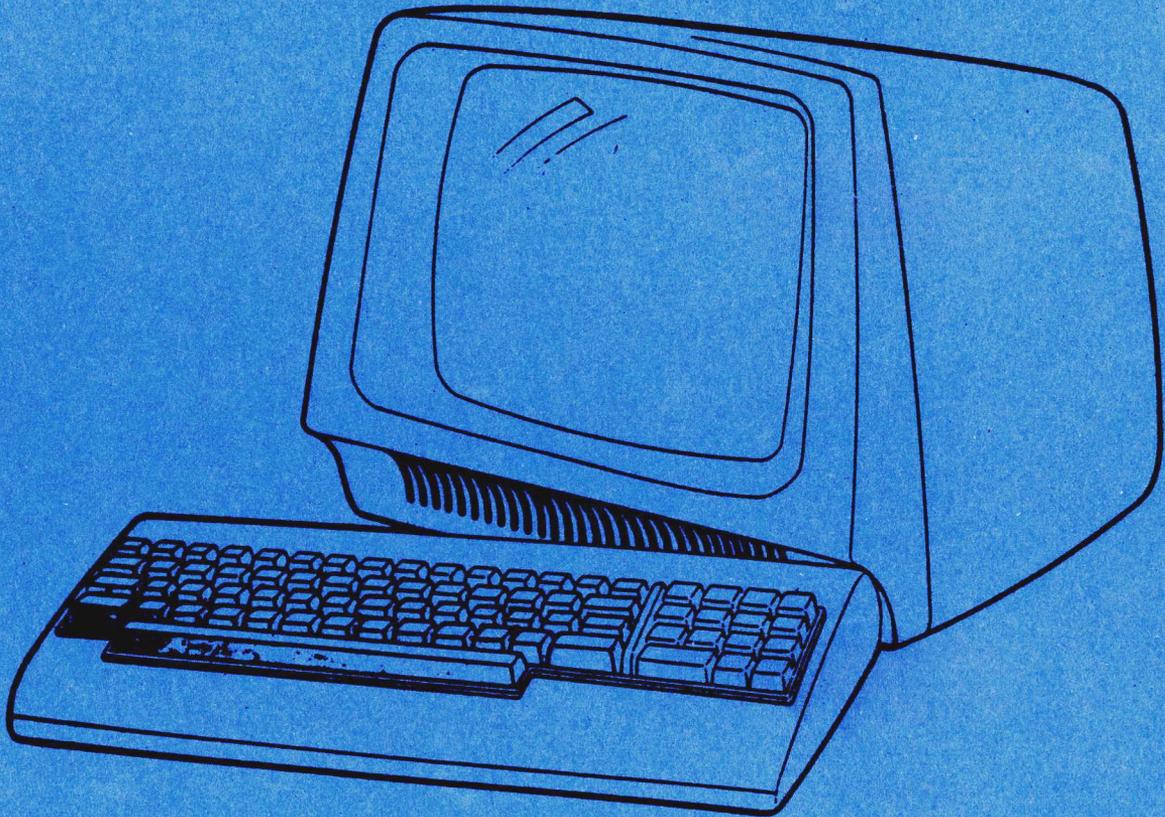


PROGRAMMER'S GUIDE

for the

TS-1 TERMINAL

The Brilliant Terminal



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PREFACE

The purpose of this manual is to assist the operator and programmer in developing programming proficiency to derive maximum benefits from the TS-1 Terminal. The manual covers programming the various special purpose keys, display and keyboard controls, escape sequences, and a section on programming the VT100 emulation. Comprehensive operating information is covered in the "Operator's Guide for the TS-1"; maintenance and troubleshooting are covered in the "Maintenance Manual for the TS-1."

Material contained in this manual is intended for information only and is subject to change without notice.

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CHAPTER 1

PROGRAM CONTROL

1-1 INTRODUCTION

The purpose of this manual is to acquaint the user and programmer with the programmable features of the TS-1 Terminal. Most of the standard ASCII Control Characters are used to provide the TS-1's capabilities; however, the TS-1 does use a few Control Codes which are not ASCII standard.

Developing programs on the TS-1 is greatly enhanced by using the Enter Mode, which allows the Control Characters to be displayed rather than executed.

Program control by the keyboard Special Function Keys and the host computer Control Codes is not accomplished in the same way. Some computer control codes have more than one command that is similar to a particular Special Function command from the keyboard.

1-2 PROGRAMMABLE FUNCTION KEYS

The standard keyboard Programmable Function Keys, **F1** through **F12**, are located on the top row of the main keyboard and are identified by the salmon color-coded characters on the faces of the keys. Each of these keys may contain up to 77 user definable characters for a maximum total of 300 characters. The **SET F** (set function) is used to store programmed character strings. The **EXAMINE F** (examine function) displays the programmed character strings and the remaining character spaces (maximum 300) available for programming. Simultaneously pressing the **FUNCTION** key with any one of the Programmable Function Keys (**F1-F12**) will execute the stored character string identified by that key.

1-2.1 Entering Data For A Programmable Function Key

If the Programmable Function Key is being programmed from the keyboard, verify that the terminal is in Block Mode. (Press the **FUNCTION** key simultaneously with the **BLOCK MODE** key.)

1. Locate the cursor in the first column of any blank line.
2. Enter the number of the Programmable Function Key to be programmed (01-28).

3. Enter the desired character string to be stored (up to 77 characters).
4. Verify that the cursor is one position to the right of the last character entered.
5. Store the string by performing the following operation:

From the keyboard: **FUNCTION** with **SET F**
From the computer: **ESCAPE** then **k**

If an error was made, verify that (1) data was entered starting in the third column or beyond, (2) the first two characters were not the Programmable Function Key number, or (3) the character string was not too long, or the input will be rejected and a ? will be displayed.

The Programmable Function Key contents are stored in continuous memory. Even during power off cycles, the contents will be retained.

If a control code is to be entered into the character string, first enter an escape command then press the control key. If an escape command is to be entered into the character string, enter the escape command twice, once to alert the terminal for a control code, and a second time to enter the escape command into the character string. An alternate method for entering control codes is to use the enter mode while programming the function keys (see Enter Mode).

1-2.2 Examining Stored Programmable Functions

Examine the contents of 01 through 12 to determine desired additions, changes, or deletions, as well as to see how many of the 300 character positions are available for programming by performing the following operation:

From the keyboard: **FUNCTION** with **EXAMINE F**
From the computer: **ESCAPE** then **j**

A number appears on the first data line of the monitor screen which indicates how many of the 300 character positions in the programmable key registers are available for use. Each line which follows the cursor control character sequences displays the contents of a Programmable Function Key, starting with the Programmable Function Key number in the first two columns of the line.

The operator may edit the Programmable Function Key contents using the Block Mode editing capabilities. After the character string has been changed, verify that the cursor is one position to the right of the last character in the string, and enter the data into continuous memory with the **FUNCTION** and **SET F** keys.

1-2.3 Invoking a Programmable Function Key

Invoke a Programmable Function Key with this function key stroke or escape sequence:

From the keyboard: **FUNCTION** with a function key
(F1 through F12)

From the computer: **ESCAPE** then a function key
(F1 through F12)

1-2.4 Erasing Programmable Function Key Data

To erase Programmable Function Key data, enter the number of the Programmable Function key to be erased in the first two columns of a line then perform the following operation:

From the keyboard: **FUNCTION** with **SET F**

From the computer: **ESCAPE** then **k**

1-3 STATUS LINE PROGRAMMING

1-3.1 Time Indicator

The Time Indicator is software controlled and may or may not be displayed. The Time Indicator may also be updated incrementally, or updated to a desired given value. Use the following group of escape sequences to change the Time Indicator:

From the keyboard: **ESCAPE** then **h** then Code
(and then Value for codes 5-7 only)

From the computer: **ESCAPE** then **h** then Code
(and then Value for codes 5-7 only)

<u>Code</u>	<u>Command</u>	<u>Description</u>
0	TIME INDICATOR ON	Displays Time Indicator
1	TIME INDICATOR OFF	Does not display Time Indicator
2	INCREMENT HOUR	Advances hour display 1 hour
3	INCREMENT MINUTE	Advances minute display 1 minute

- | | | |
|---|---------------------|--|
| 4 | REAL TIME INDICATOR | Four bytes are sent to the host computer when this command is invoked. They represent hour, minute, second, and carriage return. The hour, minute, and second are actual values plus 20 hex. |
| 5 | WRITE HOUR | The value entered is loaded into the hour display digit minus 20 (Refer to Appendix D). |
| 6 | WRITE MINUTE | The value entered is loaded into the minute display digit minus 20 (Refer to Appendix D). |
| 7 | WRITE SECOND | The value entered is loaded into the second display digit minus 20 (Refer to Appendix D). |

1-3.2 Title Indicator

A user definable title with 1 to 10 double width/single height characters appears at the left end of the Status Line (See Figure 3-2). When shipped from the factory, the terminal displays its model number in the title area. The user may modify the title as described in the following paragraphs.

