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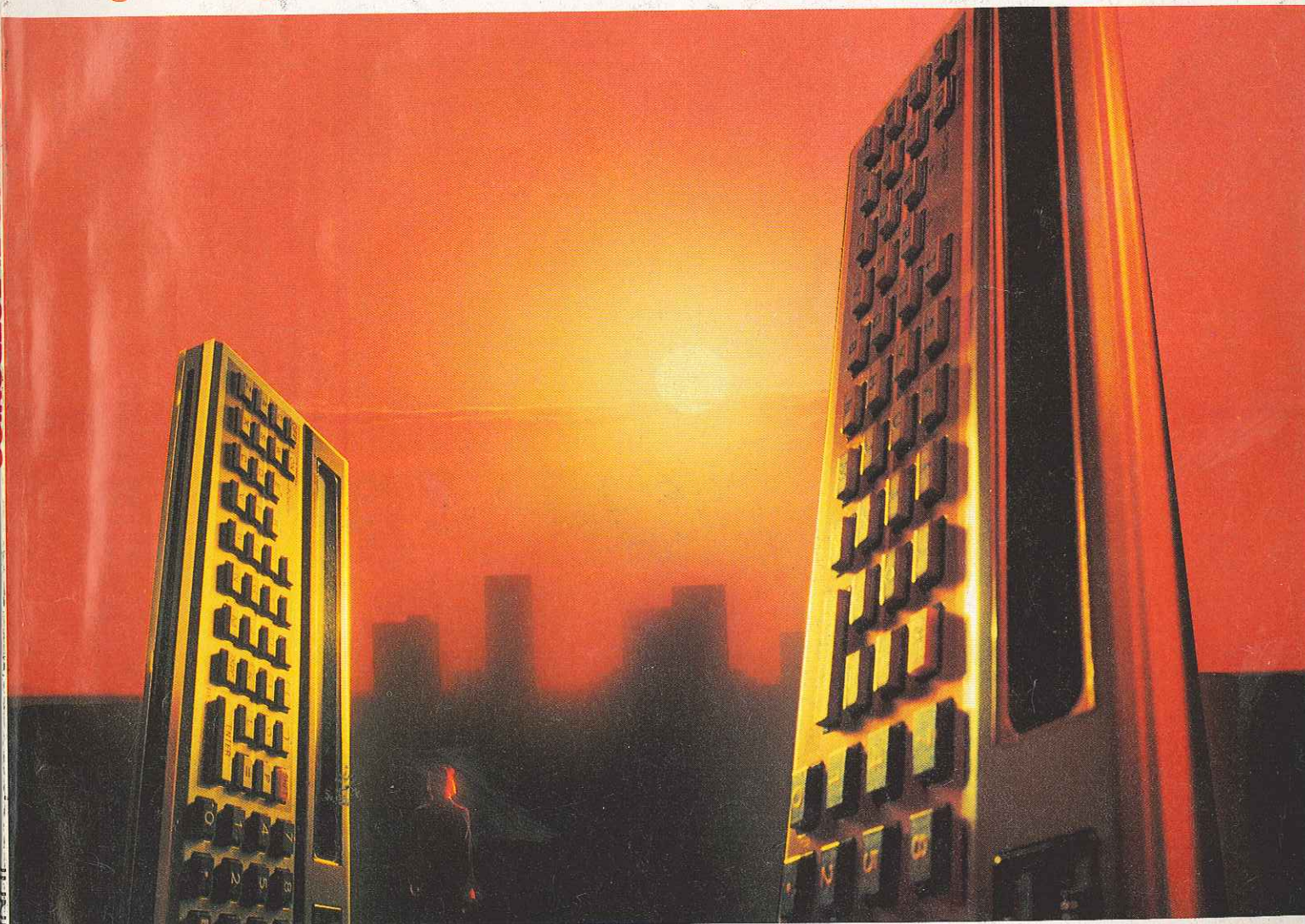
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