Expansion Interface

Catalog Number 26-1140/1141/1142
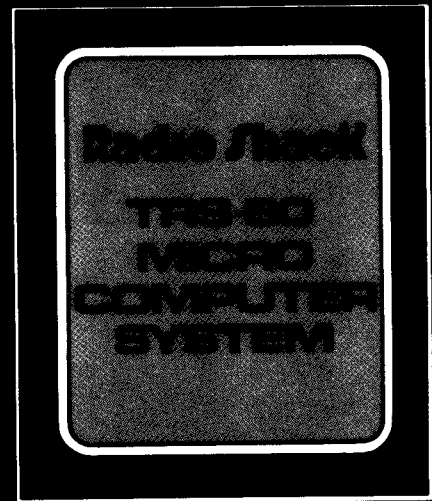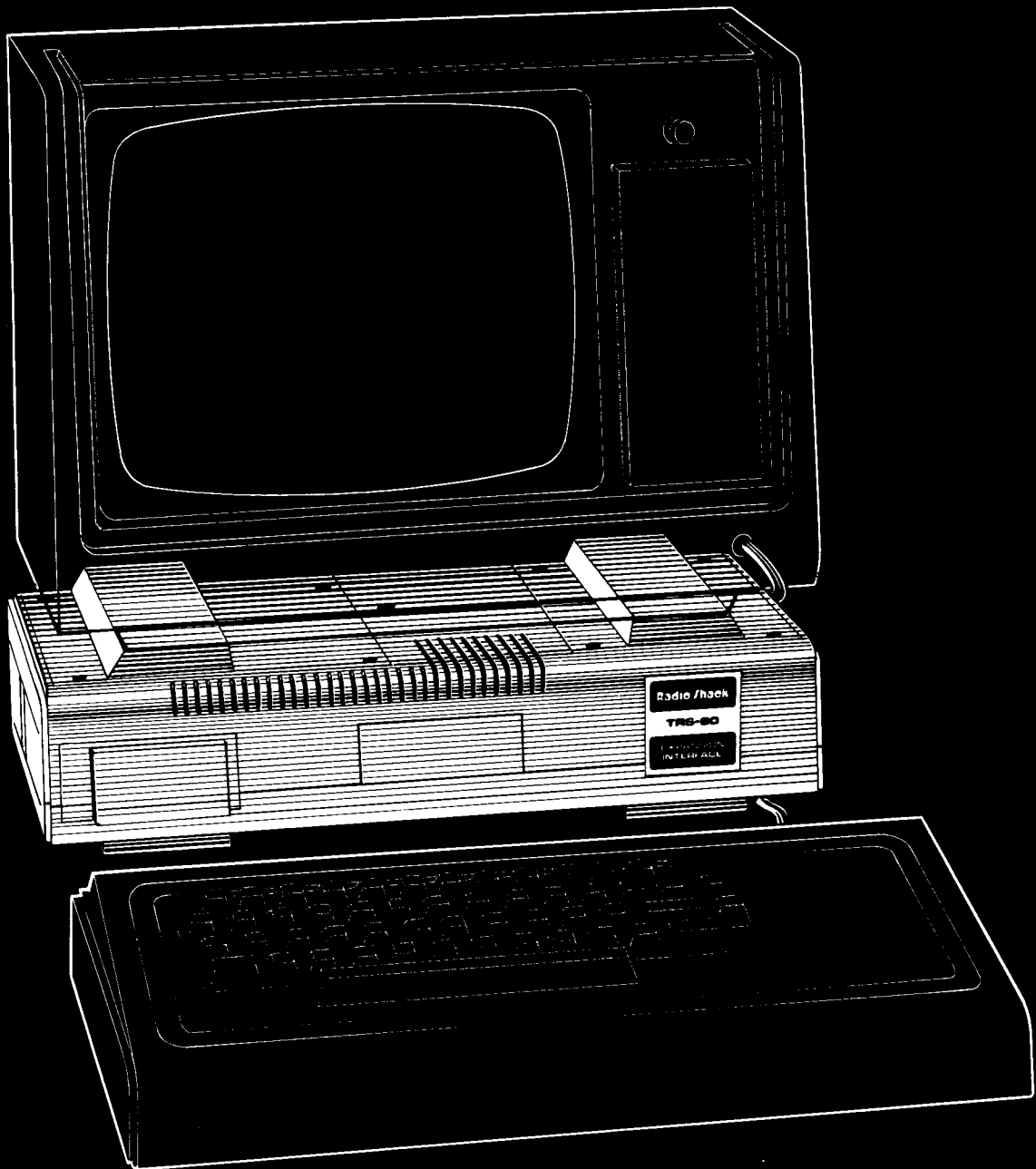
Radio Shack
TRS-80
EXPANSION
INTERFACE

Congratulations for selecting this Radio Shack Computer product!

The TRS-80 Expansion Interface greatly enhances the power and usefulness of your LEVEL II TRS-80 Computer. With it, you can connect a wide variety of external components ("peripherals") to your Computer — printers, mass storage devices, communications equipment, voice synthesizers, speech recognition devices, custom-made I/O devices, etc.

Just as importantly, the Expansion Interface lets you add Random Access Memory, so your System can hold longer programs and process more data at once. Once you have filled your TRS-80 with RAM (16K), you can add either 16K or 32K to the Expansion Interface, for a total of either 32K or 48K. (1K = 1024 memory locations or bytes.)

This unit is shipped with no RAM chips installed and it has Catalog Number 26-1140. If you up-grade your Expansion Interface to 16K RAM, you'll have a 26-1141; and if you up-grade your unit to the full 32K RAM, you'll have a 26-1142.

Here's a brief description of the connections your Interface provides:

- DIN jacks for two Cassette Recorders — to let you read data from one unit and write to the other
- Line Printer Card-Edge for connection to Radio Shack Line Printers and other suitable parallel interface printers
- Mini-Disk Card-Edge for connection of up to four Radio Shack Mini-Disk Drives
- Expansion Board Card-Edge for use when you add the RS-232-C Interface (or other custom-designed PCB) to the built-in expansion compartment
- Bus Card-Edge, which duplicates the signals present at the TRS-80 Card-Edge.

In addition to allowing all these connections, the Expansion Interface provides a 25 mS heartbeat interrupt to the Computer, which you can use to provide the "tick" for a Real-Time clock routine.

Notes: Don't connect the Expansion Interface to a LEVEL I TRS-80. The two are not compatible.

This manual pertains to Expansion Interface units whose serial numbers begin with 035000 (for 26-1140), and 008000 (for both 26-1141 and 26-1142).

Contents

Installing the Power Supplies

The Expansion Interface contains a storage compartment for two
Power Supplies — one for the Interface, the other for the TRS-80
Computer. Keeping the Supplies inside this Compartment saves space
and makes the System more "manageable".

1. The entire system should be OFF and both Power Supplies
   unplugged.
2. Remove the three phillips-head screws from the Power Supply
   Compartment cover (see Figure 1).
3. Look inside the compartment and locate the round, 5-pin DIN
   jack on the edge of the Printed Circuit Board (see the Detail in
   the Figure below). Connect the DIN plug from one of the Power
   Supplies to this jack. This just-connected Supply will now power
   the Expansion Interface.
4. Place the Expansion Interface Power Supply inside the
   Compartment as shown in Figure 1.
5. Next, place the TRS-80's Power Supply inside the Compartment
   as shown in the Figure.
6. Route the three unconnected cords (two AC powercords, one DIN
   cable) out of the case. Be sure to seat them in the cutouts
   provided in the case.
7. Replace the Compartment Cover. Don't over-tighten the screws or
   you might damage the case.
8. Connect the Power Supply DIN plug to your TRS-80's POWER
   jack. But don't plug in the AC power cords until you've made all
   peripheral connections.
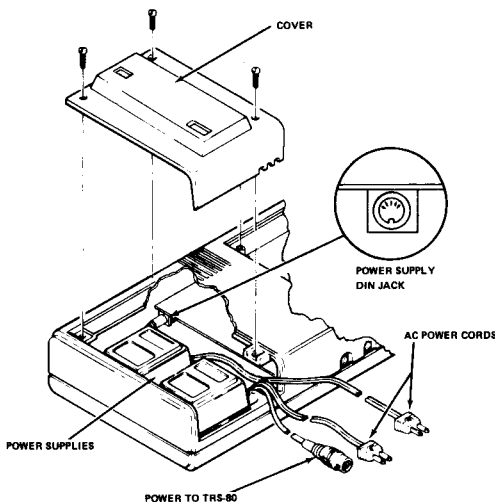
Figure 1. Power Supply installation.

Cables, Card-Edges and Jacks

Figure 2 shows the Expansion Interface with the connection cables
supplied with the unit.
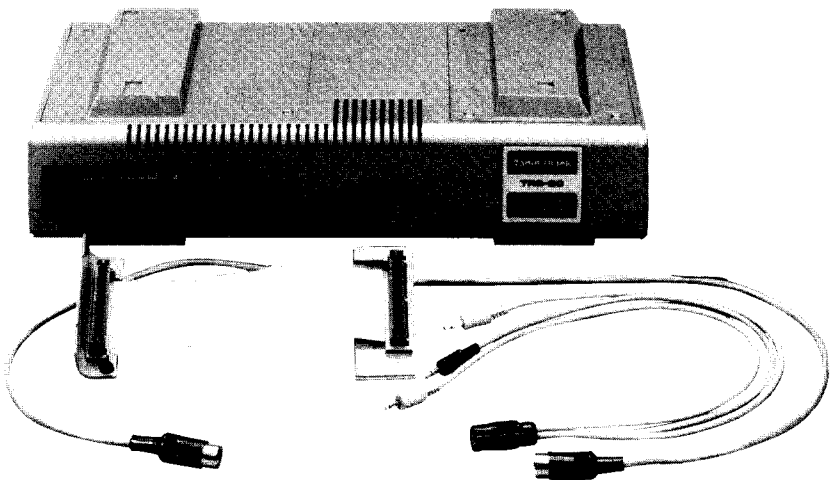
Figure 2. Expansion Interface with cables supplied.

