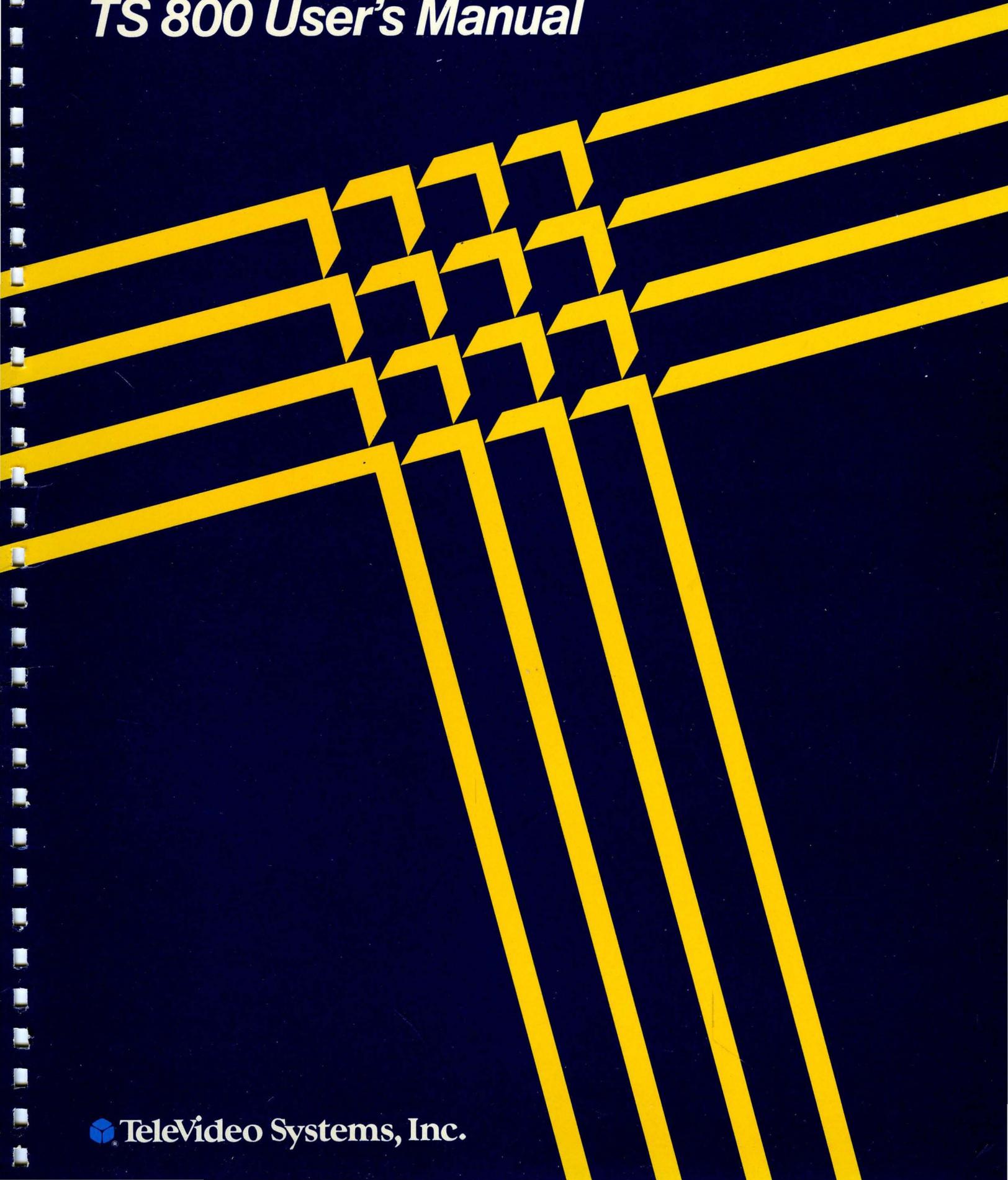


**TeleVideo<sup>®</sup>**  
***TS 800 User's Manual***



**TELEVIDEO® SYSTEMS, INC.**

**TS 800 USER'S MANUAL**

TeleVideo Part Number 2252800 Rev. A

1 November 1983

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This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to correct the interference.

