

terak
CORPORATION

RT-11/85A OPERATING SYSTEM
VERSION 3B RELEASE GUIDE

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REV 2

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 ***** RT-11/85A OPERATING SYSTEM *****
 ***** VERSION 3B RELEASE GUIDE ***** Rev 2
 ***** Pub no. 62-0029-001 *****

The following documents and disks are contained in the Terak version of the DEC RT-11 operating system software. If any of the items are missing, contact the Terak Software Service Group.

DOCUMENTS:

1. PDP-11 LANGUAGE REFERENCE MANUAL (DEC AA-5075A-TC)
2. RT-11 ADVANCED PROGRAMMERS GUIDE (DEC AA-5280B-TC)
3. RT-11/85 OPERATING SYSTEM RELEASE GUIDE (This document)
4. RT-11 SYSTEM MESSAGE MANUAL (DEC AA-5284B-TC)
5. RT-11 DOCUMENTATION DIRECTORY (DEC AA-5285C-TC)
6. RT-11 V3B SYSTEM RELEASE NOTES (DEC AA-5286B-TC)
7. RT-11/85A SOFTWARE PRODUCT DESCRIPTION (TERAK 52-0011-001)
8. RT-11 V3B POCKET GUIDE (DEC AV-5287B-TC)
9. RT-11 V3B MANUAL DIVIDER SET (DEC AV-D172B-TC)
10. TECO POCKET GUIDE (DEC AV-D530A-TK)
11. RT-11 SYSTEM USER'S GUIDE (DEC-11-ORGDA-A-D)
12. INTRODUCTION TO RT-11 (DEC-11-ORITA-A-D)
14. RT-11 TECO RELEASE NOTES (DEC-11-ORTNA-A-D)
15. PDP-11 TECO USER'S GUIDE (DEC-11-UTECA-A-D)
16. 2 each 8510/a SYSTEM REFERENCE CARD (TERAK 62-0022-001)

DISKS:

1. STANDARD MONITORS (61-0008-001) (Multidrive handler, SJ + FB monitors)
2. SYSTEM PROGRAMS (61-0008-002) (RT-11 Utilities, Assembler, Linker, etc)
3. EXTRA UTILITIES (61-0008-003) (EL, XM Monitors. 8510/a utilities)
4. SINGLE DRIVE MONITORS (61-0008-004) (With single disk drive handlers)

Upon receiving these disks, the manager of the software installation site should immediately:

- 1) scan each disk for damaged data,
- 2) verify the directory contents of each disk, and
- 3) make a backup copy of each disk.

These procedures are documented in the RT-11 manuals (see SYSTEM USERS GUIDE), and are summarized here for convenience.

Following this, working copies of the disks should be generated, and the demonstrations run to familiarize the user with the software system. The manuals INTRODUCTION TO RT-11 and SYSTEM USERS GUIDE should be read immediately. Eventually, all manuals should be read thoroughly.

RT-11 version 3b for the Terak 8510/a graphics computer system was designed to be as similar as possible to the Digital Equipment Corporation release. This was done so the user could take advantage of the excellent documentation available in the Version 3 manuals published by Digital Equipment Corporation. This documentation is part of the standard RT-11/85a software kit available from Terak. It is assumed in these release notes that the user has this documentation present.

For the user already acquainted with RT-11 V3b, the only differences between the DEC release and the Terak release are:

- 1) The System disk handler, QX.SYS, replaces the standard floppy handler. The handler is functionally compatible with the DEC handler, as viewed from the user software.
- 2) The character set of the Terak 8510/a must be initialized by the system software. This character set is fetched from a system file named CHRSET.SYS, which must be present on disks that are used to boot a system that has been turned off. (If the Terak system has not been turned off since the last character set load, and the bootstrap finds no file CHRSET.SYS, the previously loaded character set is retained.) The user may select a character set from any of those provided in the software kit by renaming that character set to CHRSET.SYS.
- 3) The console display of the 8510/a is emulated by a resident handler. There are two standard emulators available. They are documented later in these notes.
- 4) The selected emulator is a fundamental variation of the Monitors provided. The other variations are the single drive disk handler, and four variations of the RT-11 system: Base Line, Single Job, Foreground/Background, and Multiterminal. These variations are documented here.

The four RT-11 disks comprising the normal distribution set contain both the standard Digital Equipment Corporation RT-11 V3B programs and a set of programs specifically generated for use on a Terak 8510a. This special set of programs includes a set of 14 monitor programs, QX.SYS, and CHRSET.SYS. Due to the larger size of the monitors, it was decided not to distribute the material required for generating a monitor. One or more of the monitors should meet the needs of almost all users.

The following sections should be read as required for installation, programming, or customization.

- I Disk backup procedures for multidrive systems;
- II Disk backup procedures for single drive systems;
- III Monitor description and selection;
- IV Space problems and solutions;
- V Characteristics of V3B terminal emulators;
- VI Character sets;
- VII Disk directories.