You also receive connector hoods for all the card-edges, including the
one on the left rear of your TRS-80. Be sure to use the hoods for the
cable connectors. They act as keyways to help you to avoid the
misalignment of pins.
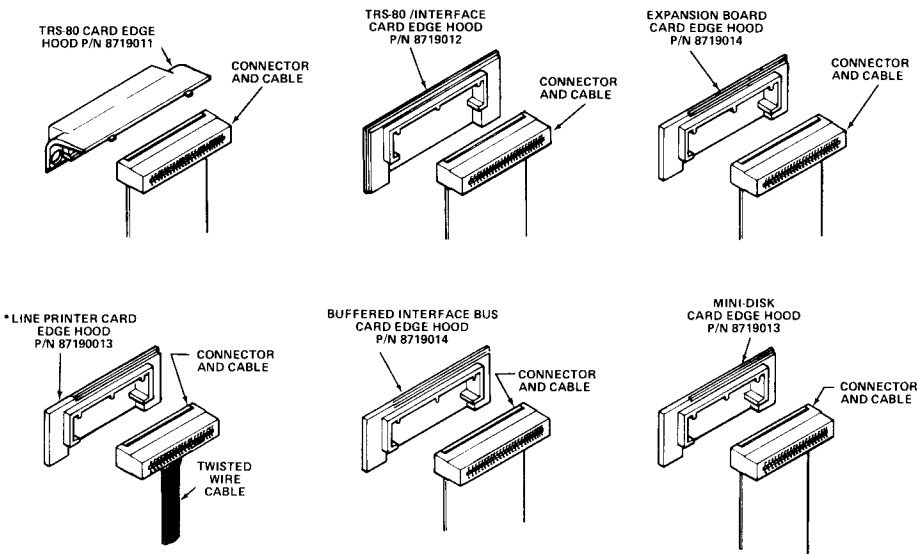
* NOTE: LINE PRINTER CABLES ARE SHIPPED BY THE
MANUFACTURER. SOME LINE PRINTERS USE A FLAT
RIBBON CABLE INSTEAD OF THE TWISTED WIRE
(ROUND) TYPE CABLE. USE THE CABLE PROVIDED
WITH YOUR LINE PRINTER.

Figure 3. Card-edge connector hoods with replacement part numbers (P/N).

Figure 4 identifies the various card-edges and jacks. Note that the card-edges are concealed behind protective cover-plates. Don't remove a cover unless you plan to use that card-edge.

To remove a cover-plate: press in on the right side of the plate until it pivots slightly. Then grasp the left side of the plate and pull out.

(FRONT VIEW)

LINE PRINTER CARD EDGE   EXPANSION BOARD CARD EDGE

TRS-80 BUS EXTENSION CARD EDGE   TRS-80 INTERFACE CARD EDGE

(REAR VIEW)

FLOPPY DISK CARD EDGE

CASSETTE 1 — I/O JACK

CASSETTE 2 — I/O JACK

TRS-80 CASSETTE — I/O JACK
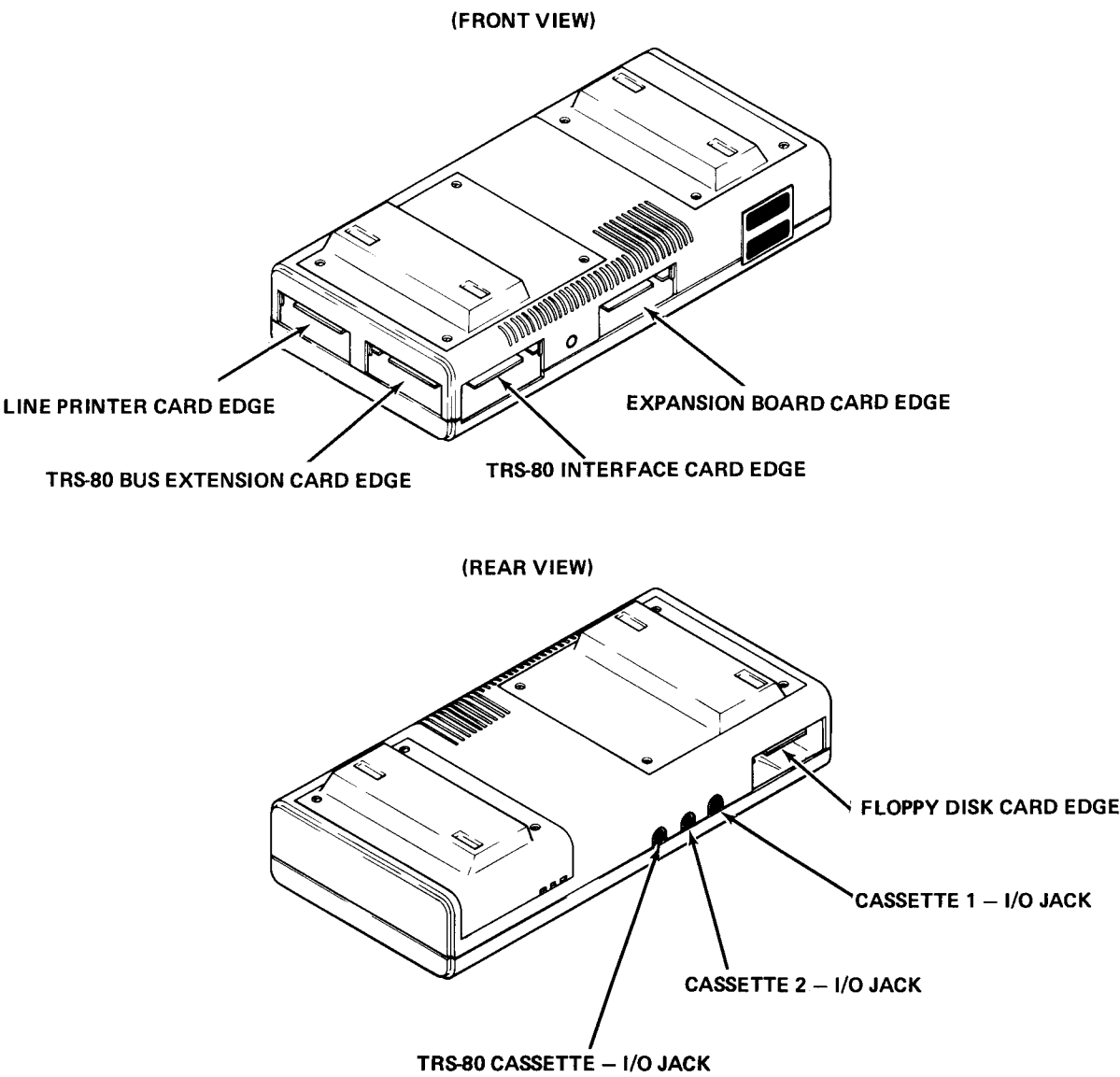
Figure 4. Card-edge and jack location.

Connection to the TRS-80

1. Position the TRS-80 as illustrated (Figure 5, rear view). Lift the door covering the Expansion Card-Edge, and slide it slightly to the right, then lift it up and away from the TRS-80 (be careful not to break the little plastic tabs).

REMOVE DOOR OVER
TRS-80 EXPANSION CARD EDGE

CONNECTOR AND CABLE
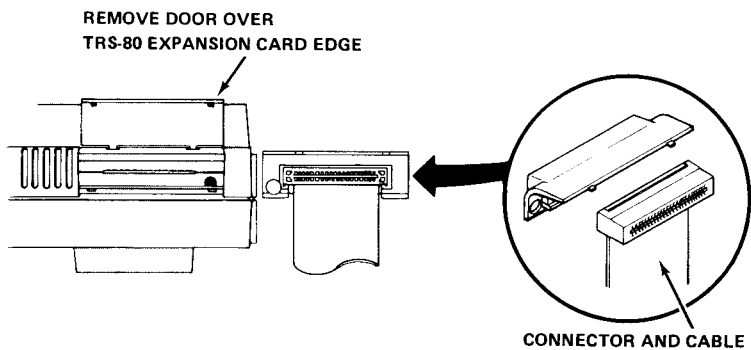
Figure 5. Connection to the TRS-80.

2. Attach one end of the TRS80/Expansion Interface cable to the TRS-80 Card-Edge, with the cable exiting from the bottom of the connector.
3. Attach the curved TRS-80 connector hood to the keyboard case; the ribbon cable should feed out from the bottom of the hood (Figure 5).
4. Attach a flat hood onto the other end of the cable, with the cable exiting from the bottom of the hood (Figure 6).
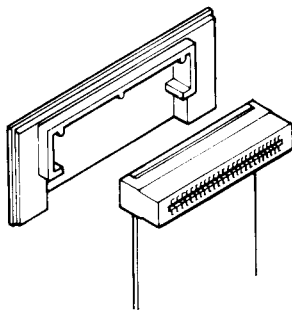
Figure 6. Place hood over connector with cable exiting from bottom of hood.

5. Position the Expansion Interface behind the TRS-80 keyboard and place the Video Display on top of the Expansion Interface, taking care that the "feet" on the Display lock into the recesses on top of the Expansion Interface case (Figure 7).

Figure 7. Set up your TRS-80/Expansion Interface/Video Display system this way.

Power-Up and Notes

With the Expansion Interface connected to the TRS-80 Computer as explained in the last section, you are ready to turn on the components.

Note: If you are going to connect any peripherals, do it while the system is OFF (see Peripheral Connection). Never change the connections to the Expansion Interface or Computer while the Computer or Interface is ON.

1. Make all connections before you plug in the AC line cords.
2. Turn on the peripherals you are going to use.
3. Turn on the Expansion Interface, by pressing the power button into the case until it clicks into position. Use the rubber eraser on a pencil, or something similar. (In the on position, the button is recessed, so you won't turn the unit off accidentally.)
4. Turn on the TRS-80 Computer.

Note: If you do not have a Mini-Disk system connected, you must hold down the BREAK key while you turn on the Computer. If you do have a Mini-Disk system connected, follow the power-up sequence recommended in your Mini-Disk Operation Manual.

With some Line Printers, you must have the Printer **on** for TRSDOS to load and operate.

To turn the system off, reverse the power-up sequence. That is, turn the TRS-80 Computer off first, etc.

Caution: Turn off all peripheral equipment (Line Printer, etc.) **before** turning off the Expansion Interface.

Notes on AC Power Sources

Although your TRS-80 Micro-Computer system uses the latest in efficient, low-current electronic devices, it is important to avoid using household extension cords, multiple outlets or "cube-taps", etc. Place your TRS-80 system as close as possible to standard AC power outlets. Otherwise, line noise from the Mini-Disk, Line Printer, or other peripherals may be transmitted through a shared line cord to the Expansion Interface or TRS-80, causing loss of memory or spontaneous reset.

If you cannot connect each component in your system directly to an AC outlet, use a high-grade, heavy-duty extension cord or multiple outlet. These are available at your local Radio Shack store.

It's also a good idea to route your AC line cords away from any of the Input/Output cables (e.g., ribbon cable) in the system. This will reduce the possibility of line noise being picked up by the I/O cables.

Adding RAM to the Expansion Interface

Connecting your "no RAM" unit (26-1140) will not affect the total amount of memory in your system.

Before adding RAM to your Expansion Interface, you must fill your TRS-80 with 16K RAM. Then, when you need more memory, you have it added to the Expansion Interface in blocks of 16K, for a total of up to 32K in the Interface, or a system total of up to 48K.

Preserve your Warranty — let Radio shack install and test all additional RAM in your Interface. The installation charge is included in the price of each additional 16K RAM kit (26-1101).