Write title:

From the keyboard: **ESCAPE** then] then Title
 From the computer: **ESCAPE** then] then Title

If fewer than ten characters are entered, fill the remaining positions with spaces to clear the previous data.

Read title:

From the keyboard: **ESCAPE** then n
 From the computer: **ESCAPE** then n

NOTE: The read title will be terminated by a carriage return only when the TS-1 is connected to a host computer or another terminal.

1-4 DISPLAY MODES

The TS-1 features four Display Modes. The Enter Mode allows the programmer to display the control characters with the incoming data strings; in this mode the control characters do not execute their normal functions. The Insert Mode allows the programmer to insert characters without continually having

to issue the Insert Character command. The Reduced Intensity Mode allows the programmer to display two intensities of video. The Protect Mode allows the programmer to protect fields of data for forms generation and other similar tasks.

1-4.1 Enter Mode

The Enter Mode allows monitor control codes to be entered into display memory and viewed on the display screen with an identifying symbol. These control codes are not ordinarily displayed.

This feature is particularly useful when debugging or deciphering an incoming data stream without executing the code. It is also useful for entering data into the Programmable Function Keys. The **ESCAPE** key does not have to be pressed each time a Control Character is to be entered into a command string.

Enabling the Enter Mode:

Display, rather than act upon all control characters (except the Reset Enter Mode escape sequence) with this escape sequence:

From the keyboard: **ESCAPE** then **U**
From the computer: **ESCAPE** then **U**

Exiting the Enter Mode:

Act upon rather than display all control characters with this escape sequence:

From the keyboard: **ESCAPE** then **u**
From the computer: **ESCAPE** then **u**

1-4.2 Insert Mode

Insert Mode moves the remainder of the cursor line to the right after the entry of any displayable character, and terminates at the end of that line. If the line was full before the operation was completed, the right-most character of that line is lost.

If a protected field is encountered and the line cannot be shifted right without endangering a protected character, the operation is aborted and no insertion is made.

The cursor position does not change during the operation. Each time a displayable character is entered, the line is shifted to the right as required.

Insert Mode will wrap the last character of the line down to the first character position of the next line so no characters will be lost if the extended memory option has been selected.

Enter Insert Mode with this escape sequence:

From the keyboard: **ESCAPE** then **q**
From the computer: **ESCAPE** then **q**

Exit Insert Mode with this escape sequence:

From the keyboard: **ESCAPE** then **r**
From the computer: **ESCAPE** then **r**

1-4.3 Reduced Intensity Mode

When the Reduced Intensity Mode is initialized, the indicator "In" appears on the status line of the monitor screen. At this time, all data will be displayed in reduced intensity.

Entering the Reduced Intensity Mode:

From the keyboard: **ESCAPE** then **)**
From the computer: **ESCAPE** then **)**

Exiting the Reduced Intensity Mode:

From the keyboard: **ESCAPE** then **(**
From the computer: **ESCAPE** then **(**

1-4.4 Protect Mode

The Protect Mode sets a character so that it cannot be altered. When a character position is protected, the cursor cannot be located at that position but will move to the next unprotected position. A "Pr" is displayed on the Status Line indicating the Protect Mode.

Entering the Protect Mode disables the line insert (**INS LINE**), line delete (**DEL LINE**) and scrolling functions. The **TAB** key will now move the cursor from an unprotected field to the first character of the next unprotected field. The **BACKTAB** key will move the cursor from an unprotected field to the first character of the last unprotected field.

To provide selective character protection, the Reduced Intensity character will be protected when the Protect Mode is activated. "In" will appear on the status line to indicate that the terminal is in Reduced Intensity Mode. In other words, once the Protect Mode is entered, a character will actually become protected when that character is set to reduced intensity.

Enter Protect Mode:

From the keyboard: **ESCAPE** then **&**
From the computer: **ESCAPE** then **&**

Exit Protect Mode:

From the keyboard: **ESCAPE** then **'**
From the computer: **ESCAPE** then **'**

Exit (reset) all Display Modes with this escape sequence:

From the keyboard: **ESCAPE** then **z**
From the computer: **ESCAPE** then **z**

This operation resets the terminal CPU and registers the same as a power up reset.

CAUTION

Invoking the **ESCAPE z** sequence causes all data on the screen and in the input data buffer to be lost.

1-5 DISPLAY ATTRIBUTES

Display attributes consist of two elements, the Attribute Location Code, and the Attribute Display Value. The Attribute Location Code controls the area affected by the attribute. TS-1 Attribute Location Codes can apply to character(s), line(s), or to a page.

The Attribute Display Value determines whether the display will be normal video, reversed video, blinking video, or blanked video. Blanking is used for such applications as password entry, where the display is masked for security reasons, or optionally displays the graphic or second language character set.

Attribute Location Codes and Display Values are set with this escape sequence:

From the keyboard: **ESCAPE** then Location Code then Value
From the computer: **ESCAPE** then Location Code then Value

DISPLAY ATTRIBUTE LOCATION CODES

Location Code

Description

g (character)

Sets the Attribute from the cursor position to all characters which follow. No display positions are used to store the attribute.

- f Clears the character (g) Attribute.
- G (line) Sets the Attribute to characters from the cursor position to the end of the line. The ADM-31 protocol is emulated, a blank protected character is stored where the Attribute is invoked and where it is reset or altered using G.
- H (page) Sets the Attribute for the entire screen.

DISPLAY ATTRIBUTE VALUES

<u>Display Attribute Values</u>	<u>Description</u>
0	Normal
1	Underline
2	Blink
3	Blink and Underline
4	Reversed Video
5	Reversed Video and Underline
6	Reversed Video and Blinking
7	Reversed Video, Blinking, and Underline
8	Blank (for passwords, etc.)
9	Blank and Underline
A	Blank and Blinking
B	Blank, Blinking and Underline
C	Blank and Reversed Video
D	Blank, Reversed Video, and Underline

E	Blank, Reversed Video, and Blinking
F	Blank, Reversed Video, Blinking, and Underline

Note

Values 8 through F are not available if
the alternate character generator option
is installed.

1-6 CHARACTER SIZE ATTRIBUTES

The TS-1 is able to display characters in five modes: normal, double width, double height, double width/double height, and blanking.

The Attribute Code for character size is F. The Attribute Values are 0-F as described below. They determine the character size and may be set either before or after data is entered. Program the Character Size with this escape sequence.

From the keyboard: **ESCAPE** then **F** then Value
From the computer: **ESCAPE** then **F** then Value

1-6.1 Double Width Attribute

This feature displays a line in Double Width characters. Only 40 characters can be displayed on a line. To program the Double Width feature for a line of characters, use this escape sequence:

From the keyboard: **ESCAPE** then **F** then Value
From the computer: **ESCAPE** then **F** then Value

<u>Value</u>	<u>Description</u>
2	Double width, blanking
3	Double Width

1-6.2 Double Height/Single Width Attribute

To invoke the Double Height attribute requires the use of two monitor display lines. The first line displays the top half of the characters, while the second line displays the lower half of the characters. This means that for each whole double height character the character must be entered twice; once for the upper half and once for the lower half. This also means that two different escape sequences must be used. A single escape sequence may be used to set characters to double height (see section 1-6.4). Program the Double Height/Single Width

Characters with this pair of escape sequences:

From the keyboard: Upper half **ESCAPE** then **F** then Value
Lower half **ESCAPE** then **F** then Value
From the computer: Upper half **ESCAPE** then **F** then Value
Lower half **ESCAPE** then **F** then Value

<u>Value</u>	<u>Description</u>
4	Double Height, Blanking, Upper Half
C	Double Height, Blanking, Lower Half
5	Double Height - Upper Half
D	Double Height - Lower Half

1-6.3 Double Height/Double Width Attribute

The Double Width/Double Height attribute combines the features of both the double width and double height characters. Only 40 characters can be displayed on a line, and two monitor display lines are required to display each character. Program the Double Width/Double Height attribute using this pair of escape sequences.