Note that the default system device name 'DK:', which is used in the following instructions, is identical in meaning to 'QX:', the system handler for a Terak 8510/a. In the following, <return> indicates that the return key is to be typed at that point in the command dialog. <CTRL>X means to type Control X by first pressing the CTRL key (like pressing the shift key) and then simultaneously typing the indicated letter key (X is this case).

SECTION I
DISK BACKUP PROCEDURE FOR MULTIDRIVE SYSTEM

If your Terak 8510/a has two or more drives:

- (1) turn the system on (or press power switch upward and release);
- (2) insert into the bottom drive (QX0) any one of the following three distribution disks: (a) the Multidrive Monitor disk, (b) the Extras disk, or (c) the System Programs disk. The system should boot and respond with

```
RT-11      V03B-00  .XXX
```

```
.LOAD TT:
```

```
.SET USR NOSWAP
```

```
.SET TT:SCOPE
```

The dot (.) is the monitor level prompt. The letters that appear where XXX is shown above identify the particular monitor that has booted. This is documented later in this manual.

- (3) Now take a blank disk, put on an appropriate label (for example: 'Copy 1 of Multi Drive Monitor' if you had used the Multidrive Monitor disk at step 2 above) and insert it in the second drive, QX1.
- (4) Respond to the monitor prompt (.) with the command

```
COPY/DEVICE DK: DK1:<Return>
```

If you make an error in typing a command you may either (a) backspace over your error to correct it or (b) use the delete key. The system usually does not act on a command until you hit the Return key. (Important exceptions to this are the control commands executed by simultaneously pressing the CTRL key and the appropriate letter key, for instance <CTRL>C, which is a command to exit the current activity and return to the (.) prompt.) The system will respond with the statement

```
DK1:/Copy are you sure?
```

At this point you must be absolutely certain that the statement says DK1: rather than DK:. If it does say DK: hit the Return key only, and the system will respond with another monitor prompt (.); then reenter the COPY/DEVICE command exactly as shown above.

- (5) Once the system has responded with exactly the statement above, type

```
Y<Return>
```

After about one minute, the system should return with the (.) prompt. This indicates that the disk in drive QX0: has been successfully backed up onto the disk in drive QX1:. If any other messages occur, attempt the procedure again. If failure persists, contact the Terak Software Service Group. The above procedure should be used to back up the 'STANDARD MONITORS', 'SYSTEM PROGRAMS' and 'EXTRA MONITORS and UTILITIES' disks. Repeat the above (steps 1 - 5) with the following modification at step 1: you need not turn the system off and then back on, but should instead reboot by pushing the top half of the toggle switch on the 8510 and then releasing it.

Next, use the following procedure to back up the 'SINGLE DRIVE MONITORS' disk.

- (1) Boot any one of the three disks you have created above.
- (2) In response to the monitor prompt(.), type:

R DUP<return>

To run the program DUP.SAV. DUP will respond with:

*

- (3) In response, type:

DK1:A=DK:/I/W<Return>

DUP will respond with:

continue?

- (4) DO NOT type a response yet. Remove the multidrive system disk from drive QX0: and insert the SINGLE DRIVE MONITORS DISK into the bottom disk drive (QX0) and an appropriately labeled blank disk in the upper drive (QX1).

CAUTION

Before you proceed check that your command was entered exactly as shown above and that the supplied single drive disk is in the bottom disk drive and a blank disk is in drive 1.

- (5) Once you are absolutely sure that everything is correct, type:

Y<Return>

After about one minute, the system should return with the message:

Insert system disk, Are you Ready?

This indicates that the disk in drive QX0: has been successfully backed up onto the disk in drive QX1:. If any other messages occur, attempt the procedure again. If failure persists, contact the Terak Software Service Group.

- (6) Remove the single disk drive disk from drive QX0:. Insert into the bottom drive the original system disk and type:

Y<Return>

- (7) and then to DUP's prompt (*) type

<Ctrl>C

You will be returned to the monitor command level and (.) prompt. At this point you will have completed the backup of all the RT-11 system disks. Put the original disks you received in this software kit in a safe place, and use the disks that you have just created for the remainder of this procedure. The single-drive monitor disk contains monitors and a disk handler that are incompatible with the multidrive monitors and disk handler. Since you will use this disk only on single disk drive systems, place it in a safe place for possible later use on such systems.

SECTION II
DISK PACKUP PROCEDURE FOR SINGLE DRIVE SYSTEM

- If your Terak has only one drive (standard in the E510 unit):
- (1) turn the Terak on (or press power switch upward and release);
 - (2) insert the Single-drive Monitor disk.