Here's a memory map showing the highest memory addresses in the various possible configurations:

	HEX ADDRESS	DECIMAL ADDRESS	
FIRST USER RAM ADDRESS →	4000	16384	4K SYSTEM
"4K" TRS-80'S STOP HERE →	4FFF	20479	
			16K SYSTEM
"16 K" TRS-80'S STOP HERE →	7FFF	32767	
	8000	32768	32K SYSTEM
FIRST ADDRESS IN EXPANSION INTERFACE →			
"16K" EXPANSION INTERFACES STOP HERE →	BFFF	49151	48K SYSTEM
	C000	49152	
"32K" EXPANSION INTERFACES STOP HERE →	FFFF	65535	
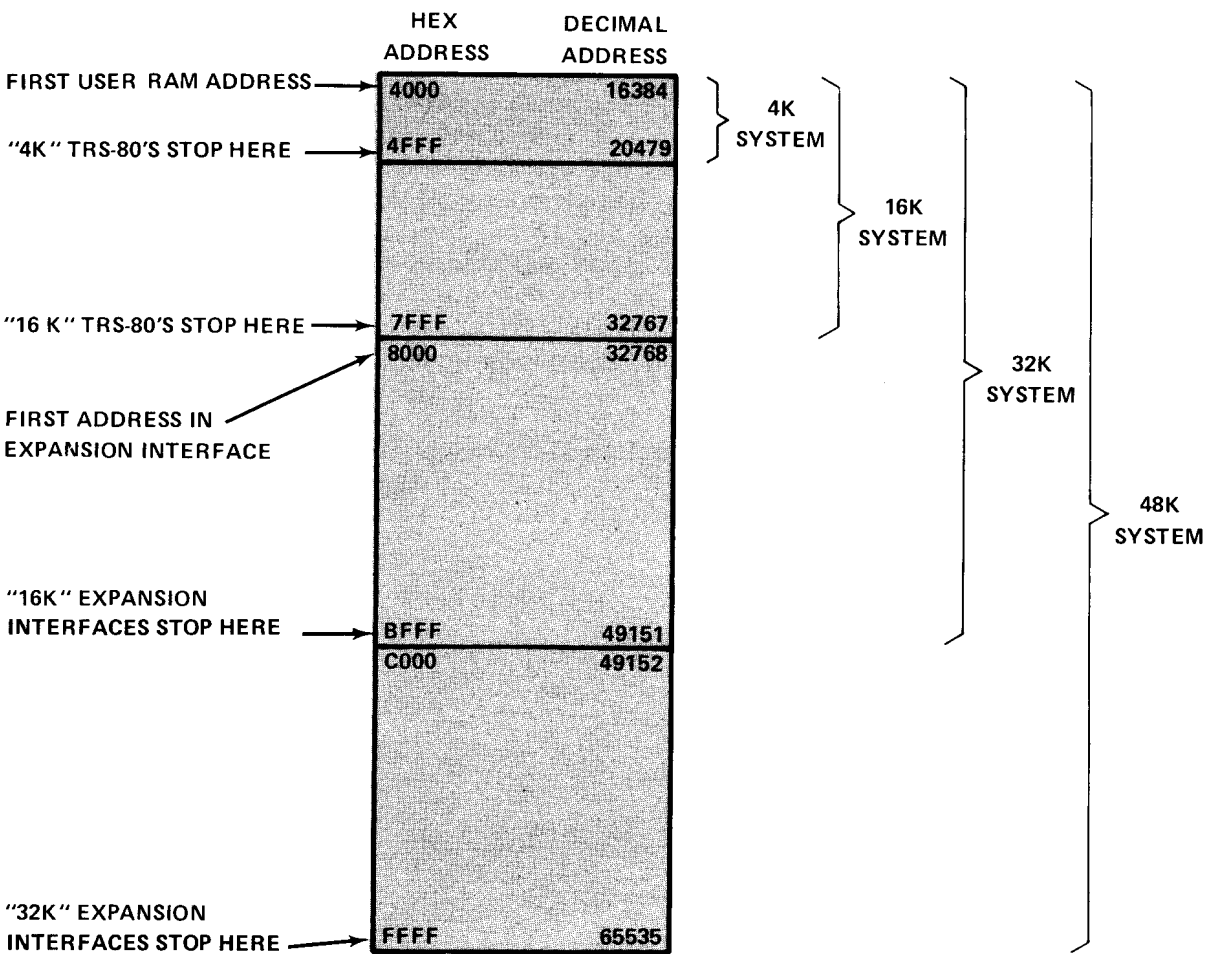
Figure 8. RAM addresses in the various TRS-80/Expansion Interface systems.

PERIPHERALS

Refer to Figures 2, 3 and 4 while connecting any peripheral equipment.

Dual Cassettes

By adding a second cassette recorder to your system, you'll be able to speed up your cassette input/output operations. For example, you can read a program or data from one recorder, edit the program or update the data, and write it out to the other recorder — no need to swap cassettes, rewind or reset Play and Record keys . . . !

Note: If you have just one recorder, leave it connected directly to the CASSETTE jack on the TRS-80. There is no advantage in having a single recorder connected via the Expansion Interface.

1. Locate the Cassette Interface Cable. It has a single DIN plug at each end.
2. Plug one end into the TRS-80 CASSETTE jack, and the other end into the Cassette jack on the Expansion Interface (the DIN jack next to the power cables).
3. You have two Cassette Recorder cables — one came with your TRS-80, the other came with the Expansion Interface. Connect one of them to the Cassette 1 DIN jack, and the other to the Cassette 2 DIN jack.
4. Now connect the two sets of Cassette plugs to your two Recorders as follows:
   A. Black plug to the EAR jack
   B. Larger Gray plug to the AUX jack
   C. Smaller Gray plug to the REM jack
5. The Recorder connected to the Cassette 1 jack is now Cassette Drive 1; the Recorder connected to Cassette 2 is now Cassette Drive 2.

Note: Depending on which Cassette recorder(s) you have, connection may vary. In general, use the same 3-plug arrangement you'd use in a single-recorder system.

Dual Cassette Operation

LEVEL II BASIC
To select a cassette drive with LEVEL II BASIC, use the following statements (see the LEVEL II BASIC Reference Manual for details):

CLOAD#-1, *filename*   Loads a program from Cassette 1
CLOAD#-2, *filename*   Loads a program from Cassette 2
Note: , *filename* is optional — omit if you want to load the first program encountered on the tape.

CLOAD#-1, ? *filename*   Compare program in memory with
               one stored on Cassette 1
CLOAD#-2, ? *filename*   Compare program in memory with
               one stored on Cassette 2

Note: *filename* is optional again.

PRINT#-1, *data*   Write data to Cassette 1
PRINT#-2, *data*   Write data to Cassette 2
Note: *data* is a standard Print list.

INPUT#-1, *variable (s)*   Input data from Cassette 1
INPUT#-2, *variable (s)*   Input data from Cassette 2
Note: *variable (s)* is a standard Input list, and it must match the Print list that wrote the data.

In the SYSTEM mode, Cassette 1 is always selected.

Assembly Language
To select Cassette 1 for an assembly language I/O routine, store zero in hex address 37E4; To select Cassette 2, store 1 in hex 37E4. For more information, refer to the Instruction Manual for the TRS-80 Editor-Assembler, Catalog Number 26-2002.

Line Printer

The Line Printer Card Edge provides a parallel data interface which is compatible with Radio Shack Line Printers. The connection cable and instructions will be supplied with the Line Printer.

Use with Other Printers

Certain other line printers can be connected to the Line Printer Card Edge. In general, the Printer must:

1. Be equipped with a female 34-pin connector to mate with the Expansion Interface card-edge.
2. Accept 7- or 8-bit ASCII data in parallel format.
3. Supply the Computer with the following status signal:
    BUSY (low = not busy, okay to send. High = busy, do not send.

Note: The other Printer status signals are optional, as follows:

  OUT OF PAPER — If the Printer does not provide this signal, simply ground this input to System Common (see Technical Information later on for pin location. Not necessary for Radio Shack Line Printers.

  SELECT and FAULT — If the Printer does not supply these signals, external resistors in the Interface will automatically pull these inputs high, to allow normal output to the Printer.

See **Technical Information** later on for details of signals present at the Line Printer Card Edge.

Line Printer Output

LEVEL II BASIC
There are two statements for output to the Line Printer, LPRINT
and LLIST. See the LEVEL II BASIC Reference Manual for details.

Note: If you don't have a line printer connected, LPRINT and
LLIST will cause your Computer to lock up, requiring you to Reset
it. (Hold down BREAK while you press Reset.) Resetting the
Computer with the Expansion Interface connected will cause you to
lose any BASIC program in memory.

Assembly Language
Hex address 37E8 is memory mapped to the Line Printer Card-Edge
and serves as an input/output port.

Before sending a byte to this port, check enabled status bits:

bit	if set then status is . . .
7	BUSY
6	OUT OF PAPER
5	DEVICE NOT SELECTED
4	NO FAULT

Note: Check your Line Printer Manual to see which status bits are
used.

When the Printer is READY, store the byte (an ASCII code for the
desired character) in hex address 37E8.

For example, if the ASCII coded character is stored in register C:

```
        ; SUBROUTINE TO OUTPUT
        ; A BYTE TO A LINE PRINTER
        ;
        ; LOAD ASCII-CODED CHARACTER
        ; INTO C-REGISTER, THEN CALL
        ; PRTDVR
        ;
PRTDVR  LD   A,(37E8H)    ; CHK STATUS
        BIT  7,A          ; BUSY BIT SET?
        JP   NZ,PRTDVR    ;   LOOP WHILE BUSY
        LD   A,C          ; GET CHARACTER
        LD   (37E8H),A    ; SEND IT TO LP
        RET               ; RETURN
```

Mini Disk(s)

Connect one 26-1160 Mini Disk Drive and up to three additional 26-1161 Mini Disk Drives, as explained in the Mini-Disk Operation Manual. The connection cable is supplied with 26-1160.

Attach one of the flat connector hoods to the Mini-Disk connector before attaching it to the Expansion Interface Card Edge. The ribbon cable should exit from the bottom of the hood.

Bus Compatible Devices

This card-edge provides required signals for additional Radio Shack peripherals. Any device that connects directly to the TRS-80 can also be connected here, **with the exception of the Screen Printer (Catalog Number 26-1151).** By using this Card-Edge, you don't tie up the entire TRS-80 Interface with a single device.

For example, you can connect the Radio Shack Voice Synthesizer (Catalog Number 26-1180) to the Expansion Interface via this Card-Edge.

Expansion Board

The Expansion Interface contains a special Expansion Board Compartment to allow installation of another optional printed circuit board to expand your system's capabilities.

For example, you can have the Radio Shack RS-232C Serial Interface (Catalog Number 26-1145) installed in this compartment. This will enable your TRS-80 to communicate with another RS-232C device (Telephone Interface, Serial Line Printer, etc.).

If you have enough experience in digital electronics, you might even design your own circuit and install it in this compartment.

When you have such a board installed, you can access it via the Expansion Board Card-Edge.

Expansion Board Installation

To expose the Expansion Compartment, remove the four phillips-head screws from the Cover and lift it off (Figure 9). Notice the connector inside the compartment; this will connect to your add-on board.

