CP/M on TRS-80

Users Notes on CP/M configured for
the TRS-80 computer by Lifeboat
Associates and Small System Software.

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TRS-80 is a trade mark of Tandy Corporation.

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the parties above subject to a license
agreement covering use on a single computer
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for any particular purpose.

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The purpose of these notes is to explain the implementation
of CP/M on the TRS-80 of Radio Shack. (TRS-80 and Radio Shack
are trade marks of Tandy Corporation). They are intended only
to present differences between the system and utilities as
developed for this implementation and the system features
described in the accompanying Digital Research manuals. Users
must refer to the Digital Research manuals for guidance in use
of the system and utilities.

A) Memory Addresses

The CP/M for TRS-80 runs at a higher address than standard CP/M.
This difference is due to the presence of the Level II BASIC ROM
in low address memory. The PAGE 0 addresses described in the
manuals (ie those falling in the range 0 thru 0FFH) are in the
same relative locations starting at 4200H. Command files (files
with type .COM) are loaded at 4300H for execution. The file
DUMP.ASM on the distribution diskette is an example of such a
file in source form. Users are encouraged to assemble, load and
run this program to gain experience with the system utilities.

The system image in memory created by the MOVCPM utility or taken
from the system tracks of a disk by the SYSGEN utility have the
CP/M modules at these addresses:

BOOT LOADER	4700H
CCP	4800H
BDOS	5000H
BIOS	5D00H

The BIOS module has 5 pages allocated (i.e. 1.25K) of which only
about 4 pages are fully used. Owners are encouraged to experiment
with this part of the system and add to it as new uses and peri-
pheral devices are acquired. Lifeboat Associate and Small Systems
Software have attempted to put the most frequently sought drivers
into the distribution system, so modifications may never be nec-
essary.

B) Keyboard

The TRS-80 keyboard does not carry all the codes defined in the
ASCII set. The CONTROL shift is performed by depressing the
SHIFT and DOWN ARROW keys. All the CP/M utilities are unmodified
and respond to the CONTROL shifted keys as described in the
manuals. The BREAK key is coded to act as a CONTROL C.

C) Programs

1) PIP.COM   File transfer utility. The use is described in
               the manual Intoduction to Features and Facilities.
               The option delimiter characters are <> rather
               than the [] described, due to the absence of
               brackets in the TRS-80 keyboard.

2) FORMAT.COM Program to initialize a new diskette or one
               used previously for TRSDOS and Disk BASIC files.
               Diskettes MUST be formatted prior to use.

3) DCV2.COM   Program by Small System Software (SSS) to
               convert SYSTEM cassette tapes to Command files.
               See the SSS description of this utility.

4) DISKCAS.COM Backup utility by SSS to put disk files to
               tape. See the SSS description.

5) CASDISK.COM Program by SSS to restore backed-up programs
               from tape to disk. See the SSS description.

6) MOVCPM.COM Utility to generate CP/M systems using more
               memory than the 16K used in the distribution
               diskette. See the description in the manual
               Introduction to Features and Facilities.

7) SUBMIT.COM Batch-like utility. See the Introduction to
               Features and Facilities.

8) ASM.COM   Assembler for Intel 8080 mnemonic source code.
               See the manual CP/M Assembler (ASM) User's Guide.

9) LOAD.COM   Utility to convert a HEX format disk file, as
               produced by ASM, into a disk Command file.

10) STAT.COM   Utility to report on file sizes and free disk
               space and to alter I/O assignments. See the
               SSS notes and the manual Introduction to Features
               and Facilities.

C) PROGRAMS Continued

11) DDT.COM   Program to display and alter memory contents
               both by Hex value and mnemonic intruction, to
               load files into memory and to trace program
               steps reporting on register values. Designed
               only for the instructions in common between
               the Z80 and 8080 CPUs. See the manual CP/M
               Dynamic Debugging Tool (DDT) User's Guide.

12) ED.COM   Text editor to create and alter text files for
               use as programs or as documents. See the manual
               ED: A Context Editor User's Manual.