From the keyboard: Upper half **ESCAPE** then **F** then Value
Lower half **ESCAPE** then **F** then Value
From the computer: Upper half **ESCAPE** then **F** then Value
Lower half **ESCAPE** then **F** then Value

<u>Value</u>	<u>Description</u>
6	Double Width/Double Height, Blanking, Upper Half
C	Double Width/Double Height, Blanking, Lower Half
7	Double Width/Double Height, Upper half
F	Double Width/Double Height, Lower Half

1-6.4 Double Height (Alternate Modes)

Double Height/Single or Double Width characters can alternately be generated from Normal size or double wide characters, after the characters have been entered by using the following escape sequence:

From the keyboard: **ESCAPE** then **m**
From the computer: **ESCAPE** then **m**

The following escape sequence is an example of how to generate Double Height/Double Width characters using the alternate mode:

ESCAPE then **F** then **3** then Desired
characters then **ESCAPE** then **m**

1-7 KEYBOARD CONTROL

1-7.1 Disabling All Special Function Keys

All Special Function Keys are disabled with this escape sequence (only **BRITE**, **DIM**, and the Programmable Function Keys will remain operational).

From the keyboard: **ESCAPE** then **§**
From the computer: **ESCAPE** then **§**

1-7.2 Enabling All Special Function Keys

All Special Function Keys are enabled with this escape sequence:

From the keyboard: **ESCAPE** then **\$**
From the computer: **ESCAPE** then **\$**

1-7.3 Disabling The Keyboard

The entire keyboard is disabled with this escape sequence:

From the keyboard: **ESCAPE** then **#**
From the computer: **ESCAPE** then **#**

When this command is invoked, keyboard operation is completely disabled and cannot be enabled from the keyboard. The only way the keyboard can be re-enabled is by means of a power off/on cycle or by receiving the enable sequence from the host computer through the communications interface.

1-7.4 Enabling The Keyboard

The entire keyboard is enabled from the host computer with this escape sequence:

From the computer **ESCAPE** then **"**

1-7.5 Using the Split Screen Mode

To set the Split Screen mode, press **ESCAPE** then **s** then the starting row number, then the ending row number. Select the desired row numbers, 1-24, and the corresponding ASCII codes, from Appendix C of the "Programmer's Guide for the TS-1 Terminal."

From the keyboard: Press **ESCAPE** then **s**
then **\$** then **+**

This command would split the screen, beginning at row 5 (**\$**), and ending at row 12 (**+**). The Split Screen mode will then be engaged, as indicated by the new home position for the cursor. To disengage the Split Screen mode (return to full display

screen), press **ESCAPE**, press **s**, press and hold **CONTROL** then press the **RUB OUT** key twice. Return to the full display screen mode is indicated by the cursor repositioned at row 1, column 1.

CHAPTER 2

OPERATING FUNCTION CONTROLS

2-1 INTRODUCTION

Operating Function Controls are those controls used by the operator/programmer to manipulate the characters displayed on the monitor screen. In many cases the operator/programmer has more than one method by which a manipulation can be executed. The method chosen will, in most cases, reflect the most convenient option.

All the Operating Function Controls, along with the possible methods for execution are described in the following paragraphs. Also included is a short definition of each control manipulation.

CLEAR functions remove Display Modes and Display Attributes while **ERASE** functions do not. Unless otherwise noted, the **CLEAR** functions set all locations to nulls while the **ERASE** functions set all locations to spaces.

2-2 OPERATING COMMAND SEQUENCES

2-2.1 Deleting a Character

Delete a single character with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **DEL CHAR**
From the computer: **ESCAPE** then **W**

The character at the cursor position is deleted. If the remainder of the line is unprotected, each character is shifted one position to the left. If any characters in the remainder of the line are protected, only those characters between the cursor and the protected characters are shifted to the left. If the right-most character is shifted, it is replaced by a space. The cursor position does not change.

2-2.2 Inserting a Character

Insert a single character with this function key sequence or escape sequence.

From the keyboard: **FUNCTION** with **INS CHAR**
From the computer: **ESCAPE** then **Q**

The character at the cursor position and all characters to its

right are moved one position to the right. If no unprotected field is encountered, the operation terminates at the end of the line. If the line was full before the operation was completed, the last character on the line is lost. The cursor position does not change; however, the cursor position now contains a space. If a protected field is encountered and the line cannot be shifted to the right without endangering a protected character, the operation is aborted and no space is inserted.

2-2.3 Deleting a Line

Delete a single line with this function key sequence or escape sequence:

From the keyboard: **FUNCTION with DEL LINE**
From the computer: **ESCAPE then R**

The line on which the cursor is located is deleted. All subsequent lines move up one line each. The last line is replaced by spaces. This function does not operate in the Protect Mode. The cursor position does not change.

2-2.4 Inserting a Line

Insert a single line with this function key sequence or escape sequence:

From the keyboard: **FUNCTION with INS LINE**
From the computer: **ESCAPE then E**

A line of spaces is inserted at the line where the cursor is positioned. All remaining lines move down one line each; if the page was filled before the operation, the last line is lost. The cursor position does not change. This operation does not function when the terminal is in the Protect Mode.

2-2.5 Clearing a Line

Clear a line from the cursor position to the end of the line with this escape sequence. Only unprotected data is affected by this sequence

From the keyboard: **ESCAPE then t**
From the computer: **ESCAPE then t**

2-2.6 Erasing a Line

Erase a line from the cursor position to the end of the line with this function key sequence or escape sequence. Only unprotected data is affected by this sequence.

From the keyboard: **FUNCTION with ERASE LINE**
From the computer: **ESCAPE then T**

2-2.7 Clearing a Page

Clear a page from the cursor position to the end of the page with this escape sequence. Only unprotected data is affected by this sequence.

From the keyboard: **ESCAPE** then **y**
From the computer: **ESCAPE** then **y**

2-2.8 Erasing a Page

Erase a page from the cursor position to the end of the page with this function key or escape sequence:

From the keyboard: **FUNCTION** with **ERASE PAGE**
From the computer: **ESCAPE** then **Y**

2-2.9 Clearing the Display Screen

Clear the entire screen to nulls with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **CLEAR**
From the computer: **ESCAPE** then *****

Erase the entire screen to spaces with this escape sequence:

From the keyboard: **ESCAPE** then **+**
From the computer: **ESCAPE** then **+**

Erase the entire screen to reduced intensity spaces with this escape sequence:

From the keyboard: **ESCAPE** then **,**
From the computer: **ESCAPE** then **,**

2-2.10 Erasing The Display Screen

Erase the entire screen of unprotected characters with this function key or escape sequence:

From the keyboard: **FUNCTION** with **ERASE**
From the computer: **ESCAPE** then **;**

Clear the entire screen of unprotected characters to nulls with this escape sequence:

From the keyboard: **ESCAPE** then **:**
From the computer: **ESCAPE** then **:**

2-3 CURSOR CONTROL

2-3.1 Moving The Cursor Left

Move the cursor one position to the left with this key sequence:

From the keyboard: **SHIFT** with
From the computer: **ESCAPE** then [then D

The cursor can also be moved to the left with the **BACKSPACE** key.

