

TRSTOS

TRS-80 Tape Operating System & Extended BASIC

Operating Instructions

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TRSTOS was written in the early 1980's as an attempt to provide much of the functionality of Disk BASIC to a cassette-based TRS-80. An early version, along with a manuscript, was submitted to 80 Microcomputing magazine in 1982. 80 Micro expressed interest in publishing TRSTOS, and paid its author \$250. Unfortunately, the program or manuscript was never published.

TRSTOS is a machine-language program that loads in low memory, just before the program statement table. As such, it is compatible with other machine-language programs that run either in protected high memory (through the 'Memory Size' setting) or embedded into BASIC strings. Some of the features include:

- Full-text error message display.
- An error locator that prints an erroneous line with a '?' at the location of the error (similar to Level I BASIC).
- An upgraded video driver compatible with the upper/lower case modification.
- An upgraded keyboard driver with the following enhancements:
 - Character repeat.
 - <Shift> 0 Caps Lock.
 - Single keystroke entry of BASIC commands, using the shift key.
 - Line Manipulating keys allowing the listing and editing of lines with single keystrokes.
 - Abbreviations for commonly used immediate mode commands.
- Screen printer accessible via <Shift> <Down Arrow> <@> or USR(0).
- Data conversion:
 - &H, &O, &B, and &D to convert from Hex, Octal, Binary or Decimal strings to integers.
 - &H\$ to convert from integer to Hexidecimal string
- Tab Extender allows TAB() up to 255.
- Fully integrated machine language debugger (called EZBUG), accessible via <BREAK> key.

- Language extensions:\
 - NAME – Renumber BASIC programs.
 - MERGE – Concatenate BASIC program on tape to one in memory.
 - CMD"D" -- Toggle <BREAK> key activation of debugger.
 - CMD"K" -- Toggle immediate mode command abbreviations.
 - CMD"U" -- Set Caps Lock programmatically.
 - CMD"L" -- Set lowercase programmatically.
 - DEFAUTO – Preset a string that is appended to all lines generated by the AUTO command.
 - GETDATA – Automatically generate DATA statements from data stored in memory.
 - DEFUSRn and USRn for up to 10 machine-language entry points.

Please note that the source code contains no programmer's comments. This was not always the case. TRSTOS was written over a 2 year period, with features added as I developed the ideas (and got ideas from others). Unfortunately, the program grew to a point where EDTASM, which is a memory resident Editor and Assembler, could no longer assemble the whole program with the comments in the limited 48K RAM space. Therefore, the comments were stripped in favor of additional features.

If running TRSTOS under TRS-80 emulation software, some emulators do not faithfully reproduce the clock speed and/or keyboard characteristics well enough for TRSTOS to be usable. For instance, Tim Mann's XTRS will not produce the keyboard repeat on the immediate-mode command line, but repeats way too fast when editing lines of BASIC.

I have found that David Keil's TRS-80 Model I emulator works perfectly at 1.77 MHz, and has the added benefit of being able to change the clock speeds when loading from tape.

As a historical note, I was 13 years old when I started writing TRSTOS.

LOADING TRSTOS

Insert the TRSTOS cassette into the CTR-80 (or use TRSTOS.CAS if using an emulator) and set the player to play.

Type:

SYSTEM

*? TRSTOS

TRSTOS will load. When complete, the TRS-80 will automatically reboot and prompt with

Memory Size?

Press <ENTER> or enter a desired memory size, followed by <ENTER>. After a few seconds, the following will be displayed:

```
RADIO SHACK LEVEL II BASIC
TRS-80 Extended Cassette BASIC 1.0
by Dennis Cardinale
```

```
Ready
>_
```

USING TRSTOS

TRSTOS is installed with the following defaults:

- Caps Lock is ON
- Autokey (single keystroke keyboard entry) is ON
- EZBUG debugger is OFF
- USR0 is set to print screen. USR1-USR9 undefined.

Keyboard stuff:

Press and hold a key. You will see that the keyboard now.

Press <SHIFT> and a letter. You will see that a keyword is automatically typed. The keystroke to keyword map is:

A) ASC(	B) STRING\$(	C) CLEAR	D) DATA
E) ELSE	F) FOR	G) GOTO	H) GOSUB
I) INPUT	J) INKEY\$	K) RANDOM	L) LPRINT
M) MID\$(	N) NEXT	O) OUT	P) POKE
Q) PEEK(	R) RETURN	S) STEP	T) THEN
U) USING	V) VARPTR(	W) STR\$(	X) SET(
Y) RESET(	Z) POINT		

To disable automatic keywords, type CMD"K". Type CMD"K" again to re-enable.