13) SYSGEN.COM Program to transfer system code from memory to
               diskette system tracks and vice versa. System
               code may also be saved as a file after fetching
               with SYSGEN or generating with MOVCPM. If this
               is done, the code may be later placed onto the
               system tracks of a diskette either by loading
               the file with DDT or by having SYSGEN perform
               the load directly. See the Introduction to
               Features and Facilities manual.

14) DUMP.ASM   Example program to experiment with using the
               ED, ASM and LOAD utilities.

D) OTHER COMMENTS

When you receive your system diskette, place a write-protect tab
onto it and resolve NEVER to write to that diskette. Make a
backup using the FORMAT, SYSGEN and PIP utilities if you have
more than one drive. For single drive users, use the FORMAT,
SYSGEN and DDT utlities to initialize the diskette and transfer
system code and files respectively.

Please return your registration card so that after-sales assistance
can be afforded to you.

The error message LOAD ERROR is not documented in the manuals. It
it caused by trying to run a Command file program with too little
memory available. Use the MOVCPM program to permit more memory
to be used. The sign-on message advises on the memory in use,
which can range between 16K and 48K.

SELECTION OF PRINTER AND KEYBOARD OPTIONS FOR CP/M

CP/M supports four different I/O devices: Console, Reader, Punch and List. Further, it is possible to assign four different software routines to each of the four I/O devices, for 16 options in all. To examine all of these options, type STAT VAL: <ENTER> and the following display will be presented:

```
CON: = TRS: LPT: R32: T32:
RDR: = XXX: XXX: XXX: XXX:    `
PUN: = XXX: XXX: XXX: XXX:
LST: = TRS: LPT: R32: T32:
```

The left column is the device: Console, Reader, Punch and List, respectively. As indicated in the table, the Reader and Punch are not used in the TRS-80 version. The Console, which is the main I/O device, and the List device both are initially set to TRS, which is the TRS-80 keyboard and video display. To determine the current settings, type STAT DEV: <ENTER>, which will cause the following display:

```
CON: IS TRS:
RDR: IS XXX:
PUN: IS XXX:
LST: IS TRS:
```

To change the LST device to T32 (TRS232), type STAT: LST:=T32: <ENTER>. Similarly, you may select any of the following options for either the Console or the List device:

OPTION	INPUT DEVICE	OUTPUT DEVICE
TRS:	TRS-80 Keyboard	TRS-80 Video Display
LPT:	TRS-80 Keyboard	Centronics (or equiv.)
R32:	RS-232-C	RS-232-C
T32:	TRS-80 Keyboard	TRS232

Selecting one of the above options for the CON: changes both the input and output device, while the same selection for LST: selects only the output device. Please note that it is possible to use an external keyboard with CP/M if you have the Radio Shack RS-232-C interface adapter.

NOTE: in order to activate the LST: device for output, type CONTROL P (Shift Down-Arrow P) from the Console. All output will then be directed to both the screen and the active List device.

SELECTING PRINTER PARAMETER OPTIONS

With the TRS232 printer interface or the RS-232-C adapter, you may select the Baud Rate, enable or disable automatic Line Feed characters and change the number of Null or Fill characters. Select the Baud rate for the RS-232-C by use of the sense switch inside the expansion interface; see your manual. All other options for these two devices are software selectable.

DEFAULT VALUES: The TRS232 is setup for a Baud rate of 300. Both the TRS232 and RS-232-C will output a line feed and 2 null characters following each carriage return. If your printer requires different values, you may create a special version of your CP/M program with the necessary modifications. Once made, the changes will become a permanent part of your version of CP/M.

ENTERING PRINTER PARAMETER CHANGES: First, you must make a copy of your system. Do this with the following sequence of commands (underlines indicate your entry; remainder is TRS-80 response):

SYSGEN <ENTER>

TRS-80 SYSGEN VER 1.5 FOR MINI DRIVES
SOURCE DRIVE NAME (OR ENTER TO SKIP)A
SOURCE ON A, THEN TYPE ENTER <ENTER>
FUNCTION COMPLETE
DESTINATION DRIVE NAME (OR ENTER TO REBOOT) <ENTER>

A>SAVE 31 CPM.COM <ENTER>

A>DDT CPM.COM <ENTER>

DDT VERS 1.4
NEXT PC
6200 4300
-

At this point you have a copy of your system in memory along with DDT, which will allow you to make changes to certain locations. The locations that must be patched to modify the printer parameters are the following:

ADDRESS	VALUE(s)	PARAMETER
5D2D:	E1 00	TRS232 Baud Rate
5D2F:	FF	Line Feed select
5D30:	02	Null or Fill characters

Change these values to correspond to the requirements for your particular printer. To prevent a line feed after a carriage return, change the value at 5D2F from FF to 00. Similarly, the number at 5D30 is the number of nulls (in hex) that will follow each carriage return. Changing this number from 02 to 0B will change the number of nulls from 2 to 11. Finally, if you are using the TRS232, the values at 5D2D and 5D2E should be changed to the values in the following table that correspond to your printer baud rate:

BAUD RATE	5D2D	5D2E	BAUD RATE	5D2D	5D2E
110	6A	02	450	95	00
134.5	F6	01	600	6F	00
150	C4	01	1200	36	00
300	E1	00			

To make the necessary changes using DDT, use the S (Substitute) command to modify the necessary memory locations. Type S ADDRESS <ENTER> and the address followed by the current value at the location will be displayed. Enter the new value followed by <ENTER> and the next address and value will be displayed. Type <ENTER> without any values and the location remains unchanged. To exit the S command, type a period. For example, to change the baud rate to 110, leave the line feed selection unchanged, and change the number of nulls to 6, the following sequence would be used:

```
-S5D2D <ENTER>

5D2D  E1  6A<ENTER>
5D2E  00  02<ENTER>
5D2F  FF  <ENTER>
5D30  02  06<ENTER>
5D31  31  .<ENTER>
-
```

(Notes)
Enter 2-byte code for
baud rate of 110.
No change here.
06 for 6 Nulls.
"." to exit S command.

At this point you have modified your system to match your printer configuration, and you are ready to place the modified system back onto your disk. To do this, exit DDT by typing BREAK. When CP/M reboots, go through the following sequence:

```
A>SYSGEN <ENTER>

TRS-80 SYSGEN VER 1.5 FOR MINI DRIVES
SOURCE DRIVE NAME (OR ENTER TO SKIP) <ENTER>

DESTINATION DRIVE NAME (OR ENTER TO REBOOT)A
DESTINATION ON A, THEN TYPE ENTER <ENTER>
FUNCTION COMPLETE
DESTINATION DRIVE NAME (OR ENTER TO REBOOT)
```

You now have your modified system on the disk in drive A. You may now modify additional disks, or simply type ENTER to return to CP/M. Your modification is now complete.

LOWER CASE OPERATION WITH CP/M

Small System Software has added a routine to CP/M to allow use and display of lower case letters for people that have modified their computers for use with the Electric Pencil. The routine is completely transparent, and is incorporated in the CP/M boot routines. To use, simply activate your lower case modification, then press reset to boot CP/M. A special routine in the boot checks the screen to see if bit 6 has been enabled. If it has, the lower case display routine is activated. Lower case letters are entered from the keyboard using the LEVEL-II convention, which means that the SHIFT key is depressed to enter lower case letters.

DCV2: CP/M UTILITY FOR CONVERTING SYSTEM TAPES TO CP/M FILES

DCV2 is a special utility program furnished by Small System Software which converts TRS-80 SYSTEM tape programs to CP/M "COM" files which may be executed directly by CP/M, even if they must occupy a section of memory where CP/M resides. The program is invoked by the command:

DCV2 <filename.ext>

where the filename parameter is optional. The program will sign-on with the following display:

DCV-2 V-1.0 (C) 1978
SMALL SYSTEM SOFTWARE

PREPARE SYSTEM TAPE FOR LOADING AND PRESS ENTER

Place your SYSTEM tape into your player, press the playback key and then press ENTER. Your tape will load with the familiar stars in the upper right. If you achieve a successful load, your screen will clear and you will see:

```
TAPE PARAMETERS
    NAME    name
    START   XXXX
    END     XXXX
    EXECUTE XXXX
```

DISKFILE WILL BE NAMED: name.ext
PRESS ENTER TO CONTINUE:

The tape parameters are the values recorded on the tape in the standard SYSTEM format, and are displayed for information only. The name used for the diskfile will either be the name you typed when you accessed DCV2, or, if you did not enter a name, will be the same as the name on the SYSTEM tape with an extension of .COM (the .COM extension is directly executable by CP/M). If everything is satisfactory, press ENTER, the disk will run, and you will see the message, DISK FILE COMPLETE when finished. Your SYSTEM tape is now on disk.