2-3.2 Moving The Cursor Right

Move the cursor one position to the right with this key sequence:

From the keyboard: **SHIFT** with
From the computer: **ESCAPE** then [then C

2-3.3 Moving the Cursor Up

Move the cursor one line up with this key sequence:

From the keyboard: **SHIFT** with
From the computer: **ESCAPE** then [then A

2-3.4 Moving The Cursor Down

Move the cursor down one line with this key sequence:

From the keyboard: **SHIFT** with
or **LINE FEED**
From the computer: **ESCAPE THEN** [then B

2-3.5 Returning The Cursor To Home Position

Move the cursor to home position (i.e. row, 1, column 1), with this key sequence

From the keyboard: **SHIFT** with **HOME**
From the computer: **ESCAPE** then [then H

2-3.6 Return

Move the cursor to the left-most column of the current line with this key or control sequence:

From the keyboard: **RETURN**
From the computer: **CONTROL** with M

If the carriage return line feed (Crlf) is not enabled in the SETUP menu, the cursor moves to the first column position on

the same line; if crlf is enabled, the cursor moves to the first column position of the next line down.

2-3.7 Loading the Cursor Address

Move the cursor to a specified address (row and column) with this key sequence:

From the keyboard: **ESCAPE** then = then Row
Value then Column Value
From the computer: **ESCAPE** then = then Row
Value then Column Value

ESCAPE = Initiates the Load Cursor escape
sequence

Row Value A character code selected from the
table in Appendix C which specifies
the line in which the cursor is to
be located.

Column Value A character code selected from the
table in Appendix C which specifies
the column in which the cursor is to
be located.

For example, to move the cursor to row 7, column 40, enter the following escape sequence:

From the keyboard: **ESCAPE** then = then 7
then 40 then G

2-3.8 Reading The Cursor Address

Read the cursor address through the Block Send channel with this escape sequence.

From the keyboard: **ESCAPE** then ?
From the computer: **ESCAPE** then ?

2-3.9 Reading Cursor Content

Read the character content at the current cursor location with this escape sequence:

From the keyboard: **ESCAPE** then ^
From the computer: **ESCAPE** then ^

2-3.91 Programming the Cursor Control Keys

The TS-1 operating system normally loads the appropriate cursor control codes for each selected emulator automatically; however, this feature is only active if a 1 is entered for the Cur-key value in the SET UP menu.

The cursor control codes which appear in the Examine Functions display are not standard ASCII codes. Each terminal manufacturer selects unique control code sequences to perform the cursor control functions. Because control codes vary, not all codes are compatible with all software. Therefore, it may be necessary to reprogram these codes; they can be programmed to user defined control codes from the keyboard or the host computer. Note that such reprogramming does not modify the TS-1's response to such a code; it merely causes that user-defined code to be output to the host computer.

Use the following steps to reprogram the cursor controls:

1. Verify that the Cur-key value in the SET UP menu is set to 0.
2. Enter the Examine Function display.
3. Enter the appropriate first two capital letters (such as HM, RG) to address a specific cursor function on any blank line.
4. Then enter the selected control codes.
5. Verify that the cursor is one position to the right of the last control code entered.
6. Press **FUNCTION** with **SET F**.
7. Verify that the desired cursor control codes have been entered by pressing **FUNCTION** with **EXAMINE F**. The new control codes should appear at the appropriate location.

2-3.92 Changing the Cursor Display

The cursor display may be changed without entering the Set-Up Mode by using the following escape sequence:

From the keyboard: **ESCAPE** then **d** then Value
From the computer: **ESCAPE** then **d** then Value

Select a Value from those listed below for the desired cursor display mode.

- 0 = No cursor display (blank)
- 1 = Cursor position underline
- 2 = No cursor display, blinking character
- 3 = Cursor position underline and blinking character
- 4 = Reversed video display block
- 5 = Reversed video underlined display block
- 6 = Reversed video display block with blinking character
- 7 = Reversed video underlined display block with blinking character

2-4 TAB FUNCTIONS

2-4.1 Setting A Tab

Set a tab at the current cursor position with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **SET TAB**
From the computer: **ESCAPE** then 1

2-4.2 Setting Tabs Every Eighth Column

Set a tab every eighth column with this escape sequence:

From the keyboard: **ESCAPE** then 3
From the computer: **ESCAPE** then 3

2-4.3 Clearing A Tab:

Clear a tab at the current cursor position with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **CLR TAB**
From the computer: **ESCAPE** then 2

2-4.4 Clearing All Tabs

Clear all tabs with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **CLR ALL TABS**
From the computer: **ESCAPE** then 0

2-4.5 Tab

Move the cursor one tab position toward the end of the line with this key, control or escape sequence:

From the keyboard: **TAB**
From the computer: **CONTROL** with I
or **ESCAPE** then i

2-4.6 Back Tab

Move the cursor one tab position toward the beginning of the line with this key sequence or escape sequence:

From the keyboard: **SHIFT** with **BACK TAB**
From the computer: **ESCAPE** then I

CHAPTER 3
TRANSMISSION CONTROL

3-1 Introduction

The key sequences described below are used to control transmissions between the TS-1 Terminal and the host computer.

3-2 CONVERSATION MODE

Enter Conversation Mode with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **CONV MODE**
From the computer: **ESCAPE** then **C**

3-3 BLOCK MODE

Enter Block Mode with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **BLOCK MODE**
From the computer: **ESCAPE** then **B**

3-4 TRANSMISSION KEY SEQUENCES

3-4.1 Sending a Line

Send a line of unprotected characters, from the first column up to and including the cursor position, to the Primary Port with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **SEND LINE**
From the computer: **ESCAPE** then **4**

3-4.2 Sending An Entire Line

Send a line of all characters, including protected characters, from the first column up to and including the cursor position, to the Primary Port with this escape sequence:

From the keyboard: **ESCAPE** then **6**
From the computer: **ESCAPE** then **6**

3-4.3 Sending a Page

Send a page of unprotected characters, from the home position up to and including the cursor position, to the Primary Port with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **SEND PAGE**
From the computer: **ESCAPE** then **5**

3-4.4 Sending An Entire Page

Send a page of all characters including protected characters, from the home position up to and including the cursor position, to the Primary Port with this escape sequence:

From the keyboard: **ESCAPE** then **7**
From the computer: **ESCAPE** then **7**

3-4.5 Printing a Line

Print a line of unprotected characters, from the first column up to and including the cursor position, output to the Secondary Port to a printer, or other output device with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** and **PRINT LINE**
From the computer: **ESCAPE** then **A**

3-4.6 Printing a Page

Print a page of unprotected characters, from the home position up to and including the cursor position, output to the Secondary Port with this function key sequence or escape sequence:

From the keyboard: **FUNCTION** with **PRINT PAGE**
From the computer: **ESCAPE** then **@**

3-4.7 Printing An Entire Page

Print a page of all characters, from the home position up to and including the cursor position, output to the Secondary Port with this escape sequence:

From the keyboard: **ESCAPE** then **P**
From the computer: **ESCAPE** then **P**

3-4.8 Unformatted Printing

Print a page of all characters, including nulls with no carriage returns or line feeds, from the home position up to and including the cursor position, output to the Secondary Port to a printer or other output device with this escape sequence:

From the keyboard: **ESCAPE** then **p**
From the computer: **ESCAPE** then **p**

3-5 RESETTING THE TERMINAL

Reset the terminal with this function key sequence or escape sequence:

From the keyboard: **CONTROL, FUNCTION, and CLEAR**, simultaneously
From the computer: **ESCAPE** then **z**

CAUTION

Invoking this reset sequence causes all data on the screen and in the data buffer to be lost.

3-6 KEYBOARD MASTER RESET

This key sequence resets the terminal to all default emulator values including screen brightness; it resets the clock to 1:01 AM, erases the screen, resets the title indicator in the status line to "TS-1", erases the content of all the Programmable Function Keys, and resets the personality to default values. To reset the keyboard, use this key sequence:

CONTROL, SHIFT, FUNCTION, and CLEAR, simultaneously

This sequence can only be performed from the TS-1 keyboard.

CAUTION

Invoking this Master Reset sequence causes all data on the screen and in the data buffer to be lost.

CHAPTER 4

VT-100 EMULATION

4-1 INTRODUCTION

This chapter covers the VT-100 emulation by the TS-1. Information on the VT-100 functions which are identical to those performed by the TS-1 are not duplicated in this chapter. Rather, the control codes and escape sequences for the VT-100 which differ from those for the standard TS-1 are described below.