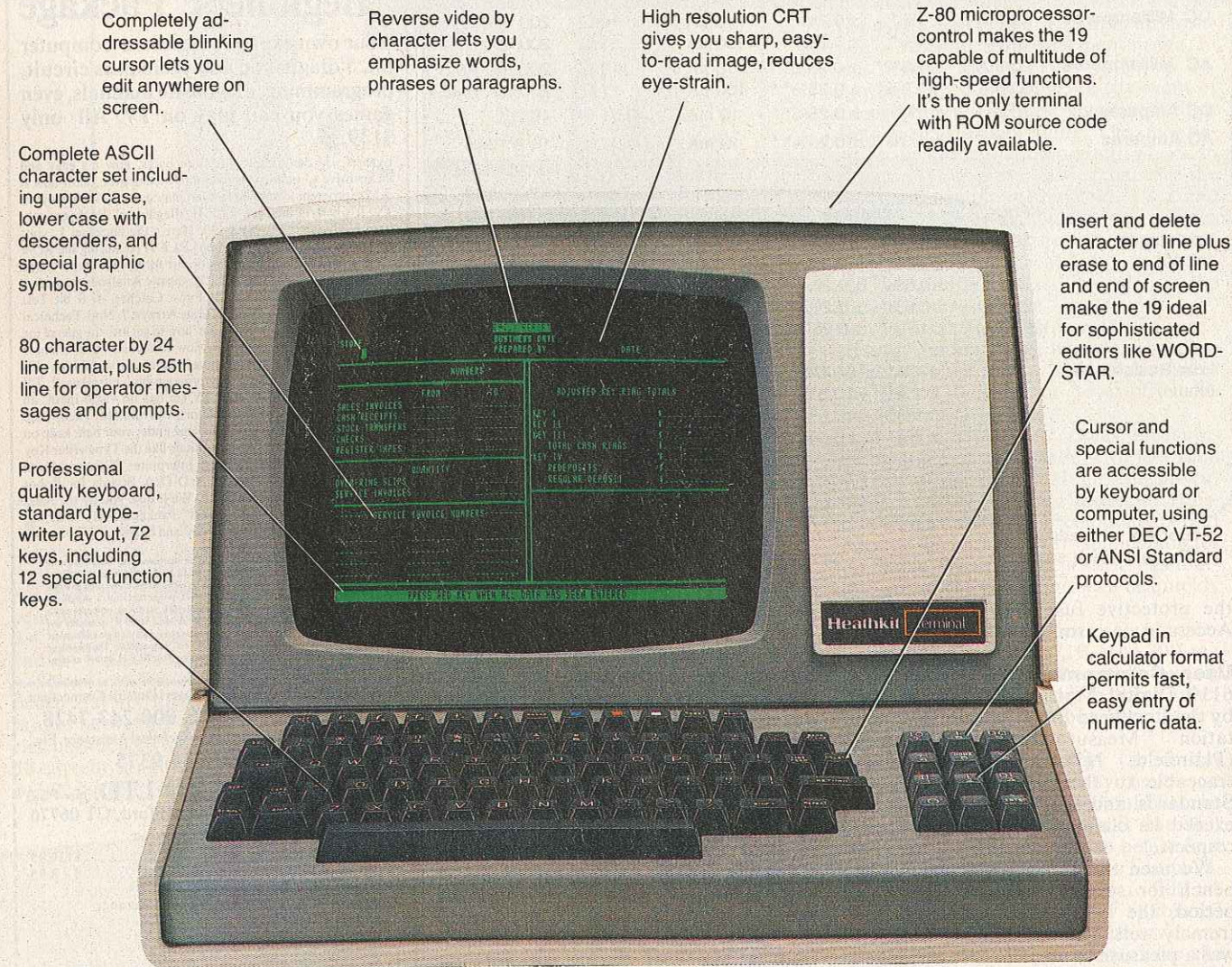
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CIRCLE NO. 14 ON FREE INFORMATION CARD