LIMITATIONS: DCV-2 will convert nearly any SYSTEM tape to a disk file. This includes all of the SMALL SYSTEM SOFTWARE programs except BASIC-1/1P. It will also convert other SYSTEM tapes, but there are limitations. Nearly all SYSTEM tapes load into memory in a continuous manner, each block of 256 bytes following the previous block. If the loading sequence is not continuous, DCV will detect this and will abort, printing an error message. DCV-1 will not convert non-continuous SYSTEM tapes to disk files.

DISKCAS - CP/M UTILITY FOR CASSETTE BACKUP

DISKCAS is a special utility program furnished by Small System Software which allows transfer of CP/M files directly to cassette for inexpensive backup or for program exchange. The program is invoked by the command:

DISKCAS filename.ext

You MUST specify a file when accessing this program. Failure to do so will result in the following display:

SMALL SYSTEM SOFTWARE DISK-CASSETTE UTILITY
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PREPARE TAPE FOR RECORDING, THEN INVOKE WITH:

        "DISKCAS FILENAME.EXT"

and control will revert to CP/M. When accessed with a proper file name and extension, you will see the same heading as above with the following message:

PREPARE RECORDER THEN PRESS ENTER -

At this point be sure you have a tape in the recorder, check to see that the small recorder control plug is installed, press the record button, then, when all is ready, press ENTER. The disk will run for a few seconds, then the file name and length will be displayed on the screen. The tape will run for a few seconds while the name and length are written on the tape. The disk will run again while the file is written into a RAM buffer. The tape will now start again, and you will see the message:

WRITING BUFFER -

After writing is complete, the word WRITTEN will appear and, if your file is more than 4K bytes long, the disk will run again while the buffer is refilled. a second WRITING BUFFER will appear and the tape will start again. This sequence will continue until the entire file is on tape. At this point, the message:

TAPE BACKUP COMPLETE

will appear and control reverts to CP/M. Your file is now on tape. Note that the sequence on tape is a short file header followed by a number of 4K blocks with a final block which is generally shorter than 4K. Eack 4K block will require about 70 seconds to write.

CASDISK: CP/M UTILITY FOR RECOVERING DISKCAS TAPE FILES

CASDISK is a special utility program furnished by Small System Software which allows transfer of CP/M tape files created by DISKCAS back to CP/M disk files. The program is invoked by the command:

CASDISK <filename.ext>

where the filename parameter is optional. The program will sign-on with the following display:

SMALL SYSTEM SOFTWARE CASSETTE-DISK UTILITY
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BE SURE TAPE RECORDER IS SETUP AND RUNNING -

If you prepared your recorder in advance, it should be running now. If not, place the tape in the proper position and press the playback control. The computer will read the title block and display the following message:

TAPE FILE NAME: tapename.ext
XXX 128-BYTE SECTORS

DISKFILE WILL BE NAMED: diskname.ext
PRESS ENTER TO CONTINUE: -

"tapename.ext" is the name that was placed on the tape at the time of recording. "diskname.ext" will either be the name typed in when CASDISK was initiated, or, if no filename was entered, will be the same as tapename.ext. Note that if the tape you are loading was not written with CASDISK, an error message will be displayed and the program will be aborted. A tape error will result in the same action, and the program will have to be re-started. If you are satisfied with the name you have chosen and the tapefile is the one you expected, press ENTER. The disk will run for a few seconds while the diskfile is created and opened. You will then see the message:

LOADING BUFFER -

The tape will begin running again and two stars will appear in the upper right of the screen with one blinking at about a 4 second rate. When the buffer is full, the above line will be completed with "LOADED", the tape will stop and the disk will run. The sequence will be repeated until the last block is read, at which time a "LAST BLOCK LOADED" will be displayed. Shortly after this message a final message will appear:

DISK FILE COMPLETE

Control is now returned to CP/M and your new file will appear in the directory.