It is assumed that an operator or programmer intending to use the TS-1's emulation of the VT-100 is already familiar with the VT-100. Therefore, the information presented in this chapter is only intended as a guideline to VT-100 functions and is not represented to be an exhaustive description of the VT-100. Programmers desiring additional detailed information regarding the VT-100 should refer to the VT-100 Series Technical Manual by Digital Equipment Corporation.

4-2 MAIN KEYBOARD

Most of the VT-100 keyboard keys are the same as or similar to the TS-1 keyboard keys; however, there are some significant differences.

Some of the common typewriter keyboard characters, such as *, +, &, =, @, _, , (, and) are located on different TS-1 data entry keyboard keys than on the VT-100 keyboard. (A TS-1 typewriter-style keyboard is available as an option.) Some function keys are also located differently on the TS-1; however, the functions performed by these keys are the same.

Function key locations which differ include **SET UP**, **BACKSPACE**, **SET TAB**, and **CLR TAB** keys. In addition there are several function keys present on the TS-1 keyboard which have no corresponding VT-100 keys. These keys include **SEND LINE**, **SEND PAGE**, **PRINT LINE**, **PRINT PAGE**, **BLOCK MODE**, **CONV MODE**, **FREEZE**, **CLEAR**, and Special Function Keys **F5** through **F12**, **BRITE**, **DIM**, **EXAMINE F**, **RUB OUT**, and **SET F**.

The function of the four programmable LED's on the VT-100 keyboard, although the same, is accomplished on the TS-1 in a different manner. The last four double width character positions on the status line (part of the Time Indicator) can be programmed to appear in reverse video when that function has been activated. Programming these indicators is described later in this chapter.

An optional typewriter keyboard is available which reduces the number of differences between the TS-1 and the VT-100 keyboards. (Refer to the Operator's Guide for the TS-1.)

The VT-100 Programmable Function Keys (PF1-PF4) are duplicated in function by the TS-1 Programmable Function Keys **F1-F4**.

Some functions of the TS-1 which are basically similar to the VT-100, but performed slightly differently include the scrolling functions, auto repeat, cursor control, Xon/Xoff, local and online modes, erase, send, print, and programmable functions. Refer to the appropriate sections of the "Operator's Guide for the TS-1" and other sections of this manual for detailed descriptions of how to use and program these functions.

4-3 NUMERIC KEYPAD

The numeric keypad keys are essentially the same for both the TS-1 and the VT-100; however, the TS-1 has several additional functions not included on the VT-100 auxiliary keypad. Refer to the appropriate descriptions of these functions in the "Operator's Guide for the TS-1," and other sections of this manual for additional information.

4-4 ESCAPE AND CONTROL SEQUENCES

All the following sequences are sent to the TS-1 from the host computer, unless otherwise noted.

Note

Any VT-100 escape sequences which alter Set-Up features common to the VT-100 and the TS-1 will alter those features in the TS-1 SETUP menu, even if the VT-100 emulation is being used.

Several terms and characters used in the escape and control sequences are described below.

ESCAPE [	The escape sequence that introduces a contiguous string of characters.
Pm and Pn	Numerical parameters which may be a single value or a character string. In some cases, these parameters are defaulted to 0 or 1.
;	Delimiter separating parameters.
Intermediate Character	A character preceding the numerical parameter.

Final Character A keyboard character that ends and executes a control sequence.

Default Character A function-dependent value assumed when no explicit value, or a value of 0 is specified.

4-4.1 Cursor Position **ESCAPE** [Pm ; Pm R

This sequence reports the cursor position to the host computer on request; the first parameter specifies the line, the second parameter specifies the column.

4-4.2 Cursor Left **ESCAPE** [Pm D

This sequence moves the cursor to the left, as requested by the host computer, or the TS-1. The parameter defines the number of column spaces to the left. If the parameter equals 0 or 1, the cursor moves one space; if the parameter equals n, the cursor moves n spaces or to the end of the line.

4-4.3 Cursor Right **ESCAPE** [Pm C

This sequence moves the cursor to the right, as requested by the host computer, or the TS-1. The parameter defines the number of column spaces to the right. If the parameter equals 0 or 1, the cursor moves one space; if the parameter equals n, the cursor moves n spaces or to the end of the line.

4-4.4 Cursor Up **ESCAPE** [Pm A

This sequence moves the cursor up within the same column, as requested by the host computer or the TS-1. If the parameter equals 0 or 1 the cursor moves up one line; if the parameter equals n, the cursor moves up n spaces or to the end of the screen.

4-4.5 Cursor Down **ESCAPE** [Pm B

This sequence moves the cursor down within the same column, as requested by the host computer or the TS-1. If the parameter equals 0 or 1 the cursor moves down one line; if the parameter equals n, the cursor moves down n lines or to the end of the screen.

4-4.6 Cursor Position **ESCAPE** [Pm ; Pm H

This sequence moves the cursor position; the first parameter specifies the line, the second parameter specifies the column. If either parameter equals 0 or 1, the cursor moves to the first line or column respectively. If both parameters equal 1, the cursor moves to the home position. This sequence is equivalent to the **ESCAPE** [Pm ; Pm f sequence.

4-4.7 Screen Alignment and Focus **ESCAPE # 8**

This sequence fills all spaces of the display screen with E's for aligning and focusing the screen image. This sequence is normally used only by Field Service Representatives.

4-4.8 Double Height/Double Width Characters

Top Half: **ESCAPE # 3**
Bottom Half: **ESCAPE # 4**

These sequences convert all the cursor line characters to either top half or bottom half of double height, double width characters. Use these sequences in pairs to form complete characters. All characters to the right of the center line are lost.

4-4.9 Single Height/Double Width Characters **ESCAPE # 6**

This sequence converts all the cursor line characters to single height/double width characters. All characters to the right of the center line are lost.

4-4.10 Restore Cursor Position and Graphics **ESCAPE 8**

This sequence restores the cursor position, graphics, and character set previously saved.

4-4.11 Terminal Report Sequences **ESCAPE [<sol>; <par>; <n bits>; <xspeed>; <rspeed>; <clkmul>; <flags>x**

The following reporting sequences are sent from the terminal to the host computer either on request, or originated from the terminal.

<u>Parameter</u>	<u>Value</u>	<u>Meaning</u>
<sol>	0 or none	This message requests unsolicited reports from the terminal when the terminal exits the Set-Up Mode.
	1	This message instructs the terminal to respond only on request.
	2	A parameter report
	3	A parameter report from the terminal only on request.

<par>	1	No parity
	4	Odd parity set
	5	Even parity set
<nbits>	1	8 bits/character
	2	7 bits/character

	0	50	} Baud rate (bits per second, transmitting and receiving)
	8	75	
	16	110	
	24	134.5	
	32	150	
	40	200	
	48	300	
<xspeed> ,	56	600	
<rspeed>	64	1200	
	72	1800	
	80	2000	
	88	2400	
	96	3600	
	104	4800	
	112	9600	
	120	19200	

<clkmul> 1 The bit rate multiplier = 16

<flags> 0 Always equals 0

4-4.12 Save Cursor Position/Graphics: ESCAPE 7

This sequence saves the cursor position, graphics and character set.

4-4.13 Set Top and Bottom Margins **ESCAPE** [Pm ; Pm r

This sequence is used to set the top and bottom margins on the display screen, defining the scrolling area. The first parameter is the top margin line of the scrolling area; the second parameter is the bottom margin line of the scrolling area. The minimum scrolling area is two lines. This sequence produces similar results as the Split-Screen feature of the TS-1.

4-4.14 Single Width/Single Height Characters **ESCAPE #5**

This sequence converts all characters in the cursor line to single width and single height.

4-4.15 Terminal Status Report **ESCAPE** [Pn n

This sequence reports the general status of the terminal to the host computer. The values of Pn and their meanings are listed below.

<u>Pn Parameter Value</u>	<u>Meaning</u>
0	Terminal responds, no malfunctions detected
5	Request from host computer to report status.
6	Request from host computer to terminal to report cursor position using a cursor position sequence.