Note - all 4 distribution disks will boot on your system, but to duplicate disks you must use the Single-drive Monitor disk. The system should boot and respond with:

```
RT-11SJ    V03P-00  .SGS
```

```
.LOAD TT:
```

```
.SET USR NOSWAP
```

```
.SET TT:SCOPE
```

```
.
```

The dot (.) is the monitor level prompt.

- (3) Now take a blank disk, and put on an appropriate label such as: 'Copy 1 of Single Drive Monitors'.

- (4) Respond to the monitor prompt (.) with the command

```
COPY/DEVICE DK: DK1:<Return>
```

If you make an error in typing a command you may either (a) backspace over your error to correct or (b) use the delete key. The system usually does not act on a command until you hit the Return key. (Important exceptions to this are the control commands executed by simultaneously pressing the CTRL key and the appropriate letter key, for instance <CTRL>C means CTRL and the letter C.) The system will respond with the statement

```
DK1:/Copy are you sure?
```

At this point you must be absolutely certain that the statement says DK1: rather than DK:. If it does say DK: hit the Return key, and the system will respond with another monitor prompt (.) and reenter the COPY/DEVICE command exactly as shown above.

- (5) Once the system has responded with exactly the statement above, type

```
Y<Return>
```

At this point the system will read some of the disk into memory and then respond with the command for you to

```
$MOUNT LOGICAL DISK 1 INTO QXØ
```

(6) Insert the blank disk labeled in step 3. The system will automatically write onto that disk the information it has read into memory. After it has finished writing it will issue the command for you to

```
$MOUNT LOGICAL DISK Ø INTO QXØ
```

(7) Insert the Single Drive Monitor disk; the procedure will repeat for a total of seven complete cycles. Be careful - if a disk is not completely inserted the system may crash in which case you will have to restart. Do not get the disks mixed up. After this process has been completed the system will respond with the monitor prompt (.).

This completes the back up of the Single Drive Monitor disk. Put the original Single Drive Monitor disk away at a safe place and boot the copy that you have just made by inserting it in the drive (QXØ) and pushing the upper half of the toggle switch on the 851Øa.

Use the following procedure to copy the remaining three distribution disks.

(1) In response to the monitor's prompt (.) type

```
R DUP<Return>
```

DUP will respond with the prompt

*

(2) In response, type

```
DK1:A=DK:/I/W<Return>
```

DUP will respond with

continue?

(3) DO NOT type a response UNTIL you have (a) REMOVED the Single Drive Monitor disk, (b) INSERTED into the disk drive one of the three remaining distribution disks such as the System Program disk, AND (c) placed a label on a blank disk showing that it is a copy.

(4) Once you are ready and are sure everything is OK type

```
Y<Return>
```


The system will now read in part of the distribution disk that you have inserted and then respond with the command for you to

```
$MOUNT LOGICAL DISK 1 INTO QX0
```

(5) Insert the blank disk which in step 3 you labelled and the system will automatically write onto that disk the information it has read into memory. After it has finished writing it will issue the command for you to

```
$MOUNT LOGICAL DISK 0 INTO QX0
```

(6) Insert the distribution disk; the procedure will repeat for seven complete cycles. Finally, the system will respond with the statement:

```
Insert system disk, Are you Ready?
```

(7) Insert into the drive the Single-drive Monitor disk and then type:

```
Y<Return>
```

and then repeat the above procedure for the remaining two distribution disks; specifically, in response to DUP prompt *, type:

```
DK1:A=DK:/I/W<Return>
```

and the system will respond with:

```
continue?
```

As before you must carefully check to make sure everything is correctly entered and then type:

```
Y<Return>
```

This time the command you receive will be slightly different. The disk handler program isn't sure which disk you have in so it reminds you at this point:

```
$MOUNT LOGICAL DISK 0 INTO QX0
```

If you have already inserted the correct disk, this may be confusing. Partially remove the disk, verify that it is the source disk, then reinsert it in the drive. (If it is not the desired source disk, remove it, and insert the correct source disk.) Then go through the procedure as above.

Once you have finished copying the distribution disks, type
<Ctrl>C

to DUP's prompt *. Again the disk handler program isn't sure which disk you have in so it reminds you at this point.

```
$MOUNT LOGICAL DISK 0 INTO QX0
```

If you have followed the instruction "Insert system disk, Are you ready?" you will already have the correct disk in the system. Partially remove the disk, check that it is the Single-drive Monitor disk, and if so, reinsert it. If it is not the Single-drive Monitor disk, remove it, and insert the Single-drive Monitor disk. This will return you to the monitor command level. At this point you will have completed the backup of all the RT-11 system disks. Put away both the master disks and the copies of the multidrive monitor disk in a safe place, and use for the rest of the procedure the disks you have just created. (There is no material on the multidrive disk that you will need until you obtain a second disk drive.) The Extras disk and the System Programs disk contain useful information that you will need. As soon as you have decided in step 3 below, which monitor you want to use, take these two disks and delete both the system monitors and the disk handler. Replace the monitor with the single disk drive monitor that you have selected, and replace the disk handler on these disks with the single disk drive disk handler.