Figure 10 gives the required dimensions for a do-it-yourself board to fit in the Expansion Compartment and connect to the Expansion Connector.
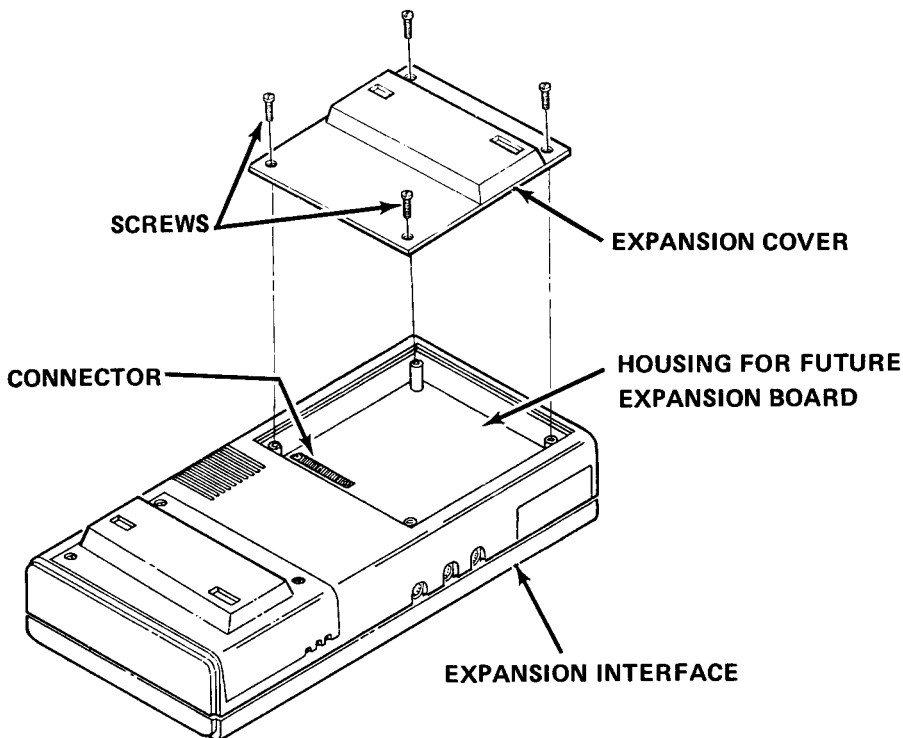
Figure 9. Remove cover to expose Expansion Board compartment.

.188 DIA.(3/16)

CENTERLINE PIN 1

.165

.150

41 SPACES @ .050=2.050

2.350

.125 DIA.(1/8)

6.375 MAX.

VIEWED FROM SIDE
OPPOSITE COMPONENTS

.160

1.78 ⟩2⟩   2.900

5.688 MAX.

NOTES

UNDERLINE OTHERWISE SPECIFIED:

1.   MAXIMUM COMPONENT HEIGHT .660

⟩2⟩ MAXIMUM COMPONENT HEIGHT 1.10
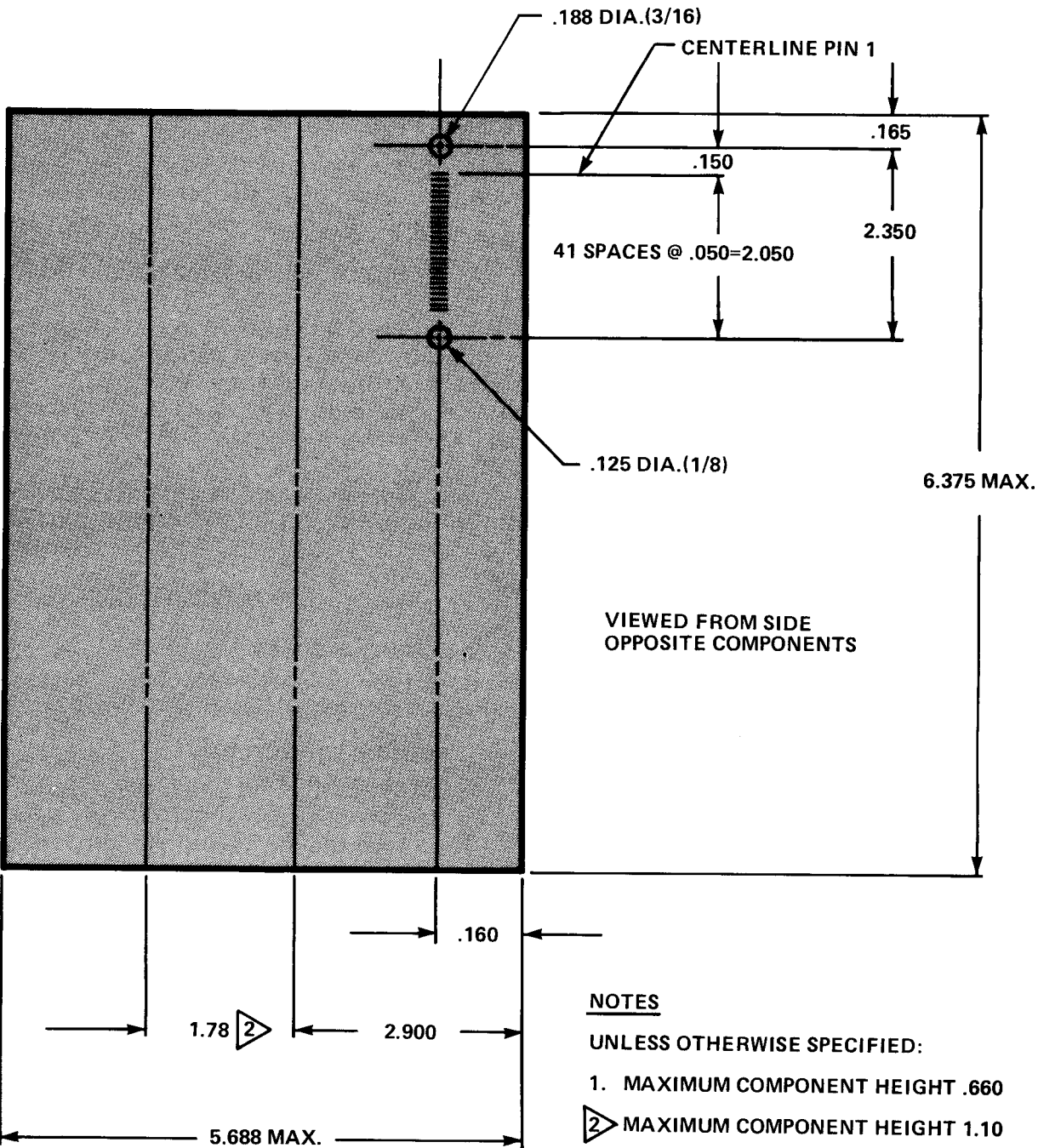
Figure 10. Expansion Board required dimensions.

TECHNICAL
INFORMATION

25 mS Heartbeat Interrupt

A clock circuit in the Expansion Interface provides an Interrupt to the Z-80, 40 times each second. When such an Interrupt is received, the Z-80 gets instructions from ROM telling it to go to a specific RAM address for further instructions. Normally, these "further instructions" simply tell the Z-80 to return from the interrupt sequence and continue where it left off.

If you have enough experience with the Z-80 Instruction Set (and with assembly-language programming in general), you can link up an Interrupt Service Routine which accomplishes some simple foreground task before it returns control to the interrupted program.

For example, you can set up a real-time clock which keeps time regardless of what the current program is — BASIC command mode, BASIC program execution, machine-language routine, etc. Here's how it's done:

1. Write an Interrupt Service Routine to
    a. Disable Interrupts
    b. Read FDC status register 37ECH to clear it
    c. Read Interrupt Status in 37E∅H
    d. Increment the software clock counter
    e. Read from 37E∅H again to reset Interrupt Latch
    f. Enable Interrupts
    g. Return to interrupted program
2. Disable Interrupts
3. Replace the Interrupt Default link at 4∅12H — 4∅14H with a jump to your Service Routine
4. Enable Interrupts to turn on the clock

Here's a BASIC program which POKES the necessary code into addresses 32680 — 32767. **Note:** Before using this program, reset your TRS-80 and answer MEMORY SIZE with the number 32679. **Note:** This program is for LEVEL II only. Don't try to use it with DISK BASIC (use the TRSDOS clock instead!).

```
50   REM...PROGRAM TO LOAD CLOCK CODE INTO RAM
100  FOR I% = 1 TO 88
110     READ D%: POKE 32679+I%, D%
120  NEXT
130  POKE 16526, 168  'LSB OF ISR START ADDRESS
140  POKE 16527, 127  'MSB OF ISR START ADDRESS
150  DATA 243, 205, 127, 10, 175, 181, 40, 14
160  DATA 237, 86, 62, 195, 50, 18, 64, 33
170  DATA 193, 127, 34, 19, 64, 251, 195, 154
180  DATA 10, 229, 245, 58, 224, 55, 203, 119
190  DATA 32, 49, 203, 127, 40, 38, 33, 94
200  DATA 64, 52, 126, 254, 40, 56, 29, 175
210  DATA 119, 35, 52, 126, 254, 60, 56, 20
220  DATA 175, 119, 35, 52, 126, 254, 60, 56
230  DATA 11, 175, 119, 35, 52, 126, 254, 24
240  DATA 56, 2, 175, 119, 58, 224, 55, 241
250  DATA 225, 251, 201, 58, 236, 55, 24, 244
```

After you have run the preceding program, run the following
program to execute the code, turn on and use the real-time clock.

```
10 'INITIALIZE CLOCK
20 CX = USR(0)   'MAKE SURE CLOCK IS OFF
30 POKE 16478, 0   'SET TICKER TO ZERO
40 INPUT "ENTER THE TIME (HR,MIN,SEC)"; CH%,CM%,CS%
50 POKE 16481,CH%: POKE 16480, CM%: POKE 16479, CS%
60 CX = USR(1)   'TURN ON CLOCK
100 'YOUR PROGRAM GOES HERE
110 'WHEN YOU WANT THE TIME, INSERT "GOSUB 10000"
120 'TIME  WILL BE RETURNED IN CT$. FOR EXAMPLE--
130     GOSUB 10000
140 PRINT@56, CT$
150 GOTO 130
10000 'READ THE CLOCK AND FORM CT$
10010 CH%=PEEK(16481): CM%=PEEK(16480): CS%=PEEK(16479)
10020 CC$=STR$(CH%): GOSUB 10100: CH$=CC$  '2-DIGIT HOUR
10030 CC$=STR$(CM%): GOSUB 10100: CM$=CC$  '2-DIGIT MINUTES
10040 CC$=STR$(CS%): GOSUB 10100: CS$=CC$  '2-DIGIT SECONDS
10050 CT$=CH$+":"+CM$+":"+CS$
10060 RETURN   'TO MAIN PROGRAM WITH CT$
10100 'MAKE INTO 2-DIGIT STRING
10110 IF LEN(CC$)=3 THEN CC$=RIGHT$(CC$,2): RETURN   'W/STRING
10120 CC$="0"+RIGHT$(CC$,1): RETURN   'WITH 2-DIGIT STRING
```

Note: To turn off the clock, execute the statement, CX = USR(0).
BE SURE TO TURN OFF THE CLOCK before performing
any cassette input/output.

