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To: VLBA Data Acquisition Group

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Subject: The Radio Shack TRS-80 Model 100 Portable Computer for
 Check-out of VLBA Hardware Requiring MCB Communications

Hardware: Because the VLBA electronic modules have been designed without front panel controls and indicators it is essential to have a means of easy communication with the module. The TRS-80 Model 100 makes a good MCB communication device as it is lightweight, (3.9 pounds), truly portable and inexpensive (~\$300). In addition, it has an internal pull-down resistor to -12v on its RS-232 input making it able to receive the MCB directly without interface circuitry - just wire the RS-232 connection to the MCB input as follows:

RS-232 on Model 100 (Male)	Function	MCB Connector (Male)
1	GND	1,5
2	Transmission from Model 100	2
3	Readback from MCB	9

Hardware Mod: In order to operate at 57.6 K-band the microprocessor crystal (from which the UART clock is derived) has to be changed from 4.9152 MHz to 5.5296 MHz.

Software: Everything can be done using BASIC owing to the inclusion of the PEEK and POKE commands. The POKE is needed to set-up the 57.6 K-band rate using short 8085 machine language routine while the PEEK is used to access the received characters from the buffer area in memory without having to invoke the INPUT\$ function. (Which cannot be used to access a CTRL Z (ASCII 1A Hex) which is used to signify an EOF.) The machine mode for 57.6 K-band (to set-up the 8155 timer) is as follows:

Mnemonic	Function	Hex Codes	Decimal Codes
PUSH PSW	Save PSW	FS	245
MVI	put 3 in A reg.	3E,3	62,3
OUT	output 3 to port BC	D3,BC	211,188
MVI	put 64 in A reg.	3E,40	62,64
OUT	output 64 to port BD	D3,BD	211,189
MVI	put 195 in A reg.	3E,C3	62,195
OUT	output 195 to port B8	D3,B8	211,184
POP PSW	restore PSW	F1	241
RET	return	C9	201

This should be POKED into memory at some unused locations - I selected locations 62901-62915. The routine can now be invoked by CALL 62901. When a character is received by the UART the RST 6.5 interrupt is set and the TRS-80 operating system program jumps to 34H. (I determined this from the circuit diagram given in the service manual - Catalog #26-3801/3802.) From the code which started at 34H, I then determined that the first character received, following communication initialization, is stored at 65350, the second at 65351 and the count of the number of characters received at 65414.

COMPAQ Portable Computer: The COMPAQ machine has been extensively used for MCB communications using software written in PASCAL. For many purposes however BASIC is easier to use and so I show a listing of a BASIC program for the COMPAQ in which the band and parity setting for MCB communications are copied from the PASCAL program and implemented as simple "out" commands, all the remaining communications statements are in the BASICA supplied with the COMPAQ.

Example: The following BASIC program provides a SCREEN for the VLBA baseband converter:

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2 REM PROGRAM SCREEN
5 DEFINT I,J,K:MAXFILES=2:CLS:CLEAR 256,62900
6 POKE 62901,245:POKE 62902,62
7 POKE 62903,3:POKE 62904,211
8 POKE 62905,188:POKE 62906,62
9 POKE 62907,64:POKE 62908,211
10 POKE 62909,189:POKE 62910,62
11 POKE 62911,195:POKE 62912,211
12 POKE 62913,184:POKE 62914,241
13 POKE 62915,201
91 INPUT "TYPE SLOT# ";LLZ
92 INPUT "CENTER FREQ ";FR
95 SLZ=2*16+LLZ:UNZ=SLZ*2:IAZ=128:LAZ=LLZ*2:LBZ=LAZ+128
100 INPUT "TYPE BW (255=16 MHZ) ";IBZ
101 INPUT "BW GAIN(0=0DB) ";16Z
102 INPUT "MODE(0=NOR,1=AUTOLEV) ";IMZ
141 ZE=FR:GOSUB 3000
143 CLS:J=1
146 IF J=2 THEN FR=0
150 FOR I=-3 TO 7
151 IF I=2 AND FR<>0 THEN ALZ=2:AHZ=LBZ:CHZ=IMZ:CLZ=USZ
152 IF I=3 AND FR<>0 THEN ALZ=3:CHZ=U4Z*16+U3Z:CLZ=U2Z*16+U1Z
154 IF I=0 AND FR<>0 THEN AHZ=LBZ:ALZ=0:CHZ=IBZ:CLZ=CHZ
156 IF I=1 AND FR<>0 THEN AHZ=LBZ:ALZ=1:CHZ=16Z:CLZ=CHZ
158 IF I=-2 THEN ALZ=UNZ:AHZ=128:CHZ=0:CLZ=255
159 IF I=-1 THEN AHZ=128:ALZ=UNZ+1:CHZ=2+LLZ:CLZ=0
164 IF I=0 AND FR=0 THEN ALZ=1:AHZ=LAZ
165 IF I=-3 AND FR<>0 THEN GOTO 500
166 IF I=-3 AND IMZ<76 THEN GOTO 500
167 IF I=-3 THEN ALZ=2:AHZ=LBZ:CHZ=IMZ+32:CLZ=USZ
168 IF I=2 AND IMZ=76 THEN ALZ=2:AHZ=LBZ:CHZ=IMZ:CLZ=USZ
300 CLOSE 2:OPEN "COM:38E1D" FOR OUTPUT AS 2:CALL 62901
320 PRINT #2, CHR$(22);
400 CLOSE 1:OPEN "COM:3801D"FOR INPUT AS 1:CALL 62901
410 CLOSE 2:OPEN "COM:3801D" FOR OUTPUT AS 2:CALL 62901:NTZ=0:N1Z=3
420 PRINT #2,CHR$(AHZ);CHR$(ALZ);CHR$(CHZ);CHR$(CLZ);
440 IF AHZ=128 THEN N1Z=2
441 NTZ=NTZ+1
442 IF PEEK(65414)<N1Z AND NTZ<200 THENGOTO 441
450 IF AHZ=128 THEN GOTO 500
451 IF NTZ=200 THEN PRINT# 40*7+1,"TIMEOUT"
452 ZLZ=PEEK(65350):ZHZ=PEEK(65351):ZLZ=PEEK(65352)
453 IF I=2 THEN FF=6144.-(ZLZ-INT(ZLZ/16)*16)*409.60
454 IF I=3 THEN FF=FF+409.75-ZHZ*1.6-INT(ZLZ/16)*0.1-(ZLZ-INT(ZLZ/16)*16)*0.01
455 IF I=0 THEN PRINT# 40*1+1,"USB BW SEL ";ZHZ;" LSB BW SEL ";ZLZ;
456 IF I=1 THEN PRINT# 40*1+1,"USB BW COM ";ZHZ;" LSB BW COM ";ZLZ;
457 IF I=2 THEN PRINT# 40*1+1,"MODE ";ZHZ;" IF SEL ";INT(ZLZ/64);
458 IF I=3 THEN PRINT# 40*1+1,"FREQ ";ZHZ;ZLZ;" = ";FF;" MHZ";
460 IF I=4 THEN ILZ=INT(ZHZ/128):IRZ=INT(ZHZ/64)-ILZ*2:ISZ=INT(ZHZ/16)-IRZ*4-ILZ*8
461 IF I=4 THEN PRINT# 40*1+1,"LOCK ";ILZ;" RAD ";IRZ;" STATUS ";ISZ;" SERIAL #";ZLZ;
462 IF I=5 THEN PRINT# 40*1+1,"USB GAIN ";ZHZ;" LSB GAIN ";ZLZ;
463 IF I=6 THEN PRINT# 40*1+1,"USB POWER ";ZHZ;ZLZ;
464 IF I=7 THEN PRINT# 40*1+1,"LSB POWER ";ZHZ;ZLZ;
490 IF INKEY$<>"" THEN GOTO 900
500 NEXT I
501 J=2
510 GOTO 146
900 END
3000 ZF=ZE*100.0+0.5:U5Z=ZF/40960.0
3020 U4Z=(ZF-U5Z*40960.0)/2560
3030 U3Z=(ZF-U5Z*40960.0-U4Z*2560.0)/160
3040 U2Z=(ZF-U5Z*40960.0-U4Z*2560.0-U3Z*160.0)/10
3050 U1Z=ZF-U5Z*40960.0-U4Z*2560.0-U3Z*160.0-U2Z*10.0
3055 IF U2Z=0 THEN U2Z=16:U3Z=U3Z-1
3060 IF U3Z=-1 THEN U3Z=15:U4Z=U4Z-1
3070 IF U4Z=-1 THEN U4Z=15:U5Z=U5Z-1
3080 U5Z=15-U5Z:U4Z=15-U4Z:U3Z=15-U3Z
3090 U2Z=16-U2Z:U1Z=15-U1Z
3100 RETURN