CP-202C

## BIG COMPUTER PERFORMANCE FROM A POCKET COMPUTER

# THE **WIDE** PRINTOUT

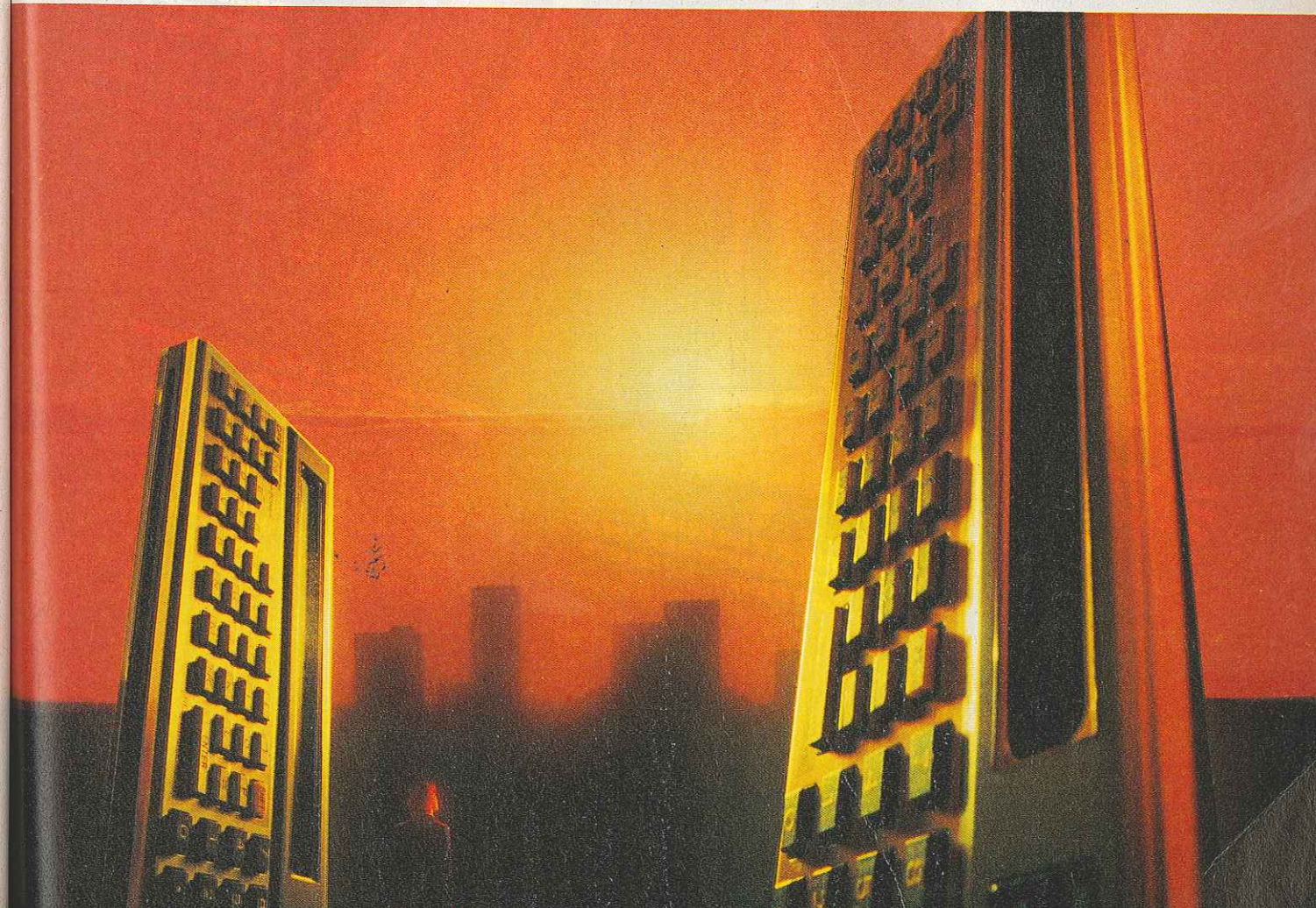
*A simple interface and some software added to a Pocket Computer enable it to "talk" to the larger TRS-80 Model I, producing easy-to-read hard copy at low cost*

BY CASS AND DAN LEWART

THE handheld computer, programmable in BASIC, brought portable computing power to us in late 1980. Called the TRS-80 "Pocket Computer" from Radio Shack (also Sharp's PC-1211), it has a wide repertoire of instructions and is user friendly. Although an accessory printer is available, it prints only 16 characters per line on

narrow adding-machine paper. This is fine for portable use, but is obviously deficient for serious work at home since the format is so difficult to read.

Hardware/software information presented here enables anyone with a TRS-80 Model I with two disk drives and a standard printer to transfer list-





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## wide printout

ings from the Pocket Computer to the  
big machine. The result is hard copy in  
conventional width that can also be  
viewed on a video screen. And the cost  
should be less than \$50.

**Description.** When a program is  
CSAVED from the Pocket Computer, in-  
stead of being fed into the cassette inter-  
face and tape recorder, it outputs to an  
inexpensive "black box" that plugs into  
the expansion interface of the TRS-80  
Model I. When CSAVEing, the Pocket  
Computer sends binary pulses repre-  
senting "tokens" corresponding to the  
BASIC statements and line numbers. The  
TRS-80, in turn, reads the charac-  
ters off the data bus, groups them into  
tokens, and translates these tokens into  
line numbers and BASIC statements. The  
BASIC program can then be format-  
ted, printed, or stored for future use.  
(Statements could possibly be executed  
on the Model I if the user can resolve  
differences between the two BASICs.)

Reading and interpreting the output  
of the Pocket Computer then becomes a  
purely software problem. A machine-  
language program reads the binary  
pulses off the bus, a BASIC program  
does the token conversion and format-  
ting, and listings are displayed on the  
screen. Hard copy can then be produced  
by a standard printer.

```
10:"Z"PAUSE "DE
MONSTRATION
PROGRAM"
20:PAUSE "SPECI
AL NON-ASCII
CHARACTERS"
:PAUSE "π, ^,
J, ¥ AND E"
30:FOR I=1TO 10
:INPUT "HOW
MANY $?"Z
40:B=Z*3E2:
PRINT "EQUAL
S "B;" ¥":
NEXT I
```

Fig. 1. A demonstration program printed  
on the regular Radio Shack/Sharp printer  
is shown at left. The same program printed  
on a Paper Tiger IDS440G printer using  
the circuit described in this article is below.

```
10:"Z"PAUSE "DEMONSTRATION PROGRAM"
20:PAUSE "SPECIAL NON-ASCII CHARACTERS":
:PAUSE "π, ^, J, ¥ AND E"
30:FOR I=1TO 10:INPUT "HOW MANY $?"Z
40:B=Z*3E2:PRINT "EQUALS "B;" ¥":NEXT I
```