SECTION III MONITOR DESCRIPTIONS AND SELECTION

At this point, it is safe to boot all the disks that you have created. You may look at their directories by using either of the two commands

.DIR

or

.DIR/ALP

These two commands are abbreviations for DIRECTORY and DIRECTORY/ALPHABETIZE; if you prefer, you may use the full unabbreviated command. The directories of each disk may be verified against the listings presented later in this document. When you boot each disk you will see, after "RT-11 V03B-00", an extension. This is the code extension of the monitor on the disk with the filename extension .SYS. Monitors for the Terak 9510/a fall into two distinct types: those for multidrive and those for single-drive systems. If you have a multidrive system you will probably never use the single-drive monitors. Monitors are also classified according to the type of job(s) that they can run. These are base line, single Job, foreground/background, and multi-terminal monitors. A Third classification determines the type of screen emulator which is linked into the monitor file. The emulators in the release kit are: a glass teletype, and the Terak standard emulator. Other terminals could be emulated, but are not released with this software kit.

The first letter in the extension will be B or S for single job monitors and F or M for foreground/background monitors. B stands for baseline, S stands for single job, F stands for foreground background, and M stands for multiterminal. The distinction between these monitors is described in the DEC RT-11 literature. The middle letter indicates the terminal emulation mode: G stands for the glass teletype emulator; while T stands for the Terak standard emulator. The last letter in the extension will be an M for multidrive monitors, or an S for single drive monitors. The hierarchy of monitors is given below:

MONITOR EXTENSIONS, SIZES IN BLOCKS, FREE HANDLER SLOTS,
AND USER SPACE IN KW

Last Letter

M or S

First Letter

B S F M B S F M

Middle
Letter

T G T G T G G T G T G T G G

BTM	BGM	STM	SGM	FTM	FGM	MGM	BTS	BGS	STS	SGS	FTS	FGS	MGS
63	60	64	62	73	71	76	63	60	64	62	73	71	76
3	3	3	3	5	5	5	3	3	3	3	5	5	5
25.8	26.3	25.5	25.9	23.6	24.1	22.9	25.8	26.3	25.5	25.9	23.6	24.1	22.8

For users for whom a single job monitor is adequate (see the DEC manuals for detailed explanations) either the STM or SGM monitor (or their single drive equivalents STS and SGS) will work well. We have found most users prefer the STM monitor, except in the most space-critical applications, where they have had to use the BGM monitor. Likewise, we have found foreground/background users generally prefer the FTM monitor. The baseline monitor is rarely used, largely because it provides fewer error messages and no timer support.

All the monitors except the baseline monitors, were generated with the QX, TT, and NL device handlers. In the baseline monitors, NL was omitted. In addition 3 or 5 free slots were included (for single- job, foreground/background, respectively) for additional devices. To add a new device handler, use the INSTALL command as described in RT- 11 V3B System Users Guide. We have found it often convenient to put the INSTALL command, and sometimes LOAD commands, in the system startup command indirect files, STARTS.COM (for single- job monitors) and STARTF.COM (for foreground/background monitors). Use of these files allows the user very easily to configure the monitor to his needs.

After you have decided which monitor to use, you can start building a working disk. If you are using a multidisk system, you can follow the DEC instructions exactly, with one exception: bootable disks must contain, in addition to the standard system files, the file CHRSET.SYS. Note that, in accordance with DEC standards, the monitor must have the filename extension .SYS so that when you build your working disk, you must change the extension of the copied monitor file to the extension SYS. For example, assuming you want the foreground background monitor with the Terak standard emulator on your working disk, copy the monitor onto your target disk using the command

```
COPY QXMNFB.FTM DK1:QXMNFB.SYS/SYS
```

Note also that all operations involving files with the SYS extension will typically cause the message

```
?PIP-W-reboot
```

accompanied by an alarm beep to be displayed.

CAUTION: DO NOT RERBOOT!

This is a warning that changing the position of SYS files will require a subsequent re- bootstrap before using the system disk. During certain operations, the disk may not be re- bootable owing to the lack of certain system files, notably CHRSET.SYS or one of the monitor files renamed with a SYS extension, or owing to the correct bootstrap not having been injected yet. In general, consider the re- boot messages as warnings, and do not re- bootstrap until the target disk is correctly built.

After copying the selected files onto a working disk, which must include the minimum of a monitor file, CHRSET.SYS, SWAF.SYS, and QX.SYS, use the following command to inject the bootstrap area with the correct bootstrap code for the selected monitor.

```
COPY/BOOT QXMN--.SYS DK: <return>      where -- corresponds to
                                          the selected monitor.
```

If you have a single disk system, you must follow the additional prompts for inserting and removing logical disks 0 and 1.