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TABLE OF CONTENTS

1. INTRODUCTION

Introduction to the TS 800 . . . . . 1.1  
Limited Warranty . . . . . 1.2  
Description . . . . . 1.2  
    Hardware. . . . . 1.3  
    Software. . . . . 1.3  
    Graphics. . . . . 1.4  
Format of Manual . . . . . 1.4  
    Special Notes . . . . . 1.4  
    Notation Conventions . . . . . 1.5  
    Programmers Quick Reference Card. . . . . 1.5

2. SETTING UP YOUR TS 800

Introduction . . . . . 2.2  
Selecting the Right Location . . . . . 2.2  
Checklist of Components. . . . . 2.3  
    Reader Comment Card . . . . . 2.3  
Installing Your System . . . . . 2.3  
    Power Cord Connection . . . . . 2.4  
    Plugging in the Power Cord. . . . . 2.4  
    Line Voltage Regulator. . . . . 2.5  
    Switch Settings . . . . . 2.5  
Connecting the TS 800 as a Workstation . . . . . 2.6  
    Cable Connections . . . . . 2.6  
    Switch Settings . . . . . 2.6  
Connecting the TS 800 as a Service Processor Terminal. 2.6  
    Cable Connections . . . . . 2.7  
    Switch Settings . . . . . 2.7  
Connecting Peripherals . . . . . 2.8  
    Attaching Cables. . . . . 2.8  
    Connecting a Serial Printer . . . . . 2.9  
    Changing the Default Printer Device . . . . . 2.10  
    Connecting a Mouse. . . . . 2.10

3. POWER ON

Introduction . . . . . 3.1  
Initial Start Up . . . . . 3.1  
    Powering Up the TS 800 as a Workstation . . . . . 3.1  
    Powering Up the TS 800 as a Service Processor  
        Terminal. . . . . 3.1  
    Booting Up . . . . . 3.2  
    Self-Tests During Power On and Reset. . . . . 3.3  
    Cursor. . . . . 3.3

System Prompts . . . . .	3.3
Adjusting the Contrast . . . . .	3.4
Key Descriptions . . . . .	3.4
Character Keys . . . . .	3.5
Special Keys . . . . .	3.5
Running Applications . . . . .	3.10
Using CP/M, the Operating System . . . . .	3.10

**4. USING CP/M, THE OPERATING SYSTEM**

Introduction to CP/M . . . . .	4.1
CP/M Terms . . . . .	4.1
Starting Up CP/M . . . . .	4.1
Reset Command . . . . .	4.2
System Prompt and the Logged Drive . . . . .	4.2
CP/M Command Lines . . . . .	4.2
Upper- and Lower-Case . . . . .	4.3
Control Characters . . . . .	4.3
Line Editing . . . . .	4.3
Disk Files . . . . .	4.4
Filenames . . . . .	4.4
Wildcard File References . . . . .	4.5
Resident Commands . . . . .	4.6
Unrecognized Commands . . . . .	4.7
DIR - List a Directory . . . . .	4.7
ERA - Erase a File . . . . .	4.7
REN - Rename a File . . . . .	4.7
TYPE- List a File on the Screen . . . . .	4.8
Transient Commands . . . . .	4.8
STAT . . . . .	4.9
PIP . . . . .	4.10
Utility Programs . . . . .	4.11
Applications Software . . . . .	4.11
Review of Technical Terms . . . . .	4.12

**5. PROGRAMMING THE TERMINAL EMULATOR**

Introduction . . . . .	5.1
Subsystems Overview . . . . .	5.1
Terminal Attributes Emulator . . . . .	5.3
Default Video Attributes . . . . .	5.4
Alphanumerics and Video Attributes . . . . .	5.4
Video Attributes . . . . .	5.4
Setting Video Attributes . . . . .	5.5
Escape Sequence Calls to the Terminal Emulator . . . . .	5.5
Escape Sequences for Clearing the Screen . . . . .	5.6
Escape Sequences for Cursor Display . . . . .	5.7
Cursor Control . . . . .	5.7
Cursor Addressing . . . . .	5.8
Tabs . . . . .	5.9
Text Editing Functions . . . . .	5.10
Keyboard . . . . .	5.15
Character Keys . . . . .	5.15
Special Keys . . . . .	5.16
Disabling/Enabling the Keyboard . . . . .	5.20

## TS 800 User's Manual

Keyclick and Bell. . . . .	5.20
Function Keys. . . . .	5.21
Programming the Function Keys . . . . .	5.21
6. VIDEO GRAPHICS	
Introduction . . . . .	6.1
Graphics Primitives Driver . . . . .	6.1
Calling the Graphics Driver. . . . .	6.2
Graphics Driver Functions. . . . .	6.5
The Mouse. . . . .	6.13
Mouse Support Functions. . . . .	6.14
Example Mouse Program. . . . .	6.19
Graphic Character Font . . . . .	6.20
Sample Graphics Access Program Using 8080 Assembly Code. . . . .	6.22
7. PREVENTIVE MAINTENANCE, TROUBLESHOOTING, AND SERVICE	
Introduction . . . . .	7.1
Cleaning . . . . .	7.1
Inspection . . . . .	7.1
Troubleshooting. . . . .	7.2
Changing the Fuse. . . . .	7.3
How to Get Service . . . . .	7.4
Service During Warranty . . . . .	7.4
On-Site Service After Warranty. . . . .	7.4
Information Needed for Service. . . . .	7.4
Technical Assistance . . . . .	7.5
Shipping the TS 800. . . . .	7.5