## PARTS LIST

- C1—220-μF, 35-V electrolytic
- C2—100-μF, 35-V electrolytic
- C3, C4—.01-μF disc capacitor
- D1, D2—50-V, 1-A silicon rectifier
- D3—3-to-6-V zener diode
- F1—0.5-A fuse with holder
- IC1—74LS02 quad NOR gate
- IC2—74LS367 hex tri-state buffer
- IC3—7805 5-V regulator
- P1—2-by-20-pin edge connector Radio  
Shack (276-1558)

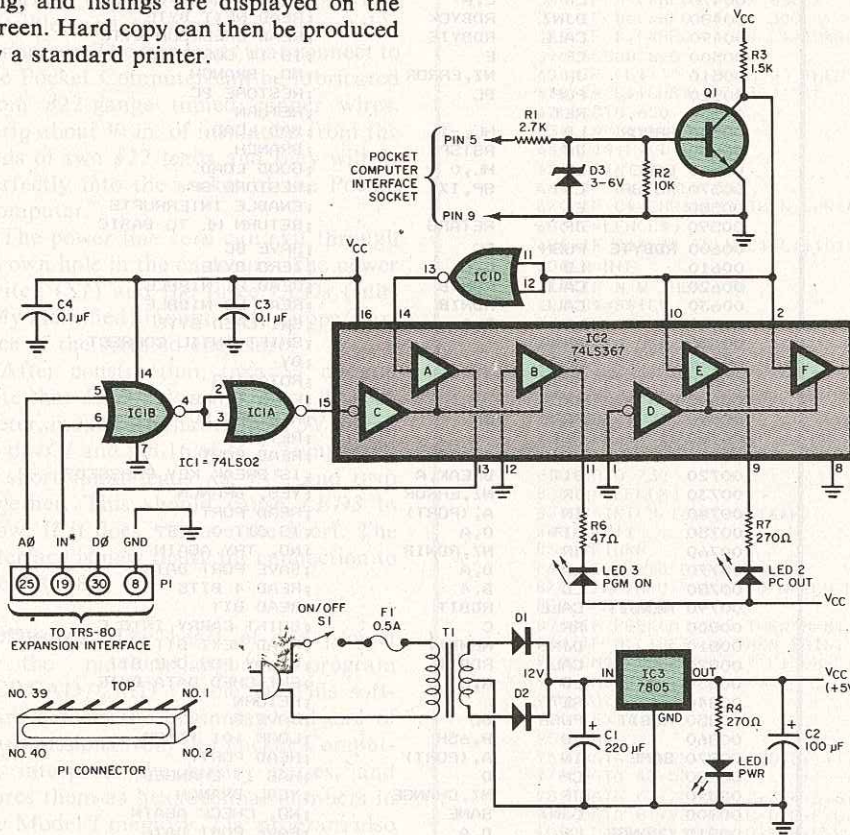
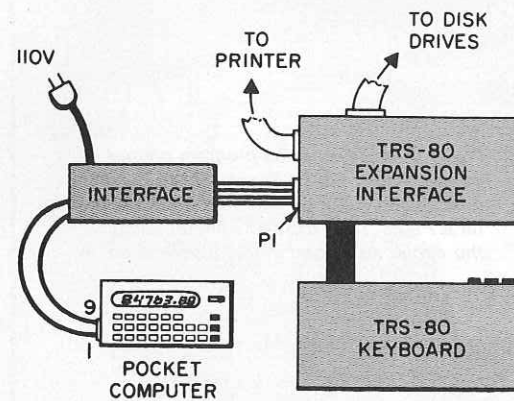


Fig. 2. Schematic of the interface circuit.  
Included is a regulated power supply.

- Q1—Npn silicon transistor (Radio Shack  
276-2014 or similar)
- R1—2.7-kΩ resistor
- R2—10-kΩ resistor
- R3—1.5-kΩ resistor
- R4, R5, R7—270-Ω resistor
- R6—47-Ω resistor
- S1—Spst switch
- T1—12-V, 1-A center-tapped transformer

**Note:** The following is available from  
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del, NJ 07733: a drilled, glass-epoxy,  
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you have a single-drive system, en-  
close a disk with TRSDOS, NEWDOS+  
or NEWDOS80 and deduct \$2.50. Your  
disk will then be returned with the  
PCREAD programs.





**Fig. 3. Use this arrangement to connect the interface circuit between the Pocket Computer and the TRS-80. Keep the four leads between the new circuit and the TRS-80 Expansion Interface as short as possible.**

The printer the authors used normally operates in the character (ASCII) mode. However, when a token describing a special non-ASCII or graphics character is encountered, the printer switches from ASCII to the graphics mode, where each matrix dot can be individually addressed. Thus, the printer can create a replica of such a character. If your printer does not provide a graphics mode, then  $\pi$  could be printed as Pi,  $\sqrt{\quad}$  as Sqr, etc. An example of a listing obtained with a Paper Tiger IDS440G printer is shown in Fig. 1.

The Pocket Computer tokens can be saved on tape or disk with the DOS DUMP command for future listing. The BASIC statements can also be saved as ASCII files for formatting with a word processor. (Using the low-cost circuit with appropriate software allows the Pocket Computer to communicate with the Model I, but not vice versa. This would require a more complicated interface and software.)