SECTION IV
SPACE PROBLEMS AND SOLUTIONS

The standard floppy disk has 480 usable blocks under RT-11. Particularly when running FORTRAN you will have disk space problems. The EXECUTE command will not work on a FORTRAN source file since it is impossible to fit FORTRA.SAV, SYSLIB.OBJ, and the operating files on one disk. The challenge is to create a system with as much free space as possible. A solution that we have used is given below.

Take a blank disk and label it as a FORTRAN working disk.

- (1) Initialize the FORTRAN disk with

```
.INIT DK1:
```

- (2) Copy onto the FORTRAN disk the system files: SWAP,QX,TT, and the SGM or SGS monitors with the COPY/QUERY command below:

```
COPY/QUERY/SYS *.SYS DK1:*.SYS
```

If your current system monitor is neither the SGM or SGS monitor you will need this additional command: (If you are using a single drive system the extension would be SGS.)

```
COPY QXMNSJ.SGM DK1:QXMNSJ.SYS/SYS
```

- (3) Then copy onto the FORTRAN disk the following SAV files: PIP, DUP, DIR, and either TECO or EDIT (EDIT is shorter, but if you are using TECO elsewhere, there will be extra effort required to use both editors) with the following command:

```
COPY/QUERY *.SAV DK1:*.SAV
```

- (4) Copy the boot onto the FORTRAN disk with the following command

```
COPY/BOOT DK1:QXMNSJ.SYS DK1:
```

- (5) Boot the FORTRAN disk and copy FORTRA.SAV onto it:

```
COPY DK1:FORTRA.SAV FORTRA.SAV
```

If you are using both the large FORTRA.SAV program and TECO, you will still have 105 free blocks on the disk. (An additional 8 blocks could be saved if you used EDIT). Note that before you boot this disk you must have booted another disk with CHRSET.SYS on it to load the characters. You will have to manually enter the commands:

```
SET TT:SCOPE
SET USR NOSWAP
```

(1) Now take a second disk, and label it as the SYSLIB disk. Use the COPY/DEVICE command to initialize the SYSLIB disk using the FORTRAN disk as the source:

```
COPY/DEVICE DK: DK1:
```

(2) Remove the FORTRAN disk from QX0 and insert the SYSLIB disk and then delete the two files TECO and FORTRA

```
DEL TECO,FORTRA
```

(3) Copy onto the SYSLIB disk SYSLIB and LINK

```
COPY DK1:(SYSLIB.OBJ,LINK.SAV) DK:
```

There will be now 110 free blocks left on the SYSLIB disk.

If you have a two-disk system you now can use the second disk entirely for your programs, permitting them to be relatively large. Of course after you run FORTRA, you will have to remove disk 0 containing FORTRA and replace it with the disk containing the SYSLIB before you can run LINK. If you have a single-disk system you will have to copy the object file that FORTRA generates to the disk with LINK and SYSLIB on it before you can run LINK.

When using MACRO only, space is generally not so severe a problem, since MACRO is more than 150 blocks smaller than FORTRAN. On the other hand, SYSMAC.SML which is 37 blocks long, must be on MACRO system disks.

SECTION V V3B TERMINAL EMULATOR CHARACTERISTICS

The 8532 display emulates a terminal. The motions of the cursor, scrolling of the screen, and other screen functions are entirely under software control. The software which performs this service is called the Emulator. The emulator code is resident with the operating system. The screen may be driven by all the standard procedure calls (e.g. .TTYOUT, PRINT in Basic, WRITE in Fortran). It may also be driven by user program I/O routines which expect to drive a serial interface at the standard console addresses. While essentially any terminal might be emulated, two standard emulators are released with this software kit. They are the GT, or glass teletype emulator, and the TK, or Terak standard emulator.

The emulator accepts characters from the hardware emulator data buffer and places them into the page buffer in a manner similar to a hardware data terminal. The characters are placed into the hardware emulator data buffer by the TTY handler built inside RT-11. RT-11 and other code which drives a serial interface will operate without modification, provided that such code runs at processor level 0 (all interrupts enabled). Note that Micro-ODT does not meet this requirement.

The GT emulator will present a glass teletype terminal. A cursor is displayed as code 177, and is therefore reserved for use by the emulator (output only). The cursor is constrained to always be on the bottom line of the screen. No support for the upper (alternate) 96 character set is provided, and since RT-11 trims all character codes to 7 bits, only output sent by the user program directly to the emulator data register can be printed in the upper character set. Only four character codes are recognized:

- Return or Line-Feed will scroll a new line;
- Form-Feed will erase the character display,
blank all graphics blanking zones,
and display all character blanking zones;
- Bell will sound a short beep at the 8532 display screen.

When a Form-Feed character is received, the GT emulator will blank all graphics zones, and unblank all character zones. Also, when a printable character is received, the GT emulator will always unblank the lower character blanking zone. Otherwise, the zone blanking bits of the video control register (VCR) are never modified by the GT emulator. Likewise, user program changing of the VCR noise, beep, and generator enable bits, is allowed. Panning is not supported. The GT emulator is used most often when memory space precludes use of the TK emulator, or the simple terminal is all that is required for a particular application.