Assembly-language programmers can use the following listing to
relocate the real-time clock code.

```
        ORG     7FA8H
ISR     EQU     7FC1H           ; SET TO ISR START ADDR
        ; ENTRY VIA BASIC USR(N)
USR     DI                      ; DISABLE INTERRUPT
        CALL    0A7FH           ; GET (HL)
        XOR     A
        OR      L               ; IS USR ARG=0?
        JR      Z,EXI           ; IF YES THEN EXIT
        IM      1               ; ELSE LINK TO ISR
        LD      A,0C3H          ; PUT IN JUMP TO ISR
        LD      (4012H),A
        LD      HL,ISR          ; START ADDR OF ISR
        LD      (4013H),HL
        EI                      ; ENABLE INTERRUPT
EXI     JP      0A9AH
        ; REAL TIME CLOCK CODE
CLK     EQU     405EH           ; TICKS STORED HERE
SEC     EQU     405FH           ; SECONDS HERE
MIN     EQU     4060H           ; MINUTES HERE
HOURS   EQU     4061H
        PUSH    HL              ; SAVE REGISTERS
        PUSH    AF
        LD      A,(37E0H)       ; GET INTERRUPT STATUS
        BIT     6,A
        JR      NZ,FDC          ; IF FDC MAKING RQST
        BIT     7,A
        JR      Z,XIT           ; EXIT IF INVALID INTRPT
        LD      HL,CLK          ; HL => TICKS COUNTER
        INC     (HL)            ; UPDATE "TICK"
        LD      A,(HL)
        CP      40              ; 40 TICKS PER SECOND
        JR      C,XIT           ; IF NO CARRY INTO SECS
        XOR     A
        LD      (HL),A          ; RESET TIKCNT
        INC     HL              ; POINT TO SECONDS-COUNT
        INC     (HL)            ;   AND UPDATE
        LD      A,(HL)          ; GET SECONDS COUNT
        CP      60
        JR      C,XIT           ; DONE IF NO CARRY TO HRS
        XOR     A               ;   ELSE RESET SECONDS
        LD      (HL),A
```

(Real-Time Clock Code, continued)

```
        INC     HL              ; POINT TO MINUTES AND
        INC     (HL)            ;    INCREMENT
        LD      A,(HL)          ; GET MINUTES COUNT
        CP      60
        JR      C,XIT           ; DONE IF NO CARRY
        XOR     A               ;    ELSE RESET MINUTES
        LD      (HL),A
        INC     HL              ; POINT TO HOURS AND
        INC     (HL)            ;    UPDATE
        LD      A,(HL)          ; GET HOURS
        CP      24              ; 24-HOUR CLOCK
        JR      C,XIT           ; DONE IF NO CARRY
        XOR     A               ;    ELSE RESET HOURS
        LD      (HL),A
XIT     LD      A,(37E0H)       ; TO RESET LATCH
        POP     AF              ; RESTORE REGS AND EXIT
        POP     HL
        EI                      ; ENABLE INTERRUPTS
        RET
FDC     LD      A,(37ECH)       ; RESET FDC IRQ RQST
        JR      XIT
        END     USR
```

Floppy Disk Controller IC

The Floppy Disk Controller (FDC) in the Expansion Interface directly controls the drive motors; track stepping and direction; write gating and data. It also inputs information on the diskette index position, track zero occurrence, write protection and data/clocking — all at the Mini Disk Card-Edge on the Expansion Interface. The FDC registers (CMD/STATUS, TRACK, SECTOR, DATA) are located at TRS-80 memory addresses 37ECH, 37EDH, 37EEH and 37EFH, respectively.

Drive selection is through Z47. Only one drive is selected at a time. A time-out timer circuit (Z33) is activated/reactivated each time a drive is selected/reselected, thereby protecting the disk drives in the instance of program "crashes", as the drives are not designed for continuous motor-on use. After two or three seconds, the MOTOR ON line (J5, pin 16) will deactivate (go high) unless Z33 is retriggered by a drive selection/reselection. Pin 6 of gate Z46 provides a signal to the FDC (pins 23 and 32) when a head load has been commanded (FDC status = READY).

TRSDOS programming takes into account that the Disk drive motor requires one second to come up to operating speed, and that head loading takes 80 milliseconds to stabilize. At the end of an FDC operation, an interrupt is generated (pin 39 of FDC goes high) which, through gate Z34 (pins 11 and 10), sets Z28, pin 9. This interrupt request is terminated by reading the FDC status register (address 37ECH) — which makes pin 39 of the FDC go low — then reading from 37E0H, which resets pin 9 of Z28.

Because of the complexity of floppy disk operation, Radio Shack does not encourage customers to bypass the TRS-80 Disk Operating System for disk I/O, nor can we answer customer questions in this area. Customers who are intent on such applications should start by reading these publications:

- Shugart SA400 OEM and Service Manuals
- Western Digital FD1771B-01 Data Sheet

Address Decoding Scheme

The Address Decoder logic consists of Z43, Z40, Z39 and one inverter from Z32.

Z40 is a dual 2-line to 4-line demultiplexer. One half of this package selects 16K increments of RAM. The input signals to this section are MRAS*, A14 and A15. MRAS* serves as a valid memory address signal; a logical $\emptyset$ indicates that the addresses have stabilized. Table 1 summarizes the I/O combinations.

INPUTS			OUTPUTS				
MRAS*	A15	A14	Z40 Pin 4	Z40 Pin 5	Z40 Pin 6	Z40 Pin 7	Address Range Selected
1	X	X	1	1	1	1	None
$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$	1	1	1	0000-3FFF
$\emptyset$	$\emptyset$	1	1	$\emptyset$	1	1	4000-7FFF
$\emptyset$	1	$\emptyset$	1	1	$\emptyset$	1	8000-BFFF
$\emptyset$	1	1	1	1	1	$\emptyset$	C000-FFFF

Note: In the Table, X = Don't care.

Table 1.

Pins 6 and 7 select the 32K and 48K rows of dynamic RAM, respectively. Pin 4 is looped back to the second half of Z40. There, it is combined with the output of NAND gate Z43 to give a logical $\emptyset$ on Pin 12 when A11, A14, A15 and MRAS* are logical $\emptyset$ and A5, A6, A7, A8, A9, A10, A12 and A13 are logical 1. Pin 12 is logical 1 at all other times. Pin 5 is not used. It is shown in Table 1 only for continuity of the I/O combinations.

The signal from Pin 12 of Z40 is combined with A2, A3, WR* and inverted RD* to produce the signals shown in Table 2.

INPUT					OUTPUT									
Z40 PIN 12	RD*	WR*	A3	A2	Z39 PIN 7	Z39 PIN 6	Z39 PIN 5	Z39 PIN 4	Z39 PIN 9	Z39 PIN 10	Z39 PIN 11	Z39 PIN 12	SIGNAL GENERATED	SIGNAL TO
1	X	X	X	X	1	1	1	1	1	1	1	1	NONE	——
$\emptyset$	$\emptyset$	1	$\emptyset$	$\emptyset$	$\emptyset$	1	1	1	1	1	1	1	37E0 READ	INTERRUPT LOGIC
$\emptyset$	$\emptyset$	1	$\emptyset$	1	1	$\emptyset$	1	1	1	1	1	1	37E4 READ	——
$\emptyset$	$\emptyset$	1	1	$\emptyset$	1	1	$\emptyset$	1	1	1	1	1	37E8 READ	PRINTER LOGIC
$\emptyset$	$\emptyset$	1	1	1	1	1	1	$\emptyset$	1	1	1	1	37EC READ	FLOPPY DISK CONTROLLER
$\emptyset$	1	$\emptyset$	$\emptyset$	$\emptyset$	1	1	1	1	$\emptyset$	1	1	1	37E0 WRITE	DRIVE SELECT
$\emptyset$	1	$\emptyset$	$\emptyset$	1	1	1	1	1	1	$\emptyset$	1	1	CSW	CASSETTE RELAY
$\emptyset$	1	$\emptyset$	1	$\emptyset$	1	1	1	1	1	1	$\emptyset$	1	37E8 WRITE	PRINTER LOGIC
$\emptyset$	1	$\emptyset$	1	1	1	1	1	1	1	1	1	$\emptyset$	37EC WRITE	FLOPPY DISK CONTROLLER

NOTE: X = Don't Care

Table 2.

Cassette Jack Signals

These jacks allow connection and control of a pair of Cassette
Recorders via the Expansion Interface. The pinouts for the three
jacks are the same.
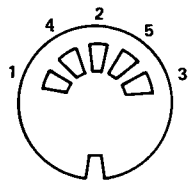
PIN	SIGNAL NAME	DESCRIPTION
1	MOTOR ON/OFF	Allows TRS-80 to control tape motion.
2	GROUND	Signal Ground.
3	MOTOR ON/OFF	Allows TRS-80 to control tape motion.
4	CASSIN	Allows taped programs to be loaded into the TRS-80.
5	CASSOUT	Allows cassette recorder to record programs from the TRS-80 onto tape.

Table 3. Cassette jack signals.

Z-80 port 255 is used for cassette control and I/O, as follows:

Bit	Function	
	Output	Input
7	not used	CASSIN Latch
6	not used	Display Mode Status
5	not used	not used
4	not used	not used
3	Video Display Mode Select $\emptyset$ = 32 char./line 1 = 64 char./line	not used
2	Cassette Motor Relay $\emptyset$ = OFF 1 = ON	not used
1	CASSOUT B (see note below)	not used
$\emptyset$	CASSOUT A	not used

Table 4. Z-80 I/O port 255 signals.