## APPENDICES

A. Specifications	A.1
B. Statement of Limited Warranty	B.1
C. Suggested References	C.1
D. Cable Specifications	D.1
E. Changing the Fuse to 230 Volts	E.1
F. Using a Two-Prong Adapter	F.1
G. Port Addresses	G.1
H. Pin Connector Assignments	H.1
I. Changing the Default LST: Device	I.1
J. Default Device Assignment	J.1
K. ASCII Code Chart	K.1

**TS 800 User's Manual**

L.	Setup Program	L.1
M.	Programmer's Quick Reference Guide	M.1

LIST OF FIGURES

1-1	The TS 800 . . . . .	1.1
1-2	The TS 800 with Hardware Peripherals . . . . .	1.3
2-1	Example Work Space . . . . .	2.1
2-2	Keyboard Connection. . . . .	2.2
2-3	Power Switch Off . . . . .	2.3
2-4	Power Cord Connection. . . . .	2.3
2-5	Rear Panel Switch. . . . .	2.4
2-6	Default Switch Sections. . . . .	2.5
2-7	D-Shaped Cable Connector . . . . .	2.8
2-8	Correctly Folded Excess Ribbon Cable . . . . .	2.9
2-9	SuperMouse Connection. . . . .	2.10
2-10	Screen Positioning Knob. . . . .	2.11
3-1	Power Switch . . . . .	3.2
3-2	Contrast Knob. . . . .	3.4
3-3	Keyboard . . . . .	3.4
3-4	Special Keys 1 . . . . .	3.5
3-5	Special Keys 2 . . . . .	3.7
3-6	Numeric Keypad Special Keys. . . . .	3.8
5-1	Subsystems Communications. . . . .	5.2
5-2	Memory Architecture. . . . .	5.3
5-3	Character Keys . . . . .	5.15
5-4	Special Keys . . . . .	5.16
6-1	Graphics Display . . . . .	6.1
6-2	Parameter Array Contents . . . . .	6.5
6-3	DrawString Parameter Array Contents. . . . .	6.6
6-4	8x8 Graphics Character Cell. . . . .	6.7
6-5	Scan Out Parameter Array Contents. . . . .	6.8
6-6	Crossshr Parameter Array Contents . . . . .	6.9
6-7	Parameter Array Contents . . . . .	6.10
7-1	Exterior Fuse Location . . . . .	7.3
7-2	Good Fuse. . . . .	7.4
7-3	Blown Fuse . . . . .	7.4
7-4	Serial Number. . . . .	7.4
D-1	RS-232C. . . . .	D.1
D-2	RS-422 . . . . .	D.1
E-1	Fuse . . . . .	E.1
E-2	Voltage Switch . . . . .	E.2
F-1	Two-Prong Power Cord Connection . . . . .	F.1

LIST OF TABLES

1-1	Notation Conventions . . . . .	1.5
2-1	Switch Settings. . . . .	2.5
2-2	Printer and Modem Baud Rate Switch Settings. . . . .	2.10
3-1	Special Keys 1 . . . . .	3.6
3-2	Special Keys 2 . . . . .	3.7
3-3	Numeric Keypad Special Keys. . . . .	3.9
4-1	CP/M Control Functions . . . . .	4.3
4-2	Common Filetype Extensions . . . . .	4.5
4-3	Technical Terms. . . . .	4.12
5-1	Video Attributes . . . . .	5.4
5-2	Escape Sequences for Video Attributes. . . . .	5.6
5-3	Clear Commands Escape Sequences. . . . .	5.6
5-4	Cursor Display Escape Sequences. . . . .	5.7
5-5	Cursor Control Commands. . . . .	5.7
5-6	Cursor Coordinates . . . . .	5.9
5-7	Tab Controls . . . . .	5.10
5-8	Editing Commands . . . . .	5.11
5-9	Monitor Mode Control Characters. . . . .	5.13
5-10	Function of Special Keys . . . . .	5.16
5-11	Keyboard Audio Commands. . . . .	5.20
5-12	Default Function Key Values. . . . .	5.21
5-13	Function Key Values. . . . .	5.22
6-1	Graphics Driver Functions. . . . .	6.5
6-2	Fill Interior Styles . . . . .	6.12
6-3	Graphics Styles. . . . .	6.12
6-4	Mouse Functions. . . . .	6.14
6-5	Character Font . . . . .	6.20
7-1	Troubleshooting Procedures . . . . .	7.2
G-1	Port Addresses . . . . .	G.1
G-2	CRT Controller Control Register Port . . . . .	G.2
H-1	Board Connectors . . . . .	H.1
H-2	RS-232C Modem Connector. . . . .	H.1
H-3	Serial Printer Connector . . . . .	H.2
M-1	Escape Sequence List . . . . .	M.1