The TK emulator will present an 'intelligent terminal' to the operator. A cursor is displayed by the emulator as either code 177 (over spaces) or code 377 (over all others). The pattern stored into the 8510/a writeable character generator for the 377 character is updated "on- the- fly" as the video reverse of whatever character is being overlaid by the cursor. These two codes (177 and 377) are therefore reserved for system use. Control characters and escape sequences are recognized to support user control of the screen such as: cursor addressing, field protect, etc. The TK emulator models the Beehive model B-100, with the exception of: no blinking, no half-intensity, no send- screen command; and with the inclusion of: reverse scrolling, panning, click, invisible cursor, single axis cursor addressing.

Some of the single character control code are useful for manual adjustment of the emulator state. The RT-11 keyboard monitor usually echos all control codes to the emulator. Thus a Control-L (or cursor down arrow) key typed can cause that code to be sent to the emulator, in this case clearing the screen and blanking all graphics, and unblanking all characters. This is useful also for Control-D (slow panning rate) and Control-E (increase panning rate).

When a Form-Feed character is received, all graphics zones will be blanked, and all character zones will be unblanked. Otherwise, the zone blanking bits of the video control register (VCR) are never modified by the TK emulator. Likewise, user program changing of the VCR noise, beep, and generator enable bits, is allowed.

Entering Protect mode is equivalent to shifting to the upper (alternate) character set for printing of all characters. RT-11 trims all characters to 7 bits, thus precluding direct printing of characters in the upper character set. This is used to 1) display characters in the upper character set, and 2) to provide a selective erasure (protected field) feature.

Until Format mode is turned on, protected (upper character set) characters in the screen are treated the same as all other characters. When Format mode is entered, the screen is prevented from scrolling (a Line Feed at the bottom line, or a Vertical Tab at the top line will cause the cursor to 'wrap around' the screen). Also, while in Format mode, the cursor will never overlay a protected (upper character set) character. It will be moved to the first available unprotected field. Last, while in Format mode, either an EOL or EOS erase command will not affect protected characters. This allows the preservation of a form, while erasing all data written into the form. Note that Protect mode, and Format mode are usually mutually exclusive, although both may be active at the same time.

When using cursor addressing, if either absolute coordinate is out of range (0 to 79 for X, and 0 to 24 for Y), the current corresponding component of the cursor position will be used in its place. Thus, by sending 80 as a column position, the cursor can be positioned at an absolute row along the current column of the cursor. Likewise, by using 25 as a row position, the cursor can be positioned at an absolute column along the current row of the cursor.

If both coordinates are out of range, the cursor will be blanked, and all subsequent printing will be lost. This is one way of blanking the cursor. The other way is to send a cursor off code. This is preferable, as printing may continue with the cursor off.

Note that the cursor can be addressed into Row 24. This is the 'hidden' row of characters supported by the 8510/a hardware to allow display of 25 rows of characters while the screen is panning. The cursor can only be addressed into Row 24. All other cursor motion will skip between rows 23 and 0. When the cursor is in row 24, if scrolling is commanded either by a Line Feed or by a Vertical Tab, the row will not be cleared before it scrolls into sight. This allows a user program to support panning the display.

In the following, "scroll mode" indicates that the screen is allowed to scroll or pan upward or downward to accommodate the cursor motion. "Block mode" indicated that scrolling or panning is inhibited, and certain cursor motions must wrap around between top and bottom rows or right and left columns of the screen.

REPERTOIRE OF CONTROL CODES AND ESCAPE SEQUENCES
FOR TK EMULATOR

SINGLE CHARACTER COMMANDS...

DECIMAL CODE	NAME	FUNCTION
4	DECPAN	DECREASE PANNING RATE
5	INCPAN	INCREASE PANNING RATE
6	CLICK	EMIT A SHORT CLICK THRU THE SPEAKER
7	BELL	EMIT A 130 US, 780 HZ TONE
8	BAKSP	MOVE CURSOR LEFT, PRINT SPACE
9	TAB	MOVE CURSOR RIGHT TO MULT OF 8 COL
10	LF	CURSOR DOWN (SCROLLS IF NOT FORMAT MODE)
11	VT	CURSOR UP (SCROLLS IF NOT FORMAT MODE)
12	FF	COMPLETE RESET AND ERASE OF SCREEN. ENTER SCROLL MODE, BLANK GRAPHICS.
13	CR	CURSOR TO COLUMN 1, SAME ROW
14	SO	PRINT IN UPPER CHAR SET (SEE ESC-])
15	SI	PRINT IN LOWER CHAR SET (SEE ESC-[)
21	CRSOFF	DO NOT DISPLAY A CURSOR.
22	CRSON	DISPLAY CURSOR.
24	CAN	CANCEL ESCAPE SEQUENCE

DOUBLE CHARACTER COMMAND SEQUENCES...