**Circuit Operation.** The circuit shown in Fig. 2 interfaces the Pocket Computer with the TRS-80 Model I.

Data pulses from the Pocket Computer, representing BASIC tokens, are amplified by *Q1*, buffered by *IC1D*, and applied via pin 14 to one three-state buffer within *IC2*. The output of this buffer (pin 13) is applied to the *DO* (data-zero) line of the TRS-80 via a 40-pin connector or plugged into the TRS-80 Expansion Interface. The *A0* address line and the *IN\** line from the TRS-80 are also coupled via this connector to the inputs of *IC1B*. When these two inputs go low simultaneously, which happens when the TRS-80 issues an *IN A* (port) command, the output of *IC1B* goes high. This signal is inverted by *IC1A* and

### TABLE I—PCREAD/CMD MACHINE-LANGUAGE PROGRAM

```

00100 BREAK EQU 2 ;BREAK KEY BIT
00110 CORNER EQU 3C3FH ;CORNER OF SCREEN
00120 EOF EQU 0FOH ;END CODE OF RECORDING
00130 FIRST EQU 0F100H ;FIRST BYTE OF BUFFER
00140 NEWDOS EQU 402DH ;ENTRY TO NEWDOS
00150 PORT EQU 00H ;CASSETTE INPUT PORT
00160 RETARG EQU 0A9AH ;RETURN HL TO BASIC
00170 ROW7 EQU 3840H ;KEYBOARD ROW 7
00180 ORG 0F000H ;61440 DECIMAL
00190 PCREAD DI ;DISABLE INTERRUPTS
00200 LD IX,0 ;ZERO IX
00210 ADD IX,SP ;SAVE SP IN IX
00220 LD HL,FIRST-1 ;POINT TO BUFFER-1
00230 CALL RDBYTE ;READ CHECKSUM BYTE
00240 LD E,0 ;ZERO CHECKSUM
00250 CALL RDBB ;READ PASSWORD
00260 RDBOB LD E,0 ;ZERO CHECKSUM
00270 LD B,10 ;READ 10*8 BYTES
00280 NXTB CALL RDBB ;READ 8 BYTES
00290 DJNZ NXTB ;READ NEXT GROUP
00300 JR RDBOB ;ZERO CHECKSUM
00310 RDBB PUSH BC ;SAVE BC
00320 LD B,B ;READ 8 BYTES
00330 RDBYCK CALL RDBYTE ;READ BYTE
00340 LD (CORNER),A ;DISPLAY ON SCREEN
00350 INC HL ;MOVE BUFFER POINTER
00360 LD (HL),A ;PUT BYTE IN BUFFER
00370 CP EOF ;IS IT END CODE?
00380 JR Z,DONE ;YES, BRANCH
00390 AND 0FH ;LESS SIGNIFICANT NIBBLE
00400 LD C,A ;SAVE IN C
00410 LD A,D ;SWITCHED BYTE
00420 AND 0FH ;MORE SIGNIFICANT NIBBLE
00430 ADD A,E ;ADD MSN TO CHECKSUM
00440 JR NC,NOOV ;SKIP ON NO OVERFLOW
00450 INC A ;INCREMENT CHECKSUM
00460 NOOV ADD A,C ;ADD LSN TO CHECKSUM
00470 LD E,A ;UPDATE CHECKSUM
00480 DJNZ RDBYCK ;READ NEXT BYTE
00490 CALL RDBYTE ;READ CHECKSUM BYTE
00500 CP E ;IS IT CORRECT?
00510 JR NZ,ERROR ;NO, BRANCH
00520 POP BC ;RESTORE BC
00530 RET ;RETURN
00540 ERROR LD HL,-1 ;BAD LOAD
00550 JR RSTSP ;BRANCH
00560 DONE LD HL,0 ;GOOD LOAD
00570 RSTSP LD SP,IX ;RESTORE SP
00580 EI ;ENABLE INTERRUPTS
00590 JP RETARG ;RETURN HL TO BASIC
00600 RDBYTE PUSH BC ;SAVE BC
00610 LD C,0 ;ZERO BYTE
00620 CALL RDNIB ;READ HI NIBBLE
00630 CALL RDNIB ;READ LO NIBBLE
00640 LD D,A ;SWITCHED BYTE
00650 RRCA ;SHIFT UNTIL CORRECT
00660 RRCA ;BY
00670 RRCA ;ROTATING
00680 RRCA ;FOUR TIMES
00690 POP BC ;RESTORE BC
00700 RET ;RETURN
00710 RDNIB LD A,(ROW7) ;READ PORT
00720 BIT BREAK,A ;IS BREAK KEY PRESSED?
00730 JR NZ,ERROR ;YES, BRANCH
00740 IN A,(PORT) ;READ PORT
00750 BIT 0,A ;IS BIT 0 OFF?
00760 JR NZ,RDNIB ;NO, TRY AGAIN
00770 LD D,A ;SAVE PORT DATA
00780 LD B,4 ;READ 4 BITS
00790 NEWBIT CALL RDBIT ;READ BIT
00800 RR C ;SHIFT CARRY INTO C
00810 DJNZ NEWBIT ;READ NEXT BIT
00820 CALL RDBIT ;DELAY FOR ONE BIT
00830 LD A,C ;SWITCHED DATA BYTE
00840 RET ;RETURN
00850 RDBIT PUSH BC ;SAVE B
00860 LD B,65H ;LOOP 101 TIMES
00870 SAME IN A,(PORT) ;READ PORT
00880 CP D ;HAS IT CHANGED?
00890 JR NZ,CHANGE ;YES, BRANCH
00900 DJNZ SAME ;NO, CHECK AGAIN
00910 CHANGE LD D,A ;SAVE PORT DATA
00920 RRCA ;SHIFT BIT INTO CARRY
00930 POP BC ;RESTORE B
00940 RET ;RETURN
00950 END NEWDOS ;BY DANIEL S. LEWART

