readers.

How often have you invested considerable time and money in a new vhf+ project, only to find, after your're partly or completely finished with the project, that someone else has undertaken a similar project and utilized ideas which would have been highly beneficial to you, had you known of them earlier? This situation is particularly troublesome when you find out about another's work during a casual conversation or at a vhf conference/convention, and particularly when the other vhf+er has decided not to publish his results, for whatever reason. In many cases, the non-publication of work which would be truly beneficial to the rest of the vhf+ fraternity is due to either lack of time between projects, or a lack of expertise in translating the physical world into the written word. Since one purpose of this column is to provide for increased dissemination of the project results of other amateurs, please do not let a lack of time or writing ability, perceived or otherwise, prevent you from forwarding your results, ideas, suggestions, etc. to me. If your information is of possible interest to other vhf+ amateurs, I would be only too happy to organize your information into a form suitable for publication. If your information is capable of being described adequately in a column such as this, it will be. In the event that your information is of greater scope and requires detail greater than can be presented in a one-page format, I would be only too happy to discuss co-authoring an article with you. My purpose is to get as much information to as many people as rapidly as possible, to increase the activity on our vhf+ bands to the greatest extent possible.

*16 Riviera Drive, Latham, NY 11210.

Effective UHF Bypass and Coupling Capacitors:

Proper operation of Amateur Radio equipment above 1 GHz requires the use of capacitors having very low loss characteristics. Fixed-value capacitors should be of the chip type, using a low-loss dielectric material. Selection of electrical characteristics is becoming an increasingly difficult problem as many chip capacitors appearing on the market are not for use in vhf+ service: their dielectric materials have prohibitively high loss at microwave frequencies and should be avoided. Beware of chip caps with pink (tantalum) dielectric! A gray or white dielectric (and preferably the latter) normally is utilized in microwave chip capacitors.

When a chip capacitor is used as a coupling or bypass element, it must appear to be as close to a microwave short circuit as possible. Because a certain amount of inductance is present in the capacitor, the chip has a self-resonant frequency; experienced microwave designers often select a particular chip capacitor which is self-resonant at the frequency of interest. This is often why a surplus microwave item will have relatively unusual values of coupling and/or bypass capacitors; the designer utilized the parasitic inductance to provide a self-resonant circuit at his frequency of interest. As most amateurs do not have access to measurement equipment and test fixtures suitable for determining the series-resonant frequency of a chip capacitor, and generally do not purchase a set of various values of chips, the use of series-resonant chip capacitors rarely has been seen in home-brew equipment.

Low-cost chip capacitors specifically manufactured to have broad series-resonant characteristics are available in the VITRAMON VEE-JEM 7800 series (available from Applied Invention, RD #2, Route 21, Box 390, Hillsdale, NY 12529). Type 7800P7G08 is self-resonant between 1.1 and 1.7 GHz, type 7800P7G04 between 1.3 and 2.6 GHz, and type 7800P7G01 between 2.5 and 4.2 GHz. I have found these self-resonant chip capacitors to be particularly well suited for source lead bypassing in 1296- and 2304-MHz GaAs FET low-noise preamplifiers and lower-power (to at least +20 dBm) amplifiers.

NiCad for PCS-2000 (continued from previous page)

11. A piece of wire about 2 inches long is connected to the junction of the 620-ohm resistor and the 1N4735. This wire connects to the (+) lead of cell #1, along with another piece of wire about 4 inches long. Both wires will fit in the hole in the tab of the cell. After soldering, tape all metal parts that show at the (+) end of the cell.

12. Connect the (-) of cell #1 to the (+) end of cell #2 by bending the tabs out and soldering them together. Tape all metal showing.

13. Connect the other two cells as shown in Fig. 2 and tape all metal showing.

14. Position batteries as shown in Fig. 2. Connect the plus and minus wires to the plus and minus pads on the wiring side of the pc board under the existing battery clips. Note that the (+) connection is nearest to the front panel of the control head, as marked alongside the battery clip.

15. Replace the back plate, being careful to fit the cells in position so that they clear the speaker jack.

16. Install the support screw shown in Fig. 1 first, then the four plate-holding screws.

17. Replace top and bottom covers. Reinstall head to main assembly. Reconnect microphone.

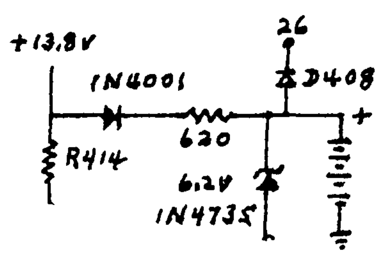


Figure 3. (see text)

Fig. 3 shows the schematic changes after the installation.

