Machine language programs for high-speed transfer of data between the KIM-1 and the CBM/PET microcomputers

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In the system described here, the CBM/PET micro-computer is used for processing data, and the more portable and less expensive 6502 KIM-1 is used for data logging. Combining these features involves the transfer of data from the KIM to the PET. This is essentially the practice I follow in laboratory studies of insect behavior. The locomotory activity of field crickets is monitored under a variety of conditions (see Campbell & Loher, 1983). The data are logged using KIM units and are periodically transferred to a PET for processing. The main aim of this paper is to explain the data-transfer system. The data-logging equipment will be described in a later paper.

The system should be easily modifiable for operation with other 6502-based units, for example, SYM to Apple. The possible interfaces with the programs provided are: KIM to PET, PET to KIM, PET to PET, and KIM to KIM.

Rhenke (1981) described a similar high-speed data-transfer system, but it cannot be used for moving data from a KIM to a PET, because the B port of the PET is not available to the user and the eight A port lines are used for the data transfer. Fortunately, it is possible to program the CB2 line of the PET 6522 VIA as a single bidirectional handshake line with any available KIM B port line. Details for programming the 6522 are given by Zaks (1979). Another advantage of the system described in this paper is that a checksum routine is provided to ensure that the transfer of data has occurred without error.

Hardware. The two units are connected via the eight A port lines of the KIM and those of the user port of the PET, plus two other connections, PB5 of the KIM to CB2 of the PET and a common ground line. PB5 of the KIM was used because PB0, PB1, PB2, and PB3 were dedicated for other purposes. Figure 1 shows the wiring details.

Programs. Instructions on machine language programming for both the KIM and PET are given in the manuals that come with these microcomputers and should be referred to if necessary.

Four machine language programs are provided in this paper: KIM-OUT, PET-IN, PET-OUT, and KIM-IN. Listings are given in Table 1. The programs for the KIM

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	GND	PA0	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PB5	CB2
KIM	1	14	4	3	2	5	6	7	8	16	application port
PET	A	C	D	E	F	H	J	K	L	M	user port

Figure 1. Cable connections for transfer of data between KIM and PET.

are located in the RAM space of the 6530 PI/memory devices starting at address 1780. Those for the PET are located in the second cassette buffer starting at address 033A. The programs are relocatable and can be placed anywhere in memory without modification, but the operating procedures described below are for the programs loaded at the addresses given above.

Operation. The operation of the data-transfer programs can be explained by reference to the flow diagrams given in Figure 2. For transfer of data from the KIM to the PET, the KIM-OUT and PET-IN programs are loaded. The start and end address pointers of the data block to be transferred are placed in zero page locations 0030 to 0033 (low order first) in both machines. The blocks specified should be of equal size. If the OUT block is smaller than the IN block, exit from the IN program will not occur. The KIM GO key is pressed at address 1780. This initializes the OUT program of the KIM, which then stops at address 17A1 (A in Figure 2) after a break. The PET-IN routine is then started at address 033A. The PET remains in its WAIT loop (AA in Figure 2) until the KIM GO key is again pressed at address 17A1. The specified block of data is then transferred from the KIM to the PET. If the transfer has been executed without error, the KIM and PET checksums will be equal. The checksums are located at address 0037 in both machines.

Table 1
Machine Code Listings for the KIM-PET Interface

KIM-OUT										PET-OUT																			
1780	08	A9	00	8D	FE	17	A9	1C		033A	08	78	A9	00	85	37	A9	CC		0342	8D	4C	E8	A9	FF	8D	43	E8	
1788	8D	FF	17	A9	00	85	37	AA		0344	A2	00	A9	08	8D	40	E8	AD		0352	4F	E8	81	30	A8	AD	40	E9	
1790	A9	2B	30	03	17	A9	00	80		035A	18	65	37	85	37	A9	EC	8D		0362	4C	E8	A0	04	88	00	F0	A9	
1798	02	17	A9	FF	8D	01	17	00		036A	CC	8D	4C	E8	A5	32	C5	30		0372	00	06	A5	31	C5	33	F0	0E	
17A0	E8	A9	01	85	36	C6	36	00		037A	E6	30	A9	00	C5	30	90	02		0382	E6	31	C9	00	F0	C5	58	00	
17A8	FC	A1	30	8D	00	17	19	05																					
17B0	37	85	37	A9	20	8D	02	17																					
17B8	A9	04	88	00	F0	A9	00	8D																					
17C0	02	17	A5	32	C5	30	00	06																					
17C8	A5	31	C5	33	F0	0E	E6	30																					
17D0	A9	00	C5	30	90	02	E6	31																					
17E0	C9	00	F0	C5	A9	37	85	EF																					
17E8	A9	00	85	F0	4C	DC	1C	00																					
										KIM-IN																			
PET-IN										1780	08	A9	00	8D	FE	17	A9	1C		1788	8D	FF	17	A9	00	85	37	A9	
033A	08	78	A9	00	85	37	A9	6C		1790	00	80	03	17	A9	00	80	02		1798	17	A9	00	80	01	17	A2		
0342	8D	4C	E8	A9	00	8D	43	E8		17A0	AD	00	17	81	30	A9	AD	02		17A8	17	29	00	02	F0	F1	28		
0344	A2	00	A9	08	8D	40	E8	AD		17B0	18	65	37	85	37	A5	32	C5		17B8	30	00	06	A5	31	C5	33	F0	
0352	4F	E8	81	30	A8	AD	40	E9		17C0	8E	E6	30	A9	00	C5	30	90		17C8	02	E6	31	C9	00	F0	C5	58	
035A	18	65	37	85	37	A9	EC	8D		17D0	37	85	EF	A9	00	85	F8	4C		17D8	DC	1C	00	00	00	00	00	00	
0362	4C	E8	A0	04	88	00	F0	A9																					
036A	CC	8D	4C	E8	A5	32	C5	30																					
0372	00	06	A5	31	C5	33	F0	0E																					
037A	E6	30	A9	00	C5	30	90	02																					
0382	E6	31	C9	00	F0	C5	58	00

Figure 2. Flow diagrams of programs OUT and IN.

For synchronization to be achieved, IN must be in its WAIT loop before data can be transferred from OUT, and the internal interrupts of the PET must be disabled [SEI (78) at address 033B]. If synchronizing diffi-

culties are encountered (if checksums are not equal), this could be resolved by placing a number >01, which gives the most rapid transfer of data, at address 17A2 (B in Figure 2). This increases the delay loop of OUT. I have found that 01 works for KIM to PET and vice versa.

For transfer of data from the PET to the KIM, the PET-OUT and KIM-IN programs are loaded. The start and end addresses of the data block to be transferred are specified for both machines starting at address 0030, as before. PET-OUT is run at address 033A to initialize the program, which then stops at address 034D. KIM-IN is then started at address 1780. KIM-IN remains in its WAIT loop until PET-OUT is restarted at address 034D. This is given by PC of the register pointers displayed on the screen after the initialization. The specified block of data is then transferred from PET to KIM.

Availability. Disassembled program listings with comments are available on request.

REFERENCES

- CAMPBELL, D. J., & LOHER, W. A microcomputer-based modulator for simulating insect songs and the response of crickets to an artificial calling song. *Behavior Research Methods & Instrumentation*, 1983, 15, 538-541.
- RHENKE, E. High-speed data transfer. *Compute!*, January 1981, 126-130.
- ZAKS, R. *6502 applications book*. Berkeley, Calif: Sybex, 1979.

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