```

passed to pin 15 of IC2 to “open” gates A and B via gate C. Gate A then passes the Pocket Computer data to the D0 bus of the TRS-80. Gate B, in turn, sinks current from LED3 (PGM ON) which, when glowing, indicates that the TRS-80 is ready to accept data from the Pocket Computer.

Gates E and F of *IC2* are always “open” due to control gate D being kept “on” by the ground at its input. Thus, gate E allows *LED2* (PC OUT) to glow as data flows from the Pocket Computer, while gate F, after inversion by *IC1C*, drives test point 1 (*TPI*).

Power is derived from a conventional full-wave rectifier (*D1* and *D2*). The rectifier output is filtered by *C1*, and regulated to 5 V by *IC3*. An indication that power is applied to the circuit is provided by *LED1* (*PWR*).

**Construction.** The circuit can be fabricated on a small piece of perf board using point-to-point wiring, or a small pc board can be made. Use sockets for IC1 and IC2.

The pc board and the small associated power supply can be mounted within almost any desired enclosure. The four leads going to the TRS-80 Expansion Interface (Fig. 3) should be as short as possible, and terminated in a suitable connector. The two leads that connect to the Pocket Computer can be fabricated from #22-gauge tinned copper wires. Strip about 1/4 in. of insulation from the ends of two #22 leads and they will fit perfectly into the socket of the Pocket Computer.

The power line cord can exit through its own hole in the enclosure. The power switch (*SI*) and the three LEDs (suitably identified) mount on the upper surface of the selected enclosure.

After construction, turn *S1* on and note that *LED1* glows. Using a dc voltmeter, make sure that there is 5V on pin 14 of *IC1* and pin 16 of *IC2*. Temporarily short input leads A0, IN\*, and GND together. This should cause *LED3* to glow. If it does, remove the short. The interface is now ready for connection to the TRS-80.

**Software.** The heart of the project is the machine-language program PCREAD/CMD (Table I). This software detects the beginning and end of transmissions from the Pocket Computer, interprets the binary pulses, and stores them as hexadecimal numbers in the Model I memory. The program also performs the timing function necessary to read the 500-baud signals from the Pocket Computer, and sets a blinking display block in the upper-right corner of the video monitor screen to indicate when the data is being read. Detailed