Note: CASSOUT A and B are both used to produce the cassette
audio signal, as follows:

CASSOUT A	B	Audio Pulse
Ø	Ø	No Signal
1	1	Pulse Low
Ø	1	Pulse Low
1	Ø	Pulse High

High ⎹ 0.85V

No Signal 0.46V

Low 0.0V
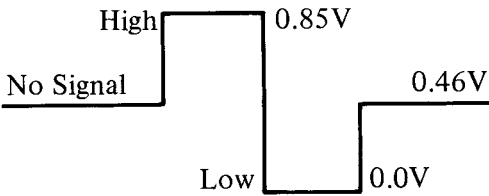
**Table 5. How CASSOUT A and B produce the three-state cassette
audio (High, Low, No Signal).**

Line Printer Card-Edge Signals

PIN	SIGNAL NAME	DESCRIPTION
1	DATA STROBE*	A 1.0 microsecond pulse used to clock the data from the processor to the printer logic.
2	GND	Signal Ground
3	D1	Input data levels. A high represents a binary one, a low represents a zero. All printable characters (i.e., codes having a one in DATA 6 or DATA 7) are stored in the printer buffer. Control characters (i.e., codes having a zero in both DATA 6 and DATA 7) are used to specify special control functions. These codes are not stored in the buffer except when they specify a print command and are preceded by at least one printable character in that line.
4	GND	
5	D2	
6	GND	
7	D3	
8	GND	
9	D4	
10	GND	
11	D5	
12	GND	
13	D6	
14	GND	
15	D7	
16	GND	
17	D8	
18	GND	
19	NC	Not Connected
20	GND	Signal Ground
21	BUSY	A level indicating that the printer cannot receive data.
22	GND	Signal Ground
23	OUT OF PAPER PE	A level indicating that the printer is out of paper.
24	GND	Signal Ground
25	UNIT SELECT SLCT	A level indicating that the printer is selected.
26	PRIME*	A level which clears the printer buffer and initializes the logic.
27	GND	Signal Ground
28	FAULT*	A level that indicates a printer fault condition such as paper empty, light detect or a deselect condition.
29	NC	Not Connected
30	NC	Not Connected
31	GND	Signal Ground
32	NC	Not Connected
33	GND	Signal Ground
34	GND	Signal Ground

NOTE: All GND signals are common.

```
33  31  29  27  25  23  21  19  17  15  13  11   9   7   5   3   1
 □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □
 □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □
34  32  30  28  26  24  22  20  18  16  14  12  10   8   6   4   2
```

28
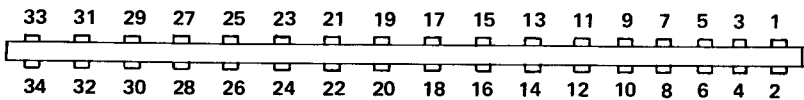
Mini Disk Card-Edge Signals

PIN	SIGNAL NAME	DESCRIPTION
1	GND	Signal Ground
2	NC	Not Connected
3	GND	Signal Ground
4	NC	Not Connected
5	GND	Signal Ground
6	NC	Not Connected
7	GND	Signal Ground
8	INDEX PULSE*	Indicates the physical beginning of a track.
9	GND	Signal Ground
10	DS0*	When active, locks the mini-disk R/W head against the mini-diskette (disk drive no. 0).
11	GND	Signal Ground
12	DS1*	When active, locks the mini-disk R/W head against the mini-diskette (disk drive no. 1).
13	GND	Signal Ground
14	DS2*	When active, locks the mini-disk R/W head against the mini-diskette (disk drive no. 2).
15	GND	Signal Ground
16	MOTOR ON	Turns ON all drive motors.
17	GND	Signal Ground
18	DIRECTION SEL*	Defines direction of motion the R/W head will take when the STEP line is pulsed.
19	GND	Signal Ground
20	STEP*	Causes the R/W head to move with the direction of motion as defined by DIRECTION SEL.
21	GND	Signal Ground
22	WRITE DATA*	Provides data to be written on diskette.
23	GND	Signal Ground
24	WRITE GATE*	Enables WRITE DATA to be written on the diskette.
25	GND	Signal Ground
26	TRACK ZERO*	A logical zero state indicates that the drive's R/W head is positioned at track zero.
27	GND	Signal Ground
28	WRITE PROTECT*	Gives the user an indication that a write protected diskette is installed.
29	GND	Signal Ground
30	READ DATA*	Provides the "raw data" (clock and data together) as detected by the drive electronics.
31	GND	Signal Ground
32	DS3*	When active, locks the mini-disk R/W head against the mini-diskette (disk drive no. 3).
33	GND	Signal Ground
34	NC	Not Connected

```
33  31  29  27  25  23  21  19  17  15  13  11   9   7   5   3   1
 □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □
 □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □   □
34  32  30  28  26  24  22  20  18  16  14  12  10   8   6   4   2
```
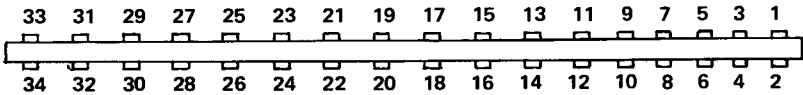
Bus Card-Edge Signals

This card edge duplicates the card edge on the TRS-80 Computer.

PIN	SIGNAL NAME	DESCRIPTION
1	RAS*	Row Address Strobe Output for 16-Pin Dynamic Rams.
2	SYSRES*	System Reset Output, Low During Power Up Initialize or Reset Depressed.
3	NC	No Connection
4	A10	Address Output
5	A12	Address Output
6	A13	Address Output
7	A15	Address Output
8	GND	Signal Ground
9	A11	Address Output
10	A14	Address Output
11	A8	Address Output
12	OUT*	Peripheral Write Strobe Output.
13	WR*	Memory Write Strobe Output.
14	INTAK*	Interrupt Acknowledge Output.
15	RD*	Memory Read Strobe Output.
16	NC	No Connection
17	A9	Address Output
18	D4	Bidirectional Data Bus.
19	IN*	Peripheral Read Strobe Output.
20	D7	Bidirectional Data Bus.
21	INT*	Interrupt Input (Maskable).
22	D1	Bidirectional Data Bus.
23	TEST*	A Logic "0" on TEST* Input Tri-States A0 - A15, D0 - D7, WR*, RD*, IN*, OUT*, RAS*, CAS*, MUX*.
24	D6	Bidirectional Data Bus.
25	A0	Address Output
26	D3	Bidirectional Data Bus.
27	A1	Address Output
28	D5	Bidirectional Data Bus.
29	GND	Signal Ground
30	D0	Bidirectional Data Bus.
31	A4	Address Bus
32	D2	Bidirectional Data Bus.
33	WAIT*	Processor Wait Input, to Allow for Slow Memory.
34	A3	Address Output
35	A5	Address Output
36	A7	Address Output
37	GND	Signal Ground
38	A6	Address Output
39	+5V	5-Volt Output (Limited Current)
40	A2	Address Output

NOTE: * means Negative (Logical "0") True Input or Output.

```
 1  3  5  7  9  11 13 15 17 19 21 23 25 27 29 31 33 35 37 39
 □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □
 □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □  □
 2  4  6  8  10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
```
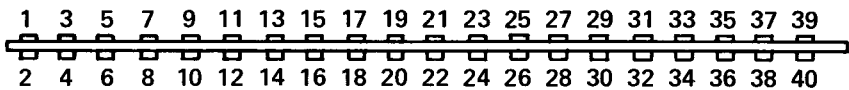
Expansion Board Card-Edge Signals

If you install an expansion board in the Expansion Compartment, this Card-Edge will give you easy access to the added board. For example, with the Radio Shack RS-232C Serial Interface installed, you will connect your external RS-232C equipment to this Card-Edge.

The Card-Edge is connected to the Connector inside the Expansion Compartment, and also to certain TRS-80 signals:

TRS-80 Data Lines ($D\emptyset$ – D7); some of the TRS-80 Address Lines ($A\emptyset$ – A2); the I/O strobes (IN* and OUT*); the reset line SYSRES*; +5 volts; ground; the interrupt line INT* and a decoded signal called E8*. E8* goes to a logical "$\emptyset$" when A3, A5, A6 and A7 are logical "1" and A4 is logical "$\emptyset$".

The Card-Edge itself is not connected to any of the TRS-80 signals. Your Expansion Board must supply any signals your external equipment will require. See the Schematic Diagram for further details.

The following table shows the Card-Edge pinouts with the optional RS-232C Interface board installed.

Expansion Board Card-Edge Signals (RS-232C Installed)

PIN	*SIGNAL NAME	DESCRIPTION
1	GND	Signal Ground
2	NC	
3	GND	Signal Ground
4	NC	
5	GND	Signal Ground
6	NC	
7	GND	Signal Ground
8	NC	
9	GND	Signal Ground
10	———	Internal Expansion Connector - Pin 16 (not used).
11	GND	Signal Ground
12	———	Internal Expansion Connector - Pin 15 (not used).
13	GND	Signal Ground
14	———	Internal Expansion Connector - Pin 14 (not used).
15	GND	Signal Ground
16	PGND	Protective Ground
17	GND	Signal Ground
18	TD	Transmit Data - Signals on this Circuit are sent to remote Equipment.
19	GND	Signal Ground
20	SGND	Signal Ground from Data Communications Equipment.
21	GND	Signal Ground
22	RD	Signals on this Circuit are received from Data Communications (remote) Equipment.
23	GND	Signal Ground
24		Internal Expansion Connector - Pin 9 (not used).
25	GND	Signal Ground
26	———	Internal Expansion Connector - Pin 8 (not used).
27	SIG GND	
28	———	Internal Expansion Connector - Pin 7 (not used).
29	GND	Signal Ground
30	CD	Carrier Detect (Received Line Signal Detector) indicates that the Data Set is receiving a character from a remote Data Set via the Communications Channel.
31	GND	Signal Ground
32	CTS	The Clear to Send signal is generated by the Data Communications Equipment. It indicates whether or not the Data Set (modem) is ready to transmit Data.
33	GND	Signal Ground
34	DTR	The Data Terminal Ready signal to the Data Communications Equipment controls switching of Data Communications Equipment to the Communications Channel.
35	GND	Signal Ground
36	RTS	The Request to Send signal to the Data Communications Equipment controls direction of Data Transmission by the Data Communications Equipment.
37	GND	Signal Ground
38	RI	The Ring Indicator signal from the Data Communications Equipment means that the Data Set is being polled and that the polling service wants to communicate.
39	GND	Signal Ground
40	DSR	Data Set Ready indicates the status of the local Data Set.