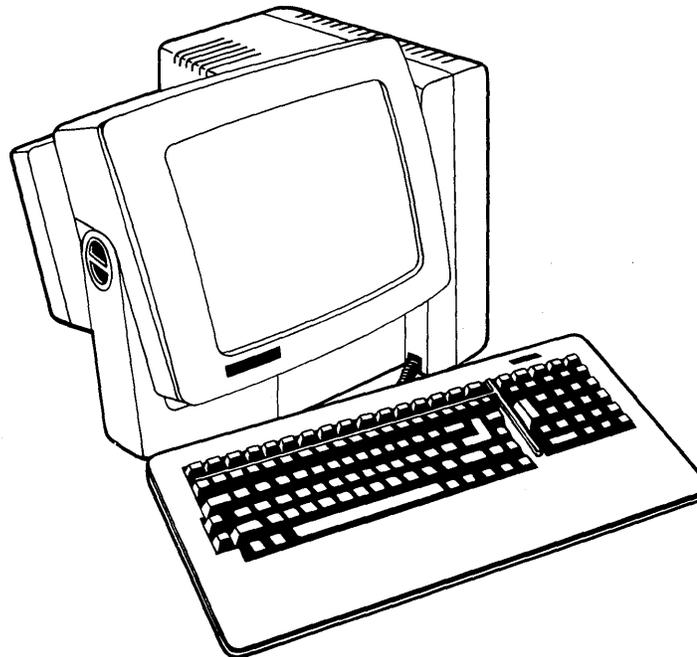
# TS 800 User's Manual

## 1. INTRODUCTION

### INTRODUCTION TO THE TS 800

Welcome to the TeleVideo world of CP/M network computers! Your new workstation is designed to meet a wide variety of business needs and the user-friendly architecture makes the TS 800 easy to install and use. The TS 800 can be connected as either a workstation or a service processor terminal to any of TeleVideo's network systems.

**Figure 1-1**  
**TS 800**



You do not need technical expertise to set up and install your workstation. This manual describes the installation procedure step-by-step and also teaches how to best utilize the many features of the system for your own needs.

Please take the time to read the installation instructions and familiarize yourself with the operation of your system. The special sections on using CP/M, and on programming give you added information for utilizing your system for more than word processing or applications programs.

**LIMITED WARRANTY**

The TS 800 is covered by a limited warranty. The terms and conditions of the complete limited warranty are provided in Appendix B.

**DESCRIPTION**

Your TS 800 is an 8-bit workstation that utilizes Zilog's Z80A microprocessor. The system's tilt-adjustable, fourteen-inch CRT screen has a P31 green phosphor color that makes viewing easier on the eyes.

The computer's processor is designed to allow both alphanumeric computing and standard business graphics. The alphanumeric display is 24 lines by 80 characters. The graphics display features a resolution of 640 x 240 pixels (squares on the screen, like a graph).

The standard system memory is 64 kilobytes (64K) which is expandable to 128K. If you want to use a printer for paper copies of your work, a modem for telecommunications, or a SuperMouse for simpler computer interaction, there are ports, or connectors, on the rear panel to do this.

The TS 800 can be used for a variety of standard and unique applications. Some of the more common uses include:

- \* Word processing
- \* Data base management
- \* Financial planning and analysis
- \* Business calculations
- \* General accounting
- \* Medical and dental record keeping
- \* Customization of applications programs
- \* Programming
- \* Graphics capabilities with many applications

The graphics capability allows you to construct graphs, and bar and pie charts for business graphics presentations. You can use graphics as an integral part of many applications programs.