Note: ESC= 27 decimal, letters are the second character.

CODE	NAME	FUNCTION
ESC A	CRSUP	CURSOR UP ONE ROW
ESC B	CRSDN	CURSOR DOWN ONE ROW
ESC C	CRSRT	CURSOR RIGHT ONE COL
ESC D	CRSLT	CURSOR LEFT ONE COL
ESC E	CLEAR	CLEAR UNPROTECTED FIELDS TO SPACES AND HOME CURSOR. DOES NOT AFFECT GRAPHICS.
ESC H	HOME	CURSOR TO COLUMN 0, ROW 0
ESC J	ERSEOS	CLEAR UNPROTECTED FIELDS FROM CURSOR TO END OF SCREEN TO SPACES.
ESC K	ERSEOL	CLEAR UNPROTECTED FIELDS FROM CURSOR TO END OF LINE TO SPACES.
ESC]	PRTON	FLAG ALL SUBSEQUENTLY PRINTED CHARACTERS AS PROTECTED. DISPLAY THEM IN VIDEO REVERSE--- DEPENDING ON CHARACTER SET. IMPLIES PRINTING IN THE UPPER HALF (UPPER 96 OF 192) CHARACTER SET. NOTE THAT CHARACTERS ARE NOT PROTECTED FROM OVERSTRIKING OR ERASING UNTIL FORMAT MODE IS ON. FORMAT AND PROTECT MODES ARE INDEPENDENT.
ESC [PRTOFF	EXIT PROTECT MODE. IMPLIES PRINTING IN THE UPPER HALF (UPPER 96 OF 192) CHARACTER SET.
ESC W	FMTON	EXIT SCROLL MODE. PROTECT ALL CHARACTERS FLAGGED AS PROTECTED. ENTER BLOCK MODE.
ESC X	FMTOFF	EXIT BLOCK MODE. ALLOW MODIFICATION OF PROTECTED CHARACTERS. ENTER SCROLL MODE.

QUADRUPLE CHARACTER COMMAND SEQUENCE (CURSOR ADDRESSING)...

Note: ESC= 27 DECIMAL, F is second character. third and fourth characters are the row and column position respectively in excess 32 decimal notation.

CODE	NAME	FUNCTION
ESC F	CRSAD	PREAMBLE TO CURSOR ADDRESSING...

NEXT TWO CHARS CARRY Y+32, X+32. ADDRESS ORIGIN IS X=0, Y=0. IF EITHER Y OR X ARE OUT OF RANGE... (OUTSIDE 0..24 OR 0..79, RESPECTIVELY) THE CURRENT Y OR X COORDINATE OF THE CURSOR WILL BE USED IN ITS PLACE. IF BOTH ARE OUT OF RANGE, ALL FURTHER PRINTING WILL BE LOST UNTIL A COMMAND PLACES THE CURSOR INTO THE SCREEN. NOTE THAT THE CURSOR MAY BE PLACED INTO THE 25-TH (HIDDEN) LINE. IN THIS MODE, SCROLLING WILL NOT CLEAR NEW LINES.

SECTION VI CHARACTER SETS

A character set file contains a packed image of either 96 or 192 character templates. Each template is a 10 byte field representing the 10 rows (top row first) of eight dots (leftmost dot corresponding to LSP of byte) of a character. The two half character sets are packed arrays of 96 character templates, covering character codes 40 (octal) thru 177 or codes 240 thru 377. In a character set file, the second half character set starts on a logical block boundary. Thus, it is possible to split a character set in halves by file surgery using DUP or PIP. Character set files are either 2 or 4 blocks long. The default extension for a character set file is '.CHR'

During bootstrap, or running of CSLOAD, character set files are loaded into the writeable character generator of the Terak 8510/a. If CHRSET.SYS (or the character set file selected by CSLOAD) contains half a character set (96 characters only, indicated by a file of only 2 blocks size, instead of 4 blocks), the upper half set will be generated from the video reverse of the half (lower) set. Otherwise, the entire 192 character set will be loaded from the contents of the full (4 block) file. If, at boot-time, CHRSET.SYS is absent, the bootstrap will proceed, hoping for the best (power not cycled since the last charset load). If you must bootstrap a disk which does not have a character set file, and the system power has been cycled, proceed as normal; the system will function normally except that pure garbage will be displayed. The utility CSLOAD is available for loading different character set files.