Whenever the host computer sends a parameter value of 5 to the terminal, the terminal always responds with a parameter value of 0.

4-4.16 Erase Display **ESCAPE** [Pn J

This sequence is used to erase some or all of the characters shown on the display, depending on Pn parameter value.

<u>Pn Parameter Value</u>	<u>Meaning</u>
0	Erase data beginning at the cursor position through the end of the display.
1	Erase data from the beginning of the display through and including the cursor position
2	Erase entire display screen

4-4.17 Erase Line **ESCAPE [Pn K**

This sequence is used to erase some or all characters in the cursor line, depending on the parameter value.

<u>Pn Parameter Value</u>	<u>Meaning</u>
0	Erase data beginning at the cursor position to the end of the line.
1	Erase data beginning from the first column through and including the cursor position
2	Erase the entire line where the cursor is located.

4-4.18 Tab Set **ESCAPE H**

This sequence sets a tab stop at the column where the cursor is located.

4-4.19 Horizontal and Vertical Cursor Position **ESCAPE [Pm ; Pm F**

This sequence moves the cursor position; the first parameter specifies the line, the second parameter specifies the column. If either parameter equals 0 or 1, the cursor moves to the first line or column, respectively. If both parameters equal 1, the cursor moves to the home position. This sequence is equivalent to the **ESCAPE [Pm ; Pm H** sequence.

4-4.20 Index **ESCAPE D**

This sequence moves the cursor down one line within the same column. If the cursor is at the bottom line, the bottom line scrolls up one line.

4-4.21 Next Line **ESCAPE E**

This sequence moves the cursor to the first column of the next line down. If the cursor is at the bottom line, the bottom line scrolls up one line.

4-4.22 Reverse Index **ESCAPE M**

This sequence moves the cursor up one line within the same column. If the cursor is at the top line, the top line scrolls down one line.

4-4.23 Reset to Initial State **ESCAPE c**

This sequence resets the terminal to the same state as after being powered-up, including the power-up self-test.

4-4.24 Reset Mode **ESCAPE** [Pn ; Pn ;...; Pn l

This sequence is used to reset one or more modes, depending on the values selected for the Pn parameters; each mode to be reset has its own Pn parameter value.

4-4.25 Advanced Video Option

When the host computer sends the sequence **ESCAPE** [Pm c to the VT-100 emulation, the terminal responds by returning the sequence **ESCAPE** [?;2c. The Advanced Video Feature can also be originated from the terminal using the same terminal sequence.

4-4.26 Select Graphic Attributes **ESCAPE** [Pn ;...; Pn m

This sequence specifies the graphic attributes according to the selected Pn parameters. All characters following this sequence are rendered according to the selected attributes until modified by a different graphics attribute sequence.

<u>Pn Parameter Values</u>	<u>Meaning</u>
0	No graphic attributes
1	Increased intensity or bold face
4	Underscore
5	Blinking
7	Reversed video image

No other parameter values are valid

4-4.27 Set Mode **ESCAPE** Pn ;...; Pn h

This sequence sets one or more modes, depending on the Pn parameter values selected; each mode to be set has its own Pn parameter value. A mode remains set until a reset mode sequence is entered.

4-4.28 Tab Clear **ESCAPE** [Pn g

This sequence clears tabs, depending on the Pn parameter value selected.

<u>Pn Parameter Values</u>	<u>Meaning</u>
0	Clear the tab stop at the cursor position
3	Clear all tab stops for all columns

No other parameter values are valid.

4-4.29 Select Character Set

These sequences are used to select one of two character sets, as shown below.

ESCAPE (B Standard ASCII characters

ESCAPE (O Special Graphics

The optional Special Graphics character set is detailed below.

<u>Octal Code</u>	<u>Key Character</u>	<u>Special Graphics Character</u>
137	_ (Underscore)	Blank
140	` (Accent Grave) ♦	Diamond
141	a	⊞ Checkerboard (error indicator)
142	b	⏪ Horizontal tab
143	c	⏴ Form feed
144	d	⏶ Carriage return
145	e	⏴ Line feed
146	f	° Degree symbol
147	g	± Plus/Minus
150	h	⏴ New Line
151	i	⏵ Vertical Tab
152	j	⏶ Lower right corner
153	k	⏷ Upper right corner
154	l	⏴ Upper left corner
155	m	⏵ Lower left corner
156	n	⊕ Crossing lines
157	o	— Horizontal line Scan 1
160	p	— Horizontal line Scan 3
161	q	— Horizontal line Scan 5

162	r	—	Horizontal line Scan 7
163	s	—	Horizontal line Scan 9
164	t	┌	Left "T"
165	u	┐	Right "T"
166	v	└	Bottom "T"
167	w	┑	Top "T"
170	x	|	Vertical bar
171	y	≤	Less than or equal to
172	z	≥	Greater than or equal to
173	{	π	Pi
174	|	≠	Not equal to
175	}	£	UK Pound symbol
176	~	.	Centered dot

4-4.30 Programmable LED's: ESCAPE [Pm q

This sequence is used to program the last four character positions of the Time Indicator on the status line to perform the same indicator function of the VT-100 programmable LED's. Activated indicators appear as reverse video characters.

<u>Pn</u>	<u>Parameter Value</u>	<u>Meaning</u>
0		Clears all four indicator positions
1		Turns on 4th position from the end
2		Turns on 3rd position from the end
3		Turns on 2nd position from the end
4		Turns on last position

4-4.31 Auxiliary Keypad Mode **ESCAPE = Pm**

To enter the auxiliary keypad mode, use this escape sequence:

ESCAPE = Selected key

To exit the auxiliary keypad mode, use this escape sequence:

ESCAPE >

These sequences engage auxiliary ANSI codes to be sent to the host computer when the various keypad keys are pressed, as shown below. When a selected key is pressed, the entire corresponding ANSI code is sent to the computer.

<u>Key</u>	<u>Auxiliary Keypad Escape Sequence</u>
0	ESCAPE O p
1	ESCAPE O q
2	ESCAPE O r
3	ESCAPE O s
4	ESCAPE O t
5	ESCAPE O u
6	ESCAPE O v
7	ESCAPE O w
8	ESCAPE O x
9	ESCAPE O y
- (dash)	ESCAPE O m
. (period)	ESCAPE O n
ENTER (Same as RETURN key)	ESCAPE O M

CHAPTER 5

ADM-31 EMULATION

5-1 INTRODUCTION

This chapter covers the ADM-31 emulation by the TS-1. Information on the ADM-31 functions which are identical to those performed by the TS-1 are not duplicated in this chapter. Rather, the control codes and escape sequences for the ADM-31 which differ from those for the standard TS-1 are described below.

5-2 PERSONALITY CODES

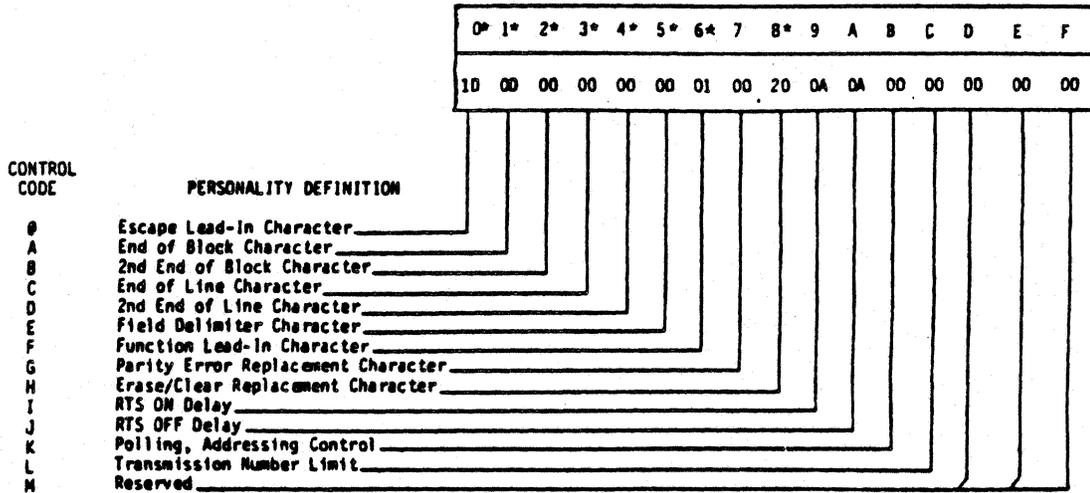
The personality codes exhibited by the ADM-31 emulation by the TS-1 are shown in Figure 5-1. It is assumed that an operator or programmer intending to use the TS-1's emulation to the ADM-31 is already familiar with the ADM-31. Therefore, the information presented in this chapter is only intended as a guideline to ADM-31 functions and is not represented to be an exhaustive description of the ADM-31. Programmer desiring additional detailed information regarding the ADM-31 should refer to the ADM-31 Intermediate Terminal Video Display unit Users Reference Manual by Lear Siegler, Inc.