### TABLE II—PRINTER DRIVER PROGRAM FOR MX-80

```

100 POKE &H40B2,&HEF;POKE &H40B1,&HFE;CLEAR 2000
110 DEFINT A-Z;DIM D$(255),F$(255);DEFUSR=&HF000
120 CMD="PCREAD/CMD"
130 FOR I=1 TO 11
140 READ A,B
150 FOR J=A TO B
160 IF I<7 THEN READ D$(J);ELSE READ T$;D$(J)=T$+" "
170 NEXT
180 NEXT
190 D$(0)=CHR$(13)
200 D$(18)=CHR$(34)
210 A$=CHR$(27)+CHR$(75)+CHR$(5)+CHR$(255)
220 "23=YEN,25=PI,26=SQR,57=CARET,75=EXP"
230 F$(23)=A$+CHR$(168)+CHR$(104)+CHR$(62)+CHR$(104)+CHR$(168)
240 F$(25)=A$+CHR$(130)+CHR$(252)+CHR$(126)+CHR$(252)+CHR$(130)
250 F$(26)=A$+CHR$(8)+CHR$(4)+CHR$(254)+CHR$(126)+CHR$(126)
260 F$(57)=A$+CHR$(24)+CHR$(32)+CHR$(64)+CHR$(32)+CHR$(24)
270 F$(75)=A$+CHR$(254)+CHR$(254)+CHR$(146)+CHR$(146)+CHR$(146)
280 INPUT"HOW MANY CHARACTERS PER LINE";W
290 IF W<11 THEN 280
300 PRINT"1)PC LOAD 2)DISK LOAD 3)LIST ";
310 INPUT"4)PRINT 5)DISK SAVE 6)EXIT";G
320 ON G GOTO 350,420,470,470,670,950
330 GOTO 300
340 "LOAD FROM PC
350 IF (INP(0) AND 1)=1 THEN 380
360 PRINT"TURN ON POCKET COMPUTER"
370 IF (INP(0) AND 1)=0 THEN 370
380 PRINT"CSAVE PC PROGRAM"
390 IF USR(0) THEN PRINT"BAD LOAD" ELSE PRINT"GOOD LOAD"
400 GOTO 300
410 "LOAD FROM DISK
420 LINEINPUT"LOAD FROM WHICH FILESPEC? ";F$
430 CM$="LOAD "+F$
440 CMD CM$
450 GOTO 300
460 "LIST (OR PRINT)
470 M=&HF100
480 C$="";N=0;K=0
490 FOR I=1 TO 7
500 GOSUB 820
510 IF B>0 THEN C$=D$(16*L+H)+C$
520 NEXT
530 M=M+1
540 CLS:PRINT C$
550 B=PEEK(M);M=M+1
560 IF B<(&HE0) THEN 630
570 IF B=(&HF0) THEN 300
580 IF B>(&HE0) THEN C$=CHR$(B-&HB0) ELSE C$=" "
590 GOSUB 820
600 IF (C$<>" " OR H>0) THEN C$=C$+CHR$(H+&H30) ELSE C$=" "
610 C$=C$+CHR$(L+&H30)+";"
620 GOTO 650
630 C$=D$(B)
640 C1$=F$(B)
650 PRINT C$; "OUTPUT STRING
660 IF G=3 THEN 550
670 IF C$=CHR$(13) THEN LPRINT S$;S$="";N=0;K=0;GOTO 550
680 E=LEN(C$)
690 IF C1$>" " THEN C$=C1$;C1$="";E=1
700 N=N+E
710 IF N>W THEN 750
720 S$=S$+C$
730 IF (C$=";" OR N=4) THEN LPRINT S$;K=N-4;S$=" "
740 GOTO 550
750 IF K=0 THEN 790
760 LPRINT:LPRINT" ";
770 N=N-K;K=0
780 GOTO 720
790 LPRINT S$;LPRINT" ";
800 S$=C$;N=4+E;K=0
810 GOTO 730
820 B=PEEK(M) "READ BYTE
830 H=INT(B/16);L=B-16*H
840 M=M+1
850 RETURN
860 "SAVE TO DISK
870 LINEINPUT"SAVE TO WHICH FILESPEC? ";F$
880 M=&HF108
890 IF PEEK(M)<240 THEN M=M+1;GOTO 890
900 IF M>(&HF698) THEN PRINT"NO PROGRAM LOADED";GOTO 300
910 CM$="DUMP "+F$+" F100H,"+RIGHT$(STR$(65536+M),5)+"",4020H"
920 CMD CM$
930 GOTO 300
940 "EXIT
950 END
960 DATA 17,29," ",QUOTE,?,!,%,Z,YEN,$,PI,SQR,"",",",",",!
970 DATA 48,57,(,),>,<,-,+,-,*,/,L
980 DATA 64,75,0,1,2,3,4,5,6,7,8,9,,EXP
990 DATA 81,93,A,B,C,D,E,F,G,H,I,J,K,L,M
1000 DATA 94,106,N,O,P,Q,R,S,T,U,V,W,X,Y,Z
1010 DATA 130,132,>,<,-,*,<
1020 DATA 144,146,TO,STEP,THEN
1030 DATA 160,173,SIN,cos,TAN,ASN,ACS,ATN,EXP,LN,LOG,INT,ABS
1040 DATA SGN,DEG,DMS
1050 DATA 176,183,RUN,NEW,MEM,LIST,CONT,DEBUG,CSAVE,CLOAD
1060 DATA 192,197,GRAB,PRINT,INPUT,RADIAN,DEGREE,CLEAR
1070 DATA 208,222,IF,FOR,LET,REM,END,NEXT,STOP,GOTO,GOSUB,CHAIN
1080 DATA FAUSE,BEEP,AREAD,USING,RETURN

```



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18	QUOTE	101	U
19	?	102	V
20	!	103	W
21	#	104	X
22	%	105	Y
23	VEN	106	Z
24	\$	130	>=
25	PI	131	<=
26	SQR	132	<>
27	+	144	TO
28	:	145	STEP
29	:	146	THEN
48	(	160	SIN
49	)	161	COS
50	>	162	TAN
51	<	163	ASN
52	=	164	ACS
53	+	165	ATN
54	-	166	EXP
55	*	167	LN
56	/	168	LOG
57	^	169	INT
64	0	170	ABS
65	1	171	SGN
66	2	172	DEG
67	3	173	DMS
68	4	176	RUN
69	5	177	NEW
70	6	178	MEM
71	7	179	LIST
72	8	180	CONT
73	9	181	DEBUG
74	.	182	CSAVE
75	IE	183	CLOAD
81	A	192	GRAB
82	B	193	PRINT
83	C	194	INPUT
84	D	195	RADIAN
85	E	196	DEGREE
86	F	197	CLEAR
87	G	208	IF
88	H	209	FOR
89	I	210	LET
90	J	211	REM
91	K	212	END
92	L	213	NEXT
93	M	214	STOP
94	N	215	GOTO
95	O	216	GOSUB
96	P	217	CHAIN
97	Q	218	PAUSE
98	R	219	BEEP
99	S	220	AREAD
		221	USING
		222	RETURN

Fig. 4. Token equivalents for converting hexadecimal number characters into BASIC statements.

function of the program is shown in the "Remark" column in the listing.