* Signal Names used in this chart are those related to Radio Shack's RS-232-C Interface.

```
  39  37  35  33  31  29  27  25  23  21  19  17  15  13  11   9   7   5   3   1
  ┌─□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□─┐
  └──□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□───□┘
  40  38  36  34  32  30  28  26  24  22  20  18  16  14  12  10   8   6   4   2
```
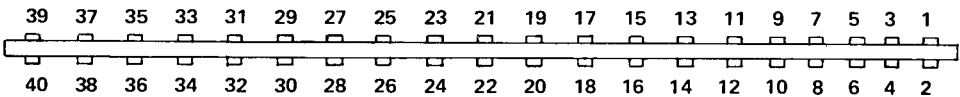
Schematic Diagrams
Control Logic
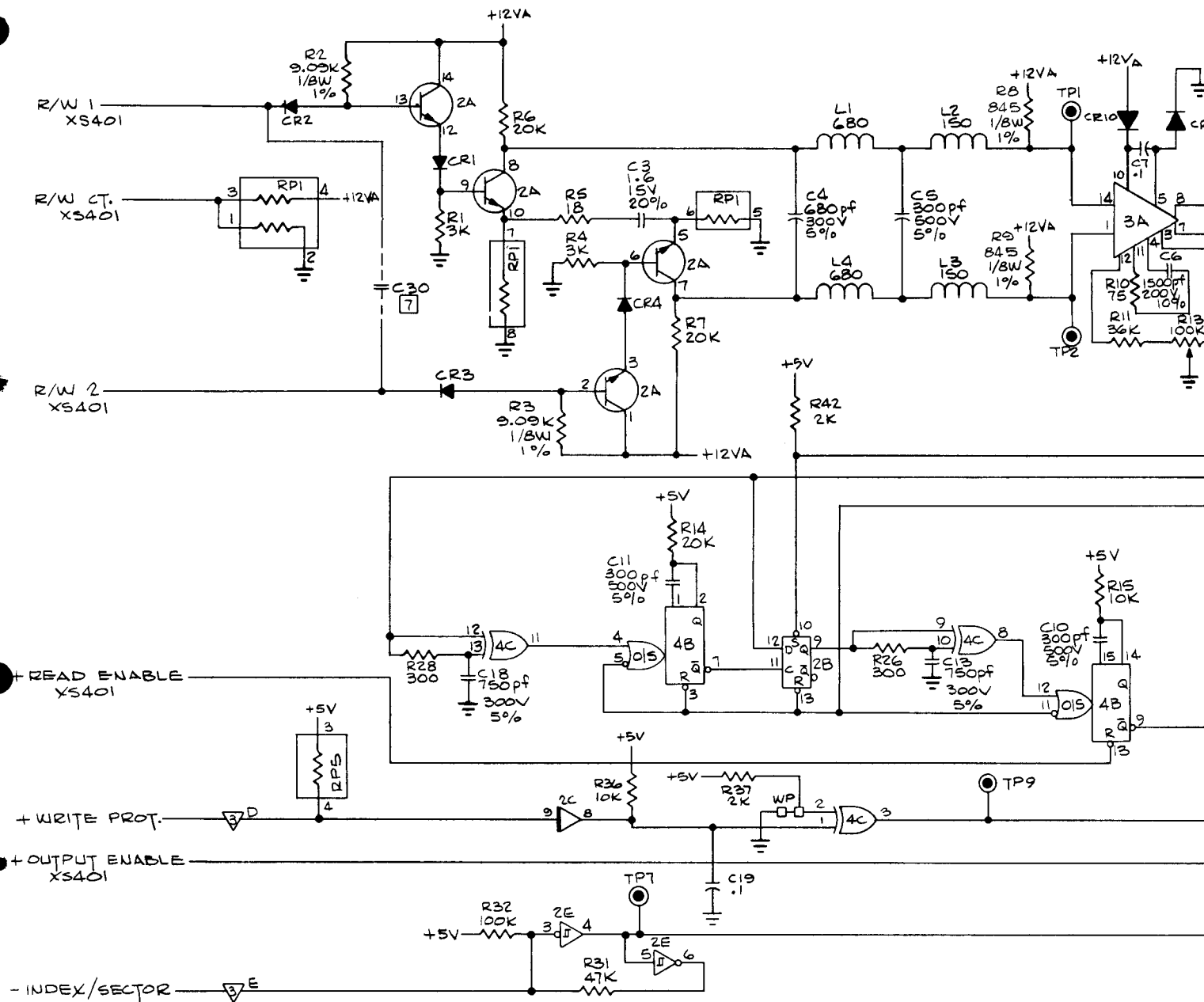
RESISTOR ARRAY

VALUE	POSITION	UNUSED
330Ω	RP2,3	
680Ω	RP1	
150Ω	RP5	
1K	RP4	
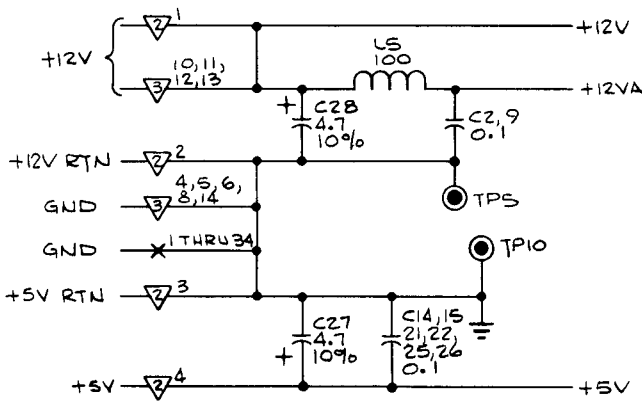
TYPE	POS.	UNUSED	VCC (PIN)	GND (PIN)	VDD (PIN)	TYPE	POS.	UNU.
7400	3E		14	7	—	74S53B	3F	
7402	3B		14	7	—	LM311N	4A	
74LS14	2E		14	7	—	NE592A	3A	
7407	2C,4D		14	7	—	7486	4C	4C2
7433	2D		14	7	—	9602	4B	
7438	2F		14	7	—	2QT2222	2A	
7474	2B,1D	1D1 8	14	7	—	2QT2905	1C	
7419S	3D		16	8	—	150Ω	1E	
74LS221	3C		16	8	—	MPQ3725	4F	

2-11

+12V_A

CR10 CR19

TP1

TP3 +12VA C8 +5V

10 16 C7 .1 R29 510

14 5 8 3A 7 2 4A 8 7

1 11 4 3 C6 3 4 1

12 R10 75 1500pf 200V, 10% R12 36K

R11 36K R13 100K TP4 9

TP2

+ PULL UP 2 XS401

+ PULL UP 1 XS401

+5V RP4 2 1 +5V

+5V R15 10K

pf V % 15 14

4B Q TP6 1 2 3F 3 30 ✗ — READ DATA

R 9 Q 13

+ WRITE PROT. XS401

12 2F 11 28 ✗ — WRITE PROTECT
13

4 2F 6 8 ✗ — INDEX/SECTOR
5

+5V R35 39 1/2W ▽ INDEX/SECTOR LED

NOTES: UNLESS OTHERWISE SPECIFIED,

1. ALL CAPACITORS ARE IN MICRO-FARADS, 50V, +80, -20%.
2. ALL DIODES ARE 1N4148.
3. ALL INDUCTORS ARE IN MICRO-HENRIES, 10%.
4. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
5. o—o INDICATES SHUNT SELECTABLE OPTION.
6. ✱ INDICATES J1, ▽2 INDICATES J2, ▽3 INDICATES J3, ▽4 INDICATES J4.
7. COMPONENT NOT INSTALLED.
8. PIN 4 OF ID IS GROUND.
9. R13 VALUE MAY BE 50K.

USED

REF DESIGNATION LAST USED	REF DESIGNATION NOT USED
C31	C20, 23, 24
CR19	
LS	
Q2	
R42	
RP5	
TP13	

TYPE	POS.	UNUSED	VCC (PIN)	GND (PIN)	VDD (PIN)
75453B	3F		8	4	—
LM311N	4A		—	1	8
NE592A	3A		—	5	10
7486	4C	4C2	14	7	—
9602	4B		16	8	—
2T2222	2A		—	—	—
2T2905	1C		—	—	—
50Ω	1E	2	—	—	—
PQ3725	4F		—	—	—

2-12

Read/Write Logic

TP13

K — MTR ON

CR6   1   R/W 1
XS400

2   1C   3
R19 20K

4   3
2   RP3   1   R20 604 1/8W 1%
5

12   1C   14   CR5   5   R/W 2
13   XS400
R18 20K

+5V
R23 909 1/8W   R24 75 1/8W
9   10   1C
8   CR9   3   ERASE
R21 20K

+12V
6   5   1C
7
RP3   C1 .033 20%   R22 274 1/8W 1%

9   2F   8
10

RP2   Q1 2N2222
4   3
4   R/W CT.
XS400
2   — ACTIVITY LED

+5V
R34 150

3   2C   4
+5V   1   RP5   2   8   ACTIVITY LED
+12V
CR16 1N4003
L   — HEAD LOAD

TP11
1F
7   8   6
HM
1   14   7   3F   5
HS

+ READ ENABLE XS400

+ OUTPUT ENABLE XS400

12   10
D   Q   9
11   C   8
1D   R   13

+5V
R38 270
+12V
1   4D   2   13   14
2E   4F   12   CR14 1N4003   N   ΦD

2   2D   1
3   3   3B   1
3B   10   5   2D   4   +5V
.33   R39 270
600   9   S/L   QA   15   13   4D   12   2   4F   3   CR15 1N4003   M   ΦC
2   J   14
10   CK   QB   13
3   K   QC
4-BIT   R40 270
4   A   SREG   QD   5   4D   6   7   4F   5   CR17 1N4003   R   ΦB
5   B   3D
6   C
7   D   R41 270
R   3   4D   4   9   4F   8   CR18 1N4003   P   ΦA
CR13 CR12 CR11   +5V   10
P8

1   2E   2   6   3B   4   2   2F   3   26   — TRACK ZERO
5   C16 300pf 500V 5%

6   RP4
+5V

2-14

Figure 13. Expansion Interface schematic diagram (sheet 1)

LINE PRINTER BUS
J4

Z49-74LS367

BUSY
OUT OF PAPER *
UNIT SELECT SLCT *
FAULT *

| 21 |
| 23 |
| 25 |
| 28 |

Vcc 20 10 Vss
4D   Q4
3D   Q3
2D   Q2
1D   Q1
8D   Q8
7D   Q7
6D   Q6
5D   Q5
CLK

Z48
74LS273

DATA 8
DATA 7
DATA 6
DATA 5
DATA 4
DATA 3
DATA 2
DATA 1

| 17 |
| 15 |
| 13 |
| 11 |
| 9 |
| 7 |
| 5 |
| 3 |

DATA STROBE * | 1 |

R34 4.7K   R24 4.7K

Z33
74LS123 R/C

R23 20K
C61 200pF

| 22 |
NC | 26 | 24 |
| 27 |
| 20 |
NC | 18 | 19 |
| 16 |
| 14 |
| 12 |
| 10 |
| 8 |
| 6 |
| 4 |
| 2 |
| 34 |
| 33 |
NC | 31 | 32 |
| 30 |
NC | 29 |

4D 4Q
3D 3Q
2D 2Q
1D 1Q
CLK
CLR

Z47
74LS175

R24 4.7K
Z33
74LS123 Q

R25 200K
C62 33 6.3V
LOW LEAKAGE

Z46
74LS20

DS3* | 32 |
DS2* | 14 | 12 |
DS1* | 10 |
DS0* | 16 |
MOTOR ON

HLT 23
RDY 32

Z41-7416

STEP 15
DIREC 16
WG 30
WD 31
HLD 28 NC

Z34-7416

STEP* | 20 |
DIRECTION SELECT * | 18 |
WRITE GATE * | 24 |
WRITE DATA * | 22 |
NC | 34 |
| 31 |
29	33
25	27
21	23
17	19

R22 150 R31 150 R32 150 R33 150

74LS04
Z32

FD DATA 27

WPRT 36
IP 35
TR00 34

READ DATA * | 30 |
WRITE PROTECT * | 28 |
INDEX PULSE * | 8 |
TRACK ZERO * | 26 |
| 15 |
| 13 | 11 |
| 9 |
NC | 6 |
NC | 4 |
NC | 2 |