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REM PROGRAM SCREEN FOR COMPAR
DEFINT I,J,K: DIM A%(250):CLS
INPUT "B.BCONV# (1,2,3,4, OR 9,10 FOR IFD)":LL%
UN%=(2*16+LL%-1)*2:AD=2*16*256!+(LL%-1)*64+.5
IF LL%>8 THEN AD=(2*16+4)*256!+(LL%-9)*128!+.5
BH%=INT(AD/256!):BL%=INT(AD-BH%*256!)
INPUT "L.O. FREQ. ZERO FOR NO PARAM CHANGES ";FR
IF FR<>0 THEN INPUT "I.F. SELECT ":IK%
IF FR<>0 THEN INPUT "TYPE BW (255=16 MHZ)":IB%
IF FR<>0 THEN INPUT "BW GAIN(O=ODB)":IG%
IF FR<>0 THEN INPUT "MODE(O=NOR,+1=AUTOLEV,+2=SWITCHED,+64=AVERAGE)":IM%
ZE=FR:GOSUB 3000:CLS:J=0:K=1
FOR I=-2 TO 7
AL%=BL%+I:AH%=BH%
IF FR<>0 AND I<4 THEN AH%=AH%+128
IF I=0 THEN CH%=IB%:CL%=CH%
IF I=1 THEN CH%=IG%:CL%=CH%
IF I=2 OR I=-1 THEN CH%=IM%:CL%=U5%+IK%*64
IF I=3 THEN CH%=U4%*16+U3%:CL%=U2%*16+U1%
IF I=-1 AND IM%>64 AND J<>0 THEN AL%=BL%+2:AH%=BH%+128:CH%=IM%+(J-1)*32
IF I=-2 AND J<>0 THEN GOTO 500
IF I=-1 AND J<>0 AND IM%<64 THEN GOTO 500
IF I=-2 THEN AL%=UN%:AH%=128:CH%=0:CL%=48
IF I=-1 AND J=0 THEN AL%=UN%+1:AH%=128:CH%=BH%:CL%=BL%
CLOSE #1:OPEN "COM1:300,N,8,1,DS,CS" AS #1
OUT 1019,135:OUT 1016,2:OUT 1017,0:OUT 1019,7:OUT 1019,27
PRINT #1,CHR$(22):;OUT 1019,1:NT%=0:N1%=3
PRINT #1,CHR$(AH%);CHR$(AL%);CHR$(CH%);CHR$(CL%);
IF AH%>128 THEN N1%=2
NT%=NT%+1
IF LOC(1)<N1% AND NT%<200 THEN GOTO 441
IF LOC(1)<N1% THEN LOCATE 9+I,1:PRINT "ER":I:LOC(1);
IF AH%>128 OR LOC(1)<3 THEN GOTO 500
Z1%=ASC(INPUT$(1,1)):ZH%=ASC(INPUT$(1,1)):ZL%=ASC(INPUT$(1,1)):
IF I=2 THEN FF=6144!-(ZL%-INT(ZL%/16)*16)*409.6
IF I=3 THEN FF=FF+409.75-ZH%*1.6-INT(ZL%/16)*.1-(ZL%-INT(ZL%/16)*16)*.01
IF I=0 THEN LOCATE 1,1:PRINT"USB BW SEL ";ZH%:" LSB BW SEL ";ZL%:
IF I=1 THEN LOCATE 2,1:PRINT"USB BW COM ";ZH%:" LSB BW COM ";ZL%:
IF I=2 THEN LOCATE 3,1:PRINT"MODE ";ZH%:" IF SEL ":INT(ZL%/64):
IF I=3 THEN LOCATE 4,1:PRINT USING "####.##":FF:LOCATE 4,10:PRINT "MHZ":