SECTION VII
SYSTEM DISK DIRECTORIES

The following directory listings may be obtained by booting the selected disk, and typing

DIR<return>

DIRECTORY OF 61-0008-001

SWAP	.SYS	24	03-Dec-78	QX	.SYS	3	06-Jan-79
TT	.SYS	2	03-Dec-78	QXMNSJ.SGM		62	05-Mar-79
QXMNFB.FGM		71	05-Mar-79	QXMNSJ.SYS		64	23-May-79
QXMNFB.FTM		73	23-May-79	QXMNSJ.BGM		60	05-Mar-79
QXMNSJ.BTM		63	23-May-79	STARTS.COM		1	11-Jan-78
STARTF.COM		1	11-Jan-78	PIP	.SAV	16	03-Dec-78
DIR	.SAV	17	03-Dec-78	DUP	.SAV	21	06-Jan-79
CHRSET.SYS		4	05-Dec-78	< UNUSED >		4	
15 Files, 482 Blocks							
4 Free blocks							

DIRECTORY OF 61-0008-002

SWAP	.SYS	24	03-Dec-78	QX	.SYS	3	06-Jan-79
TT	.SYS	2	03-Dec-78	QXMNSJ.SYS		62	05-Mar-79
PIP	.SAV	16	03-Dec-78	DIR	.SAV	17	03-Dec-78
DUP	.SAV	21	06-Jan-79	LINK	.SAV	29	05-Dec-78
LIER	.SAV	18	05-Dec-78	MACRO	.SAV	45	05-Dec-78
LP	.SYS	2	11-Mar-78	DUMP	.SAV	7	05-Dec-78
EDIT	.SAV	19	05-Dec-78	FILEX	.SAV	18	05-Dec-78
CREF	.SAV	6	05-Dec-78	PATCH	.SAV	9	05-Dec-78
SRCCOM.SAV		11	05-Dec-78	PAT	.SAV	7	08-Jan-79
ODT	.OEJ	10	08-Jan-78	STARTS.COM		1	11-Jan-78
CHRSET.SYS		4	05-Dec-78	RESORC.SAV		12	12-Mar-79
HELP	.SAV	21	08-Jan-79	HELP	.TXT	74	08-Jan-79
SYSMAC.SML		37	05-Dec-78	NL	.SYS	2	11-Mar-78
HELP	.TEC	3	08-Jan-79	< UNUSED >		6	
27 Files, 480 Blocks							
6 Free blocks							

DIRECTORY OF 61-0008-003

SWAP .SYS	24	03-Dec-78	QX .SYS	3	06-Jan-79
TT .SYS	2	03-Dec-78	CHRSET.SYS	4	05-Dec-78
QXMNSJ.SYS	64	23-May-79	STARTS.COM	1	11-Jan-78
QXMNFB.MGM	76	05-Mar-79	QXMNFB.MGS	76	05-Mar-79
DUP .SAV	21	06-Jan-79	DIR .SAV	17	03-Dec-78
FIP .SAV	16	03-Dec-78	FORMS .CHR	4	08-Jan-79
SMUDGE.CHR	4	08-Jan-79	LARGE .CHR	4	08-Jan-79
INVRSE.CHR	4	08-Jan-79	APL .CHR	4	07-Dec-78
RUSIAN.CHR	4	08-Jan-79	HEBREW.CHR	4	08-Jan-79
OCRB .CHR	4	08-Jan-79	CURSIV.CHR	4	08-Jan-79
MATH .CHR	4	08-Jan-79	V2SET .CHR	4	08-Jan-79
CHRSET.SAV	2	07-Dec-78	TECO .SAV	25	15-Apr-79
INSERT.TEC	2	11-Mar-78	SORT .TEC	3	11-Mar-78
EDIT .TEC	1	11-Mar-78	LOCAL .TEC	2	11-Mar-78
BATCH .SAV	26	11-Mar-78	FA .SYS	7	11-Mar-78
SYSF4 .OBJ	39	21-Mar-78	GETSTR.FOR	2	11-Mar-78
PUTSTR.FOR	2	11-Mar-78	CSLOAD.SAV	2	02-Jun-79
PAS2FT.SAV	5	28-Feb-79	DEMOBG.MAC	2	11-Mar-78
DEMOFG.MAC	3	11-Mar-78	< UNUSED >	15	
37 Files, 471 Blocks					
15 Free blocks					

DIRECTORY OF 61-0008-004

SWAP .SYS	24	03-Dec-78	QX .SYS	3	04-Mar-79
TT .SYS	2	03-Dec-78	QXMNSJ.SYS	62	05-Mar-79
QXMNFB.FGS	71	05-Mar-79	QXMNSJ.STS	64	23-May-79
QXMNFB.FTS	74	23-May-79	QXMNSJ.BTS	63	23-May-79
QXMNSJ.BGS	60	05-Mar-79	CHRSET.SYS	4	05-Dec-78
PIP .SAV	16	03-Dec-78	DIR .SAV	17	03-Dec-78
DUP .SAV	21	06-Jan-79	STARTS.COM	1	11-Jan-78
< UNUSED >	4				
14 Files, 482 Blocks					
4 Free blocks					