J5
FLOPPY DISK BUS

Z42
FDI771B-01

DAL7
DAL6
DAL5
DAL4
DAL3
DAL2
DAL1
DAL0
INTRQ
CLOCK

3PM 18   STEPS & DIRECTION
TEST 22   FACTORY TESTING
XTDS 25   EXT DATA SEPARATION
FD CLOCK 26 INTERNAL DATA CLOCK
WF 33   WRITE FAULT
DINT 37   DISK INITIALIZATION

R29 10K

J3
BUFFERED
INTERFACE
BUS

NC | 1 |
J2-2 (SYSRES *) | 2 | 3 |
Z44-3 (A10) | 4 | 5 |
Z44-7 (A12) | 6 |
Z44-5 (A13) | 7 |
Z44-9 (A15) | 8 | 9 |
Z44-16 (A11) | 10 |
Z44-18 (A14) | 11 |
Z44-14 (A8) | 12 | 13 |
J2-12 (OUT *) | 14 | 15 |
Z30-10 (WR *)
J2-14 (INTAK*)
Z30-9 (RD *)
NC | 16 | 17 |
Z44-12 (A9) | 18 |
J2-18 (D4) | 20 | 21 |
J2-19 (IN*)
J2-20 (D7) | 22 | 23 |
J2-21 (INT*)
J2-22 (D1) | 24 | 25 |
J2-23 (TEST *)
J2-24 (D6) | 26 | 27 |
Z45-18 (A0)
J2-26 (D3) | 28 | 29 |
Z45-3 (A1)
J2-28 (D5) | 30 |
(GND)
J2-30 (D0) | 31 |
Z45-16 (A4) | 32 | 33 |
J2-32 (D2)
J2-33 (WAIT*) | 34 | 35 |
Z45-5 (A3)
Z45-14 (A5) | 36 | 37 |
Z45-7 (A7) | 38 | 39 |
Z45-12 (A6)
Z45-9 (A2) | 40 |

RE
WE
A0
A1
VDD
Vcc
VBB
DRQ
TG43
PH3
VSS
CS

MMUX * Z32-11 (SHT 2)
MCAS * Z27-12 (SHT 2)
MRAS * Z27-10 (SHT 2)

Z37-DDU-4-4-7835
Z38-74LSZ43

NOTES
1. UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE 1/4W 5%
ALL CAPACITORS ARE IN MICROFARADS

2. SYMBOLS LEGEND
△ + 12V
△ + 5V
▽ - 5V
▼ SIGNAL GND

Figure 13. Expansion Interface schematic diagram (sheet 2)

+12V
+5V
-5V

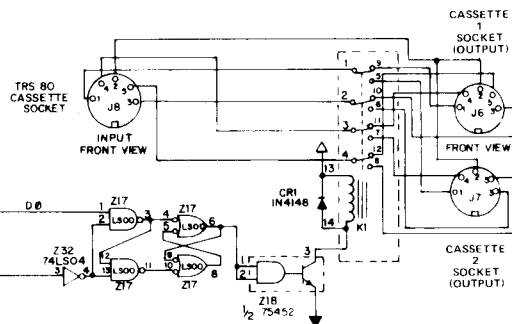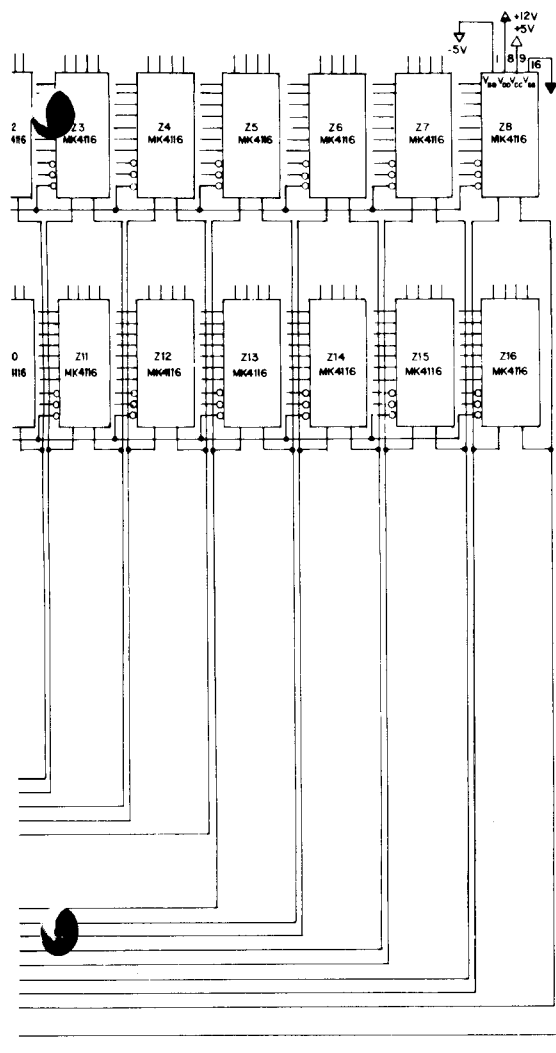Vss VDD VCC VBB
8 9 16

Z3 MK4116   Z4 MK4116   Z5 MK4116   Z6 MK4116   Z7 MK4116   Z8 MK4116

Z11 MK4116   Z12 MK4116   Z13 MK4116   Z14 MK4116   Z15 MK4116   Z16 MK4116

CASSETTE 1 SOCKET (OUTPUT)

TRS 80 CASSETTE SOCKET J8
INPUT FRONT VIEW

FRONT VIEW
J6

CASSETTE 2 SOCKET (OUTPUT)
J7

PIN
1 EN
2 GROUND
3 EN
4 CASSIN
5 CASSOUT

CR1 1N4148
K1

D0

Z17 LS00   Z17 LS00   Z17 LS00   Z17 LS00
Z32 74LS04
Z18 1/2 75452
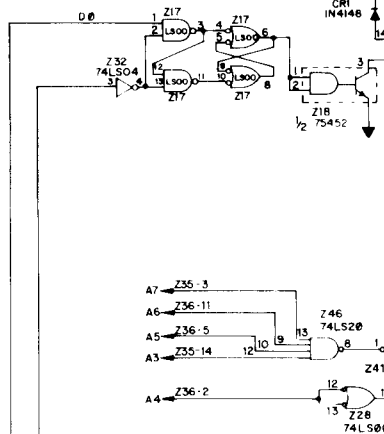
INTERNAL EXPANSION PIN-OUT

GND 42 41
Vcc 40 39
NC 38
NC 37

A7 Z35-3
A6 Z36-11
A5 Z36-5
A3 Z35-14

Z46 74LS20
R20 47K
Z41 7416

A4 Z36-2
Z28 74LS00
Z28 74LS00

E6 36
D6 35
34
D7 33 SYSRES
32 D4
D5 31
A1 30
A0 29
D0 28
D3 27
D2 26
D1 25
INT 24
IN 23
A2 22
OUT 21
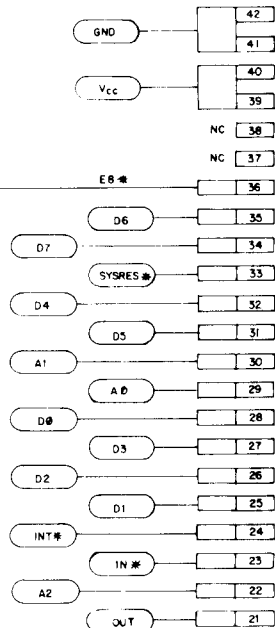
EXPANSION BOARD CONNECTOR J1

Q2 MJE2955
R12 0.33
R13

Q3 2N3904
R17 560

C46 +C52 47 16V
C10 C16 C30 C36 0.01 16V

C13,C19,C33,C39,C41,C42,C45,C49,C51,
C54,C58,C59,C64,C65,C66,C67,C68,
C69,C72,C73,C74,C75,C76,C77,C78,C79
0.1 50V

R14 47K
CR4 1N4735 10%

Q1 2955
R35 56 3W
R5 2.2K
R6 2K
R7 1K
R11 12K
R10 3.3K
C50 .001

+12V
+C56 47 16V
C12,C14,C18,C20 C32,C34,C38,C40 0.01 16V
C9,C11,C15,C17,C29 C31,C35,C37,C71 0.1 50V
C48 47

NC 20 19 NC
NC 18 17 NC
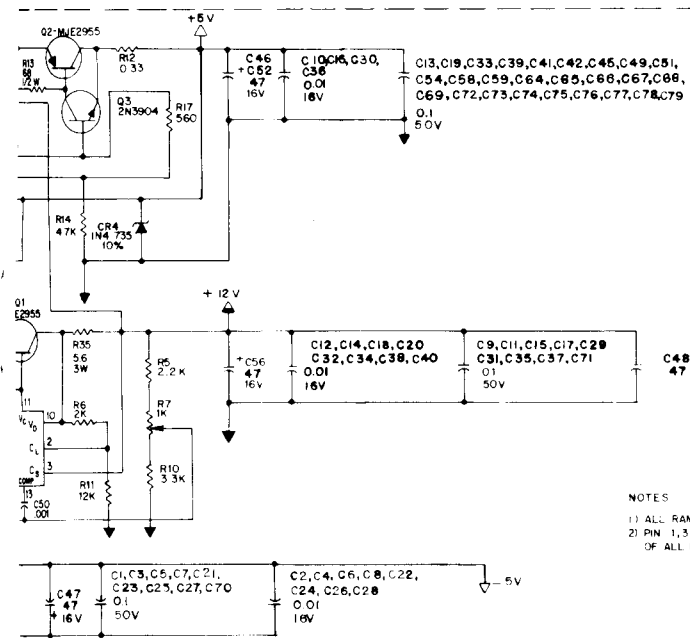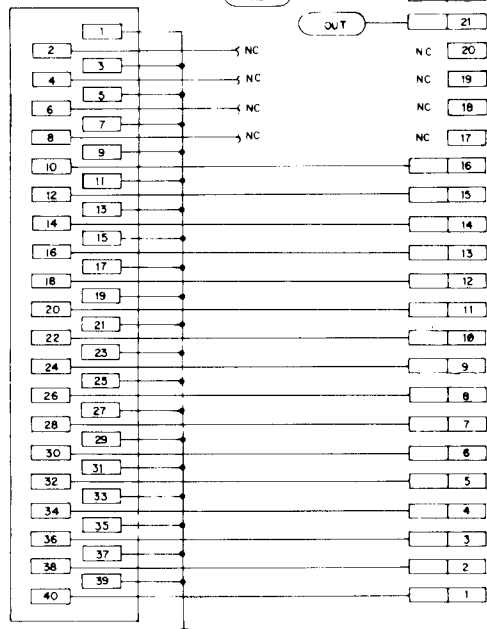
NOTES
1) ALL RAMS (MK4116) ARE IN 16 PIN SOCKETS
2) PIN 1,3,4,5,6,7,8,9,10,11,12,13 AND 16 OF ALL RAMS TIED IN PARALLEL.

-5V
C47 47 16V
C1,C3,C5,C7,C21, C23,C25,C27,C70 0.1 50V
C2,C4,C6,C8,C22, C24,C26,C28 0.01 16V

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