5-3 DISPLAYING PERSONALITY CODES

To display ADM-31 personality codes, first verify that either the TS-1 mode or the ADM-31 mode is selected in the SETUP menu, then use the following escape sequence:

From the keyboard: **ESCAPE** then **o**
From the computer: **ESCAPE** then **o**

Refer to Figure 5-1 for definition of the displayed personality codes.



* 0 through 6 and 8 are the only codes the TS-1 supports in the ADM-31 emulation; the others are not required.

Figure 5-1. Personality Change Codes

5-4 CHANGING PERSONALITY CODES

Personality codes which modify terminal operations may be changed. Use the following escape sequence to change personality codes:

From the keyboard: **ESCAPE** then . then
a Selected Control Code then
the Selected Replacement Character

From the computer: **ESCAPE** then . then
a Selected Control Code then
the Selected Replacement Character

For the Selected Control Codes and Selected Replacement Characters (ASCII Code), refer to Figure 5-1 and Appendix C.

For example, to replace the erase replacement character with an * use this escape sequence:

From the keyboard: **ESCAPE** then . then
CONTROL with **H** (or **h**)
then *****

To verify that the above operation was correctly performed use this key sequence:

From the keyboard: **FUNCTION** with **ERASE**

The display screen should be filled (all 1920 spaces) with asterisks.

5-5 CURSOR MOVEMENT CONTROL CODES

The cursor movement control codes automatically change when the ADM-31 Emulation is selected, and Cur-key in the SETUP menu is set at 1. Verify these codes by displaying the contents of the Programmable Functions. They should be set as follows:

HM RS	Home
RG FF	Right
LF BS	Left
UP VT	Up
DN LF	Down
BT NK	Backtab

APPENDICES

APPENDIX A

SUMMARY OF ESCAPE SEQUENCES

Note

As used below, the term "clear" means to clear to nulls, whereas the term "erase" means to erase to spaces.

<u>2nd Code of Escape Sequence</u>	<u>ASCII Code</u>	<u>Hex</u>	<u>Operation</u>
"	0100010	(22)	Keyboard enable
#	0100011	(23)	Keyboard disable
\$	0100100	(24)	All Function Keys enabled
%	0100101	(25)	Selective Function Keys enabled
&	0100110	(26)	Set Protect Mode
'	0100111	(27)	Exit Protect Mode
(	0101000	(28)	Normal Intensity
)	0101001	(29)	Reduced Intensity
*	0101010	(2A)	Clear all protected and unprotected characters to nulls.
+	0101011	(2B)	Erase all to Spaces (Clears Display Attributes)
,	0101100	(2C)	Erase all to Reduced Intensity space. (Display Attributes Cleared.)
0	0110000	(30)	Clear all tabs
	0110001	(31)	Set Tab
2	0110010	(32)	Clear Tab

3	0110011	(33)	Set Tabs Every 8th Column
4	0110100	(34)	Send Line
5	0110101	(35)	Send Page
6	0110110	(36)	Send Line including protected positions
7	0110111	(36)	Send Page including protected positions
:	0111010	(3A)	Clear unprotected characters to nulls. Display attributes unaffected.
;	0111011	(3B)	Erase Unprotected Characters to spaces. Display Attributes Unaffected
"	0111101	(3D)	Load cursor address
?	0111111	(3F)	Read cursor address
	1000000	(40)	Print page
A	1000001	(41)	Print line
B	1000010	(42)	Block Mode enable
C	1000011	(43)	Conversation Mode enable
E	1000101	(45)	Insert Line
F	1000110	(46)	Line display attribute, double width, double height, blanking
G	1000111	(47)	Character display attribute (Line)
H	1001000	(48)	Character display attribute
I	1001001	(49)	Backtab

P	1010000	(50)	Print entire Page includes unprotected characters
Q	1010001	(51)	Insert character
R	1010010	(52)	Delete line
T	1010100	(54)	Erase line from cursor position to end of line (unpro- tected data only)
U	1010101	(55)	Set Enter Mode
W	1010111	(57)	Delete character
X	1011000	(58)	Reset Enter Mode
Y	1011001	(59)	Erase page to spaces from cursor position to end of page (unprotected data only)
Z	1011010	(5A)	Reset Protect, Insert, Enter, and Reduced In- tensity Modes
	1011100	(5C)	Invoke Function Key (F1-F12)
]	1011101	(5D)	Load Status Line
f	1100110	(66)	Reset character attribute mode
g	1100111	(67)	Set character attribute mode
h	1101000	(68)	Time Control
i	1101001	(69)	Tab
j	1101010	(6A)	Examine F1-F12
k	1101011	(6B)	Set Function keys (F1-F12)
l	1101100	(6C)	Reset Function keys (F1-F12)

n	1101110	(6E)	Read status
p	1110000	(70)	Print Unformatted
q	1110001	(71)	Set Insert
r	1110010	(72)	Reset Insert
t	1110100	(74)	Clear Line from cursor to end of line (unprotected data only)
u	1110101	(75)	Reset Enter Mode
x	1111001	(78)	Setup Enable
y	1111001	(79)	Clear Page from cursor position to end of page (unpro- tected data only)
z	1111010	(7A)	Reset Terminal

APPENDIX B

KEY TO CONTROL CODES

<u>Display Control</u>	<u>ASCII Code</u>		<u>ASCII</u>	<u>Definition/Operation</u>	
	<u>Binary</u>	<u>Hex</u>			
	0000000	(00)	NUL	No Operation	
SH	0000001	(01)	SOH	Start of Heading	A
SX	0000010	(02)	STX	Start of Text	B
EX	0000011	(03)	ETX	End of Text	C
ET	0000100	(04)	EQT	End of Transmission	D
EQ	0000101	(05)	ENQ	Answer Back Mode	E
AK	0000110	(06)	ACK	Acknowledge	F
BL	0000111	(07)	BEL	Audible Alarm	G
BS	0001000	(08)	BS	Backspace	H
HT	0001001	(09)	HT	Horizontal Tab	I
LF	0001010	(0A)	LF	Line Feed	J
VT	0001011	(0B)	VT	Vertical Tab	K
FF	0001100	(0C)	FF	Form Feed	L
CR	0001101	(0D)	CR	Carriage Return	M
SO	0001110	(0E)	SO	Shift Out	N
SI	0001111	(0F)	SI	Shift In	O
DL	0010000	(10)	DLE	Data Link Escape	P
D1	0010001	(11)	DC1	Device Control 1	Q
D2	0010010	(12)	DC2	Device Control 2	R
D3	0010011	(13)	DC3	Device Control 3	S
D4	0010100	(14)	DC4	Print Buffer Off	T

NK	0010101	(15)	NAK	Not Acknowledged	U
SY	0010110	(16)	SYN	Synchronous Idle	V
EB	0010111	(17)	ETB	End Transmission Block	W
CN	0011000	(18)	CAN	Cancel	X
EM	0011001	(19)	EM	End of Media	Y
SB	0011010	(1A)	SUB	Substitute	Z
EC	0011011	(1B)	ESC	Escape	[
FS	0011100	(1C)	FS	File Separator	
GS	0011101	(1D)	GS	Group Separator]
RS	0011110	(1E)	RS	Record Separator	
US	0011111	(1F)	US	Unit Separator	?
[]	1111111	(7F)	DEL	Delete	(Del)

NOTE: Underlining designates TS-1 control operation.