## TS 800 User's Manual

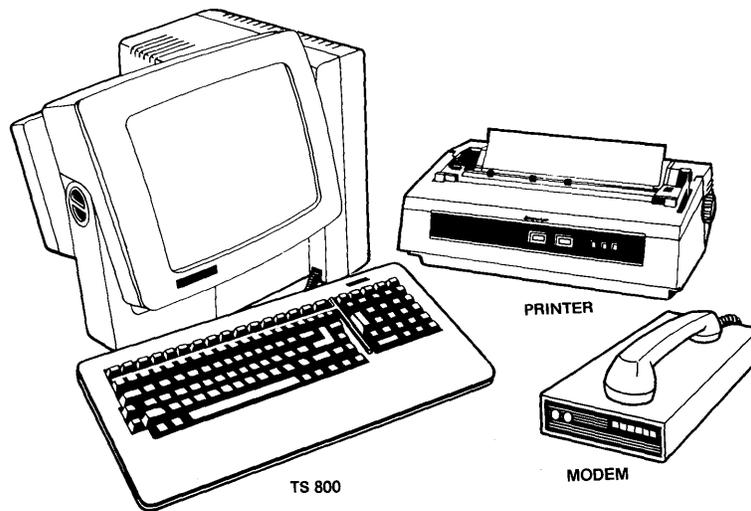
By adding a mouse, many graphics and menu-driven applications programs become even easier to use. Contact your computer store for further information about TeleVideo's SuperMouse.

### Hardware

The hardware in the TS 800 includes the various parts of the computer. These include the main unit, and the keyboard. The TS 800 is connected to one of TeleVideo's networking systems through the RS-422 port on the rear panel of the workstation.

Figure 1-2 shows the TS 800 with other possible hardware peripherals that your system can accept.

**Figure 1-2**  
**TS 800 with Hardware Peripherals**



### Software

TeleVideo's networking systems are controlled by the MmmOST operating system. MmmOST is the operating system for the central service processor. MmmOST is an acronym for Multi-user, Multi-processor, Multi-tasking Operating System Technology. When the central service processor is turned on, MmmOST is loaded into memory to control the functions of the entire networking system.

When the TS 800 is turned on, MmmOST will load the CP/M operating system into the memory of the TS 800. CP/M then controls all of the basic functions of the TS 800 workstation. Chapter four of this manual is an introduction to the CP/M operating system.

## TS 800 User's Manual

Software for the TS 800 consists of those applications programs that have been installed on the central service processor. There are two types of applications programs available to the network user:

Single-user programs such as

- \* Word processing
- \* Business graphics
- \* Financial planning and analysis
- \* Software development

Multi-user programs such as

- \* Data base management
- \* General accounting
- \* Medical and dental record keeping
- \* Remote data processing
- \* Electronic mail

Your computer store representative can recommend applications software for your networking system.

### Graphics

The graphics capabilities of the TS 800 allow you to use business graphics applications programs for creating graphs and charts for your business needs. Chapter 7 teaches the programmer how to access the TS 800's integral graphics capabilities at the assembly language level.

### FORMAT OF MANUAL

There are a few conventions used in this manual that you should understand. Special notes throughout the manual draw your attention to particular information. Symbols are used to indicate particular keys in various instructions.

### Special Notes

Two types of notes call attention to information of special importance:

**NOTE!** General note giving information to every operator.

**STOP!** Note giving information concerning the safety of the operator, possible damage to the system, or possible loss of data. **When you see this, STOP and read the note before proceeding!**

## TS 800 User's Manual

Step-by-step procedures are used in this manual to show how to perform various functions. These procedures show what the user types in and how the system responds to that action. The following is an example of the procedure format:

- USER:       1. **User Action**  
              (What you type in)
- SYSTEM:     2. **Screen Display**  
              (What you see on your screen)

Read the entire procedure before beginning the operation and completely read the step you are working in before entering a response. Many steps offer a choice. All user actions are shown in **bold print**.

### Notation Conventions

Throughout this manual, the following symbols are used to describe user actions.

**Table 1-1**  
**Notation Conventions**

Symbol	Key	Action
<CR>	RETURN (Carriage Return)	This symbol indicates that you are to press the RETURN key.
^C	CTRL (Control) C	This symbol indicates that you are to press the CTRL and C keys simultaneously. The ^ symbol can be used with any alphanumeric character.
ESC	LOC ESC/ESC (Escape)	This notation indicates that you are to press the LOC ESC/ESC key.
/		This symbol, when used between two keys, indicates that you are to press the two keys simultaneously. For example, SHIFT/LOC ESC indicates to press the SHIFT and LOC ESC keys at the same time.

### Programmer's Quick Reference Guide

The Programmer's Quick Reference Guide summarizes all control and escape commands for display control as well as the switch settings for installation. See Appendix M and the reference card.