IF I=4 THEN IL%=INT(ZH%/128):IR%=INT(ZH%/64)-IL%*2:IS%=INT(ZH%/16)-IR%*4-IL%
IF I=4 THEN LOCATE 5,1:PRINT"LOCK ";IL%:" RAD ";IR%:" STATUS ";IS%:" SERIAL
#:ZL%:
IF I=5 THEN LOCATE 6,1:PRINT"USB GAIN ";ZH%:" LSB GAIN ";ZL%:
IF I=6 THEN LOCATE 7,11:PRINT USING "#####":ZH%*256+ZL%:LOCATE 7,1:PRINT "
USB POWER":
IF I=7 THEN LOCATE 8,11:PRINT USING "#####":ZH%*256+ZL%:LOCATE 8,1:PRINT "
LSB POWER":
IF I=6 THEN A%(K)=86.99-ZL%MOD 80
IQ#="INKEY#
IF IQ#="P" THEN LOCATE 20,1:PRINT "PLOT":GOSUB 700
IF IQ#<>" " AND IQ#<>"P" THEN LOCATE 9,1:END
NEXT I
J=J+1:K=K+1:FR=0:IF K=250 THEN K=0
IF J=3 THEN J=1
GOTO 150
WIDTH "LPT1:":255
FOR IY%=1 TO 10
LPRINT CHR$(27);"K";CHR$(250);CHR$(0);
FOR IX%=1 TO 250
Y%=A%(IX%):P#=CHR$(0):YL%=INT(Y%/8)
IF YL%=IY% THEN P#=CHR$(128/(2-(Y%-YL%*8)))
IF IX%=1 OR IX%=250 THEN P#=CHR$(255)
IF IY%<10 AND IY%>1 THEN GOTO 786
PA%=ASC(P#)+2:PB%=ASC(P#)+128
IF PA%=4 OR PA%>255 THEN PA%=PA%-2
IF PB%>255 THEN PB%=PB%-128
IF IY%=1 THEN P#=CHR$(PB%) ELSE P#=CHR$(PA%)
LPRINT P#;
NEXT IX%
LPRINT CHR$(27);"3";CHR$(24)
NEXT IY%
LPRINT "PLOT SCALE IS 0 TO 80":RETURN
3000 ZF=ZE*100!+.5:U5%=INT(ZF/40960!)
3020 U4%=INT(((ZF-U5%*40960!)/2560!))
3030 U3%=INT(((ZF-U5%*40960!)-U4%*2560!)/160!)
3040 U2%=INT(((ZF-U5%*40960!)-U4%*2560!)-U3%*160!)/10!)
3050 U1%=INT(ZF-U5%*40960!-U4%*2560!-U3%*160!-U2%*10!)
3055 IF U2%=0 THEN U2%=16:U3%=U3%-1
3060 IF U3%=-1 THEN U3%=15:U4%=U4%-1
3070 IF U4%=-1 THEN U4%=15:U5%=U5%-1
3080 U5%=15-U5%:U4%=15-U4%:U3%=15-U3%
3090 U2%=16-U2%:U1%=15-U1%
3100 RETURN

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} computes MCB address which are consistent with VME software

sets even parity at 57 Kbaud

sets odd parity

reads 3 monitor bytes

makes mini-plot on Fx-80 printer

subroutine to calculate 5 nibbles needed to control baseband converter synthesizer