APPENDIX C

CURSOR ROW AND COLUMN CODE CONVERSION

<u>Cursor Row or Column</u>	<u>ASCII Code</u>	<u>Hex</u>	<u>Cursor Row or Column</u>	<u>ASCII Code</u>	<u>Hex</u>
1	SPACE	20	40	G	47
2	!	21	41	H	48
3	"	22	42	I	49
4	#	23	43	J	4A
5	\$	24	44	K	4B
6	%	25	45	L	4C
7	&	26	46	M	4D
8	'	27	47	N	4E
9	(	28	48	O	4F
10	)	29	49	P	50
11	*	2A	50	Q	51
12	+	2B	51	R	52
13	,	2C	52	S	53
14	-	2D	53	T	54
15	.	2E	54	U	55
16	/	2F	55	V	56
17	0	30	56	W	57
18	1	31	57	X	58
19	2	32	58	Y	59
20	3	33	59	Z	5A
21	4	34	60	[	5B
22	5	35	61		5C
23	6	36	62	]	5D
24	7	37	63		5E
25	8	38	64		5F
26	9	39	65	▾	60
27	:	3A	66	a	61
28	;	3B	67	b	62
29	<	3C	68	c	63
30	=	3D	69	d	64
31	>	3E	70	e	65
32	?	3F	71	f	66
33	@	40	72	g	67
34	A	41	73	h	68
35	B	42	74	i	69
36	C	43	75	j	6A
37	D	44	76	k	6B
38	E	45	77	l	6C
39	F	46	78	m	6D
			79	n	6E
			80	o	6F

APPENDIX D

TIME INDICATOR

HOUR, MINUTE, SECOND CODE CONVERSION

<u>Hour</u> <u>Minute</u> <u>Second</u>	<u>ASCII</u>	<u>Hex</u>	<u>Hour</u> <u>Minute</u> <u>Second</u>	<u>ASCII</u>	<u>Hex</u>
0	SPACE	20			
1	!	21	31	?	3F
2	"	22	32	@	40
3	#	23	33	A	41
4	\$	24	34	B	42
5	%	25	35	C	43
6	&	26	36	D	44
7	'	27	37	E	45
8	(	28	38	F	46
9	)	29	39	G	47
10	*	2A	40	H	48
11	+	2B	41	I	49
12	,	2C	42	J	4A
13	-	2D	43	K	4B
14	.	2E	44	L	4C
15	/	2F	45	M	4D
16	0	30	46	N	4E
17	1	31	47	O	4F
18	2	32	48	P	50
19	3	33	49	Q	51
20	4	34	50	R	52
21	5	35	51	S	53
22	6	36	52	T	54
23	7	37	53	U	55
24	8	38	54	V	56
25	9	39	55	W	57
26	:	3A	56	X	58
27	;	3B	57	Y	59
28	<	3C	58	Z	5A
29	=	3D	59	[	5B
30	>	3E	60		5C

APPENDIX E

CHARACTER SIZE ATTRIBUTES

The TS-1 is able to display characters in five modes: normal, double width, double height, double width/double height, and blanking using this escape sequence:

ESCAPE then **F** then Value

Double Height alternate mode:

ESCAPE then **m**

<u>Value</u>	<u>Description</u>
0	Normal with Blanking
1	Normal
2	Double Width, Blanking
3	Double Width
4	Double Height Blanking, Upper Half
C	Double Height Blanking, Lower Half
5	Double Height - Upper Half
D	Double Height - Lower Half
6	Double Width/Double Height, Blanking - Upper Half
C	Double Width/Double Height, Blanking - Lower Half
7	Double Width/Double Height - Upper Half
F	Double Width/Double Height - Lower Half

Normal size or double width characters already entered may be changed to double height characters (with their original width unchanged) with the following escape sequence:

ESCAPE then **m**

APPENDIX F

DISPLAY ATTRIBUTES

Display Attributes are programmed with this escape command:

ESCAPE then Location Code then Attribute Value

DISPLAY ATTRIBUTE LOCATION CODES

<u>Location Code</u>	<u>Description</u>
g (character)	Sets the Attribute from the cursor position to all characters which follow.
f	Clears the character (g) attribute.
G (line)	Sets the attribute to characters from the cursor position to the end of the line. The ADM-31 protocol is emulated, and a blank protected character is stored where the attribute is invoked.
H (page)	Sets the Attribute for the entire screen.

DISPLAY ATTRIBUTE VALUES

<u>Display Attribute Values</u>	<u>Description</u>
0	Normal
1	Underline
2	Blink
3	Blink and Underline
4	Reverse Video
5	Reverse Video and Underline
6	Reverse Video and Blinking
7	Reverse Video, Blinking, and Underline
8	Blank (for passwords, etc.)
9	Blank and Underline
A	Blank and Blinking
B	Blank, Blinking, and Underline
C	Blank and Reverse Video
D	Blank, Reverse Video, and Underline
E	Blank, Reverse Video, and Blinking
F	Blank, Reverse Video, Blinking, and Underline

APPENDIX G

SUMMARY OF TS-1 ESCAPE CODES

LSB	MSB							
	0	1	2	3	4	5	6	7
0	NUL	DLE		0 CLEAR ALL TABS	@ PRINT PAGE	P PRINT PAGE ALL	\	P UNFORMATTED PRINT
1	SOH	DC1	!	1 SET TAB	A PRINT LINE	Q INSERT CHAR	a	q SET INSERT
2	STX	DC2	" ENABLE KEYBOARD	2 CLEAR TAB	B BLOCK MODE	R DELETE LINE	b	r RESET INSERT
3	ETX	DC3	# DISABLE KEYBOARD	3 SET TABS 8	C CONV MODE	S	c	s SET SCROLL
4	EOT	DC4	\$ ENABLE ALL FUNCTION KEYS	4 SEND LINE	D	T ERASE LINE FROM CURSOR (UN- PROTECTED)	d	t CLEAR LINE FROM CURSOR (UN- PROTECTED)
5	ENQ	NAK	% ENABLE SELECTIVE FUNCTION KEYS	5 SEND PAGE	E INSERT LINE	U ENTER MODE	e SET BRIGHTNESS LEVEL	u RESET ENTER MODE
6	ACK	SYN	& SET PROTECT MODE	6 SEND LINE ALL	F CHAR SIZE ATTRIBUTES	V	f RESET CHAR ATTRIBUTE	v
7	BEL	ETB	' EXIT PROTECT MODE	7 SEND PAGE ALL	G CHAR ATTRIBUTE LINE	W DELETE CHAR	g CHAR ATTRIBUTE PAGE	w
8	BS	CAN	(NORMAL INTENSITY	8	H CHAR ATTRIBUTE ALL	X RESET ENTER MODE	h CLOCK CONTROL	x SETUP ENABLE
9	HT	EM	) REDUCED INTENSITY	9	I BACK TAB	Y ERASE PAGE FROM CURSOR (UN- PROTECTED)	i TAB	y CLEAR PAGE FROM CURSOR (UN- PROTECTED)
A	LF	SUB	* CLEAR ALL	: CLEAR TO NULLS (UN- PROTECTED)	J	Z RESET MODES	j EXAMINE FUNCTION KEYS	z RESET TERMINAL
B	VT	ESC	+ ERASE ALL	: ERASE TO SPACES (UN- PROTECTED)	K	[CURSOR MOVEMENT	k SET FUNCTION KEYS	{ SET FRENCH
C	FF	FS	' ERASE TO DIM SPACES	<	L	\ INVOKE FUNCTION KEY	|	|
D	CR	GS	-	= LOAD CURSOR ADDRESS	M	] LOAD STATUS LINE	m DOUBLE HEIGHT	| RESET FRENCH
E	SO	RS	SET PERSONALITY	>	N	^ READ CURSOR DATA	n READ STATUS LINE	~
F	SI	UT	/	? READ CURSOR ADDRESS	O	-	o DISPLAY PERSONALITY	DEL

NOTE: CLEAR MEANS CLEAR TO NULLS
ERASE MEANS ERASE TO SPACES