**2. SETTING UP YOUR TS 800**

**INTRODUCTION**

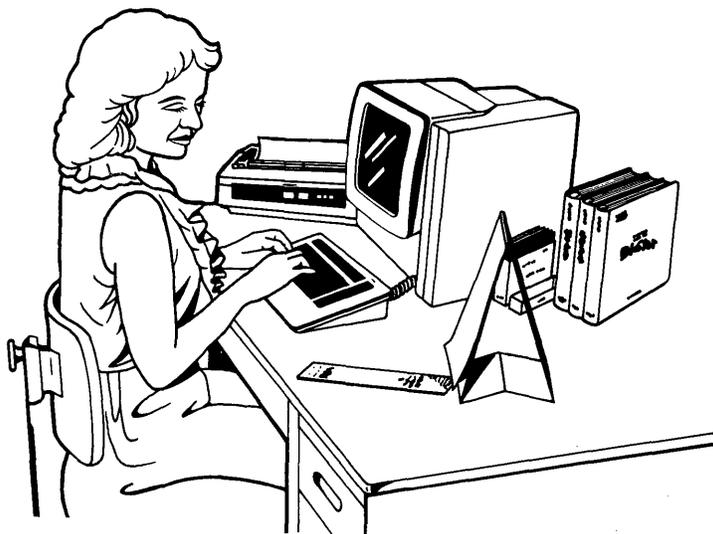
Your TS 800 was tested and inspected before it was packed for shipment. Inspect it carefully when you receive it.

After identifying the parts of your system, follow the directions to install it. Installation includes finding a suitable location, checking and attaching the components, setting switches, and determining the power requirements. Included in this chapter are directions for connecting a printer, modem, and mouse.

**SELECTING THE RIGHT LOCATION**

Select a sturdy, level surface. Leave at least four inches of free space around the enclosure for proper air flow.

**Figure 2-1  
Example Work Space**



**General Environment**

The TS 800 operates best at temperatures and humidity levels in which you are also comfortable. Sudden and drastic temperature changes may adversely affect your stored data.

The system requires a clean environment--free of contaminants such as dust and smoke. Excessive moisture or oil particles in the air can hinder the performance of the system.

## TS 800 User's Manual

### CHECKLIST OF COMPONENTS

As you unpack, check to make sure you received the following items:

1. TS 800 including:
  - Keyboard
  - Main unit with CRT (screen)
  - Power cord
2. Documentation consisting of:
  - TS 800 User's Manual

**NOTE! IF ANY ITEM IS MISSING, CONTACT YOUR COMPUTER STORE BEFORE PROCEEDING WITH THE INSTALLATION.**

### Reader Comment Card

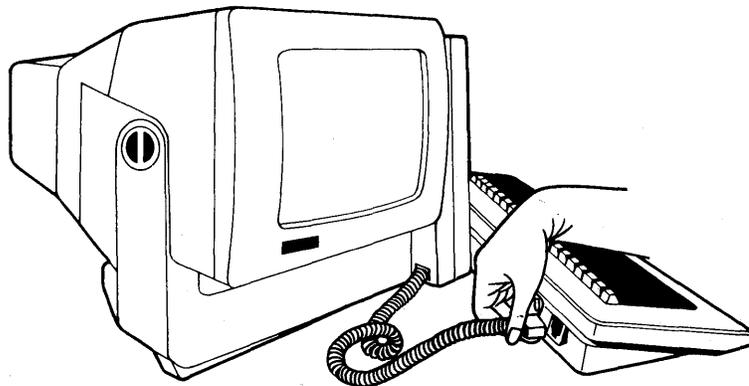
Your comments about this manual are welcome. To facilitate this, we have provided a Reader Comment Card in the back of the manual. Please take a moment to complete and return the card after you have installed your system.

### INSTALLING YOUR SYSTEM

After selecting a good place for your computer and checking for all the parts of your system, it is time to install your TS 800.

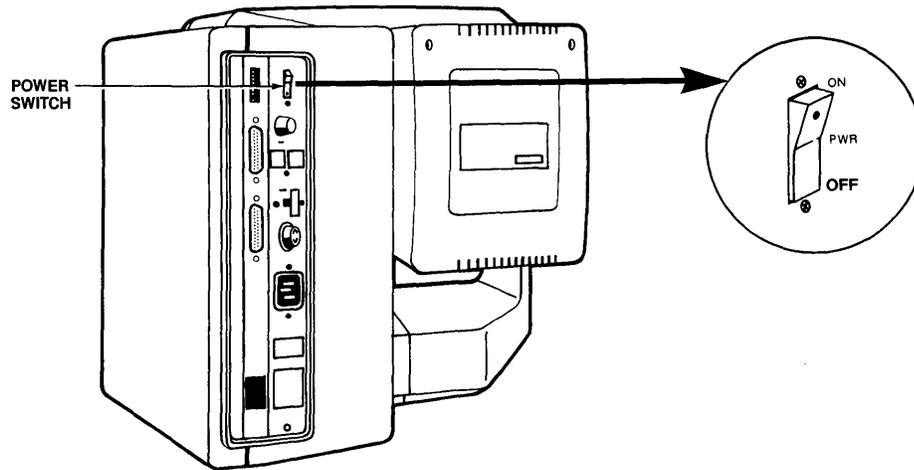
Place the keyboard in a position that is comfortable for you. Plug the telephone-type coiled cord that is connected to the front of the main unit into the phone jack outlet on the back of the keyboard.