A BASIC driver program (PC-READ/BAS) then takes the hexadecimal numbers characters stored in the Model I computer memory (equivalent to the Pocket Computer program listing), forms them into tokens, and translates the tokens into BASIC statements according to Fig. 4. (This was first derived by Norlin Rober.)

Three versions of a printer driver program were written in disk BASIC for Epson MX-80 with Grafrax, Paper Tiger IDS/440G, and for printers without graphic capabilities. The version for the MX-80 is listed here (Table II). Minor modifications would be required for other graphic printers. These programs are available on diskette (see Parts List). The BASIC programs give the option to specify the maximum number of characters per line. The text will

break at whole tokens when the maximum number of characters per line is exceeded (again see Fig. 1).

**Checkout and Operation.** Connect the Pocket Computer to the interface as shown in Fig. 3. With both units powered up, CSAVE a program and note that LED2 on the interface blinks. If you have a scope, observe the rectangular pulses at TPI as the Pocket Computer outputs in the CSIZE mode.

Now turn everything off and plug the interface P1 connector into the Model I Expansion Interface as shown in Fig. 3. Turn on the power for the TRS-80 Model I, the interface, and the pocket computer, run a BASIC driver program that calls PCREAD/CMD. When prompted, CSIZE a program from the Pocket Computer. You then have the options of displaying, printing, or saving the program.

# A NEW, EFFECTIVE ANTI-BURGLARY SYSTEM

Here's a wireless theft-prevention system that sounds an alarm before a burglar enters the home

BY RAYMOND L. KIRBY

**I**INTRUSION systems to protect one's valuables and life have become increasingly popular as burglaries continue to rise. The theft-prevention system presented here operates in an effective manner using unusual means to thwart thieves.

Firstly, it's a pre-entry deterrent since it is activated by attempted forced-entry noises such as the sound of breaking glass, splintering wood, metal striking metal, etc. At the same time, it ignores such "normal" sounds as talking, telephone ringing, and the doorbell. Secondly, it does not require running of wires and installation of switches, and so on. As a consequence, the system alerts the user to forced-entry efforts before the thief can enter the home, and installation is utterly simple.

The pre-entry warning system described in this article features a sound discriminator that can cover a 3000-square-foot area, a 110-dB siren, battery backup in case of power-line failure, the ability to turn on lights, an exit delay, duration control, remote arm/disarm, and compatibility with many other intrusion alert systems. Best of all, this system can be built for under \$200.

**Circuit Operation.** As shown in Fig. 1, the ceramic microphone picks up the entire gamut of sounds within the protected area. The microphone signal is amplified by IC1A, which has some frequency rolloff due to R2 and C2. Stage gain is determined by R4, which is set during calibration.

After level selection by R5, the audio signal is fed to bandpass filter

IC1B. The feedback network consisting of C5, C6, R8, and R9 peaks this circuit at approximately 16 kHz. Thus, conventional speech and household noises will not pass the IC1B filter—but, the high-frequency (mechanical) noises caused by attempted forced entry will. The filtered audio signal is then applied to timer IC2A of Fig. 2.

When the filtered audio signal applied to pin 6 exceeds about 4 V, IC2A is activated. The timing circuit consists of R13, R14, and C8, with R13 permitting a duration adjustment between 10 seconds and two minutes. This range can be shortened or lengthened by changing the value of R14.

When pin 5 of IC2A goes high, C9 charges and causes pin 13 of IC2B to go high. This, in turn, causes Q1 to

turn on, thus keeping pin 6 of IC2A high to prevent self-activation. Diode D1 prevents rapid discharge of C9 via pin 5 of IC2A. This hold-off lasts approximately five seconds. Since pin 9 of IC2B goes low during this time, LED1 remains off. However, after the brief timing interval, pin 13 goes low and pin 9 goes high. This shuts off Q1, arming the circuit, and the high at pin 9 turns on LED1, signifying that the system is ready to activate.

Transistor Q9 is also coupled to pin 6 of IC2A. As long as a short exists across the N.C. LOOP terminals, Q9 is cut off. When the short is removed, Q9 goes into conduction and shuts down IC2A, similar to the action of Q1. To prevent false activation under low-voltage conditions, transistors Q2 and Q3 of Fig. 3 form a Schmitt trigger. The collector of Q3 is connected