Type in a small program. Make some errors. When you try to run the program, the error will be displayed in full-text, the line will be printed, and a question mark will show the location of the error.

Try the Line Manipulating Keys (LMK's). The are:

Period: show current line

Comma: edit current line

Up Arrow: show previous line

Down Arrow: show next line

Shift Up Arrow: show first line

Shift Down Arrow: show last line.

Try lowercase mode: Type <SHIFT> 0 or CMD"L". To go back to upper case mode, type <SHIFT> 0 again or CMD"U". Note: The keyword abbreviations are disabled in lowercase mode.

To print the screen, type <SHIFT> <Down-Arrow> @ or USR(0).

ABBREVIATIONS

TRSTOS allows some command to be run via abbreviations on the immediate-mode command line. For a character to be recognized on the command line, it must be the first uppercase character on the line. Standard arguments for each abbreviated command will be accepted, just as if the command itself was typed. The abbreviations accepted are:

A – AUTO

C – CONT

D – DELETE

E – EDIT

L – LIST

M – MERGE

R – RUN

S – SYSTEM

BASIC EXTENSIONS

Try the base conversions:

```
>PRINT &H3C00
15360
>PRINT &H$15360
3C00
```

Also try &B, &O and &D.

To automatically generate DATA statements, use the GETDATA command:

GETDATA start address, end address, starting line number

DATA statements will be generated for all memory locations within the start address to end address range, beginning at the starting line number, with 10 data items per line.

In standard Level II BASIC, the AUTO command can be used to automatically type line numbers for you. In TRSTOS, you can also prefix each line with a string by using the DEFAUTO command:

DEFAUTO="string" where string is the string with which to prefix each line. For instance:

```
Ready
>DEFAUTO="DATA "
>AUTO 1000
1000 DATA _
```

To clear the DEFAUTO string, use DEFAUTO=" ".

As in Disk Basic, you may use DEFUSRn=addr and USRn(arg) for user machine-language routines.

To renumber a BASIC program, type NAME startnum, endnum, increment. All parameters are optional. No parameters rennumbers the whole program. No increment uses an increment of 10.

To merge a program from tape to a program in memory, use MERGE. The program on tape will be appended to the one in memory. You should be sure that the line numbers in the program in memory are smaller than those on the tape.

Finally, TAB(n) with $0 \leq n \leq 255$ may be used in PRINT and LPRINT statements.

EZBUG

EZBUG is the integrated machine language monitor/debugger incorporated into TRSTOS. With EZBUG, you can display and change memory and registers, load and save machine-language programs from and to tape, search for byte patterns, debug programs using up to three breakpoints, and fill and move memory blocks.

If EZBUG is not required, it may be unloaded (and memory reclaimed) by typing KILL <ENTER>. This will erase any program in memory.

To start EZBUG, first activate the <BREAK> key by typing CMD"D". Now, anytime the <BREAK> key is pressed, EZBUG will immediately start. The command-line prompt in EZBUG is a colon (:).

The command-line commands are ([] = optional parameter):

D[aaaa]	Display address aaaa
J aaaa [b1 [b2 [b3]]]	Execute code at aaaa with breakpoints at b1, b2, and b3.
C [b1 [b2 [b3]]]	Continue execution at PC with breakpoints.
R[r]['][nnnn]	Display/modify register pairs (i.e. RB' 1234 sets pair BC' to 1234).
RF[']	Display status register bits.
L	Load machine-language program from tape.
W start end xfer name	Write machine-language program to tape.
S nnnn "string	Search for ASCII string starting at nnnn.
S nnnn [aa[bb]] [cc[dd]] ...	Search for byte patterns starting at nnnn.
B	Return to BASIC.
M start end dest	Move memory range start to end to dest.
F start end bb	Fill memory start to end with bb.
H ddddd	Convert decimal number ddddd to hexadecimal.

In the display (D) mode, the following keystrokes are available:

- <UP ARROW> move display up 1 line.
- <DN ARROW> move display down 1 line.
- <SH><UP ARROW> move display up 1 page.
- <SH><DN ARROW> move display down 1 page.
- <D> display another address.
- <BREAK> escape back to command line (or out of continuous update (U) mode, or modify memory (M) mode).
- <U> Continuously update memory display (<BREAK> to exit).
- <A> Set memory modification mode to ASCII.
- <H> Set memory modification mode to HEX.
- <M> Modify memory (<BREAK> to exit).

Enjoy. Send comments to Dennis Cardinale at dennis@core-enterprises.com.