The battery will charge any time that power is connected to the rig, whether the power switch is ON or OFF. The charging rate is limited to 16 mA, and the current drain to maintain memory is 120 nA. The 6.2-V zener will protect the battery and the rig if any over-voltage condition should occur in a car.

Components

Conducted by Mark Forbes,* KC9C

I have heard from several readers, and they all seem to like the "Components" column. If you have any criticisms of the column, or a general area that you would like me to cover, let me know. Or, if there is something that you particularly like, I wouldn't mind hearing from you either! This month, more CMOS and microwave devices dominate the column. It seems that much development work is being done in these two areas.

Thomson-CSF RF & Microwave Transistors

Thomson-CSF, a European-based semiconductor company with branches in the U.S., has a full line of rf and microwave transistors available. The line covers from 2 MHz all the way to 4.2 GHz, and power outputs from less than 0.25 to 1200 watts. Their catalog lists transistors for linear, fm, wideband, TV and CATV applications. A copy of their catalog may be obtained by writing to Thomson-CSF Components Corp., P.O. Box 1454, Canoga Park, CA 91304.

National MA2016 16k x 8 Static RAM Module

National Semiconductor has announced its first in its modular line of microcomputer components. The MA2016 is in a hybrid type package and contains eight 2k x 8 static CMOS RAMs. Also on board is an address decoder. Thus, the module is a stand-alone 16k x 8 static RAM. Thanks to CMOS construction, the power requirement is only 400 mW at 5V. Data retention is possible down to 2V minimum. The physical size of the package is that of two 40-pin DIPs side by side.

The modules can be stacked in piggyback fashing to obtain a denser memory in the same size pc board footprint. National is expected to have a full line of stackable components including ROMs, NSC800, and I/O. Write: National Semiconductor Corporation, 2900 Semiconductor Drive, Santa Clara, CA 95051.

National Semiconductor LP311 Voltage Comparator

The LP311 is the low-power equivalent of the LM311 comparator. The low-power version has a power saving of 30:1 over the LM311. The penalty is a response time sacrifice of 6:1, but for many applications where power is a prime concern, the LP311 is an excellent part. Supply voltages must be in the range of 3 to 36 Vdc. The LP311 is available in both metal can and 8-pin mini-DIP packages. Data on this part is available at the same address as above.

*1000 Shenandoah Dr, Lafayette, IN 47905, 317-447-4272, 2300-0230 UTC weekdays, until 0230 weekends.

Intersil IM6716 2k x 8 CMOS UV EPROM with Latches

The Intersil IM6717 is essentially a CMOS version of the 2716, but includes on-board address latches. Thus the 6716 can be used directly with processors having multiplexed address buses. The current consumption of the part is only 10 mA active and 100 uA in the standby -- since the 6716 is in the active mode only when addressed, the average power consumption is quite low. Pricing for the IM6716 is $12.68 and up, depending on the quantity and speed of the part desired. For more information, write: Intersil, Inc., 10710 N. Tantau Ave, Cupertino, CA 95014.

Third Domain Video Sync Stripper and Separator

The RSS101 can provide the decoding function for composite video. Dc restoration is performed on the input video, and sync pulses are stripped away. The composite sync is separated into the vertical and horizontal components, and field detection and discrimination are performed on interlaced composite video inputs.

The RSS101 is compatible with EIA RS-170, RS-330, RS-343 and RS-420. The part can be used with any scan rate. The RSS101 is packaged in a 16-pin DIP and operates from + and -5 volts. The RSS101 is $85.00 in single pieces. Write to: Third Domain, Inc., P.O. Box 35400, Tucson, AZ 85740.

Supertex N-Channel DMOS Power FETs

The VQ1000 is an enhancement-mode 4-transistor MOSFET package. The 4 transistors are usable independently. Applications include line drivers, logic interface, LED driver, linear amplifiers and stepper motor drivers.

The transistors are houses in a 14-pin DIP package. Pricing is in the $3 to 5 range. Write: Supertex, Inc., 1225 Bordeaux Drive, Sunnyvale, CA 94086.

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