**Figure 2-2  
Keyboard Connection**



Locate the ON/OFF power switch on the rear panel of the main unit. Be sure the power switch is turned off by pressing the plain end of the switch.

Figure 2-3  
Power Switch Off



**Power Cord Connection**

The power cord that came with your system plugs into the back of the main unit as shown in Figure 2-4. The source power supply and proper connections are described here.

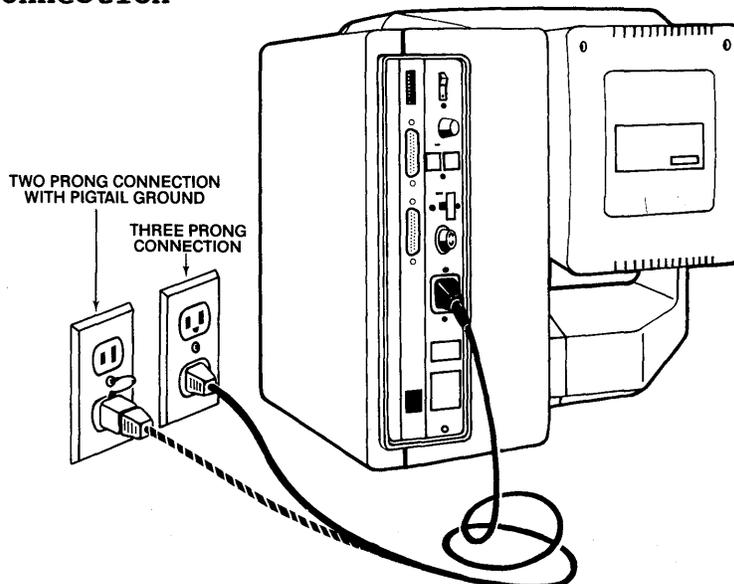
The TS 800 requires a three-prong electrical outlet. If you do not have one and need an adapter, or if you are adapting the TS 800 for 230 volts, refer to Appendices E and F.

**Plugging in the Power Cord**

Plug the power cord that you received with the TS 800 into the plug on the back of the unit as shown in Figure 2-4.

Plug the other end of the power cord into an electrical outlet as you would any appliance.

Figure 2-4  
Power Cord Connection



## **Line Voltage Regulator**

We recommend using a line voltage regulator. By using a line voltage regulator, you can safeguard your system from power surges and voltage spikes that may interfere with the normal operation of your system. Contact your computer store for information on availability and installation.

## **Switch Settings**

Switch settings control many functions, including video display. Most switches can be set according to your preference, but some must be set in required positions.

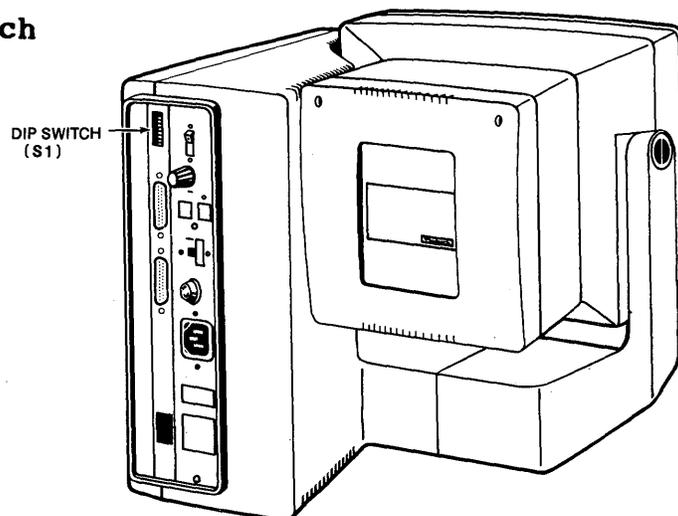
During installation it is important that you check the switch settings to match your system requirements.

The TS 800 has one switch, called a DIP switch, located on the rear panel and labeled S1. See Figure 2-5. This switch contains ten sections (they look like small levers). These sections control various system functions. Figure 2-6 illustrates the positions of the sections as they are set by TeleVideo (default settings).

If you want to change any settings, see Table 2-1 for alternative switch settings.

**STOP!** The sections of the DIP switch are small individual switches. The top of each lever has a small recess that accepts the tip of a ball-point pen. Gently push the switch to the desired position with a pen, and always give the switch a second push to make certain that it is seated properly in the position you have chosen. **DO NOT USE A PENCIL!** Pencil lead is an electrical conductor, and any small grains of lead falling into the switch sections may cause a malfunction.

**Figure 2-5**  
**Rear Panel Switch**



**Figure 2-6**  
**Default Switch Sections**  
 (as set by TeleVideo)

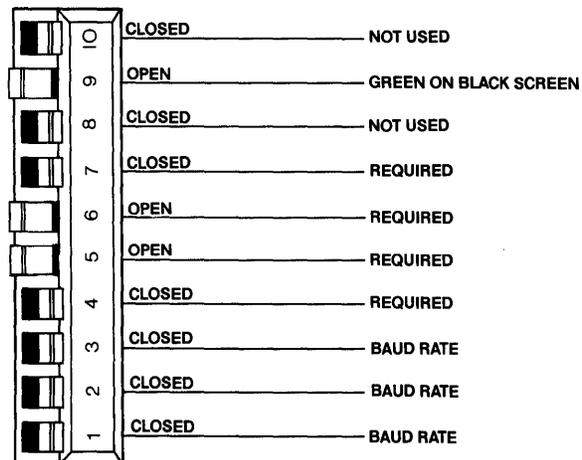


Table 2-1 lists all the possible settings for the DIP switch. Read through the table, and set the sections according to your requirements.

**Table 2-1**  
**Switch Settings**

Section	Default Setting (set to right or left)	Function
1	closed (right)	Baud rate (see Table 2-3)
2	closed (right)	Baud rate (see Table 2-3)
3	closed (right)	Baud rate (see Table 2-3)
4*	closed (right)	
5	open (left) closed (right)	Workstation (default) Service processor terminal
6*	open (left)	
7*	closed (right)	
8	closed (right)	Not used
9	open (left) closed (right)	Green on black screen (default) Black on green screen
10	closed (right)	Not used

\* Required settings

## **CONNECTING THE TS 800 AS A WORKSTATION**

This section describes the installation of the TS 800 in the network environment as a workstation. In this mode the user has access to shared resources and files, although each user has his own independently operating system software.

### **Cable Connections**

When operating as a workstation, the TS 800 should be within 1000 feet of the service processor. Refer to the section "Attaching Cables" for more information.

Attach one end of an RS-422 interface cable to the TS 800 RS-422 connector and the other end to any one of the ports labeled **USER** on the rear of the TS 806/20 or TS 816/40 (shown in the respective User's Manuals.)

### **Switch Settings**

The following steps describe dip switch settings for user station operation. Refer to Table 2-1 for additional switch settings.

1. DIP switch S1-4 must be closed.
2. DIP switch S1-5 must be open.
3. DIP switch S1-6 must be open.

## **CONNECTING THE TS 800 AS A SERVICE PROCESSOR TERMINAL**

This section describes the installation of the TS 800 in the network environment as a service processor terminal. In this mode, the TS 800 serves as the terminal through which an operator controls the entire network; it is dedicated to the service processor and cannot function as a user station.

### **Cable Connections**

When the TS 800 is used as a service processor terminal, the cable connecting it to the central service processor should not exceed 100 feet. Refer to the section Attaching Cables.

Attach one end of an RS-232C interface cable to the connector labeled **TERMINAL** on the rear of the TS 806/20 or TS 816/40 case (as shown in their respective User's Manuals.) Attach the other end to the RS-232C connector labeled RS-232 on the rear of the TS 800. (The pin assignments for the terminal connector are furnished in Appendix H.)

**NOTE!** The RS-232 port has two switch-selectable configurations: it can be used to attach a modem to the TS 800 stand-alone system, or it can be used to attach the TS 800 to a TS 806/20 or TS 816/40 as a service processor terminal. **A MODEM CANNOT BE ATTACHED TO THE TS 800 WHEN IT OPERATES AS A SERVICE PROCESSOR TERMINAL.**

### **Switch Settings**

Certain switch settings are required for the TS 800 to operate as a service processor terminal:

1. DIP switches 4 and 5 must be closed and 6 must be open.
2. The system is set at the factory for a baud rate of 9600, but you can change this to meet the requirements of the service processor. The baud rate is controlled by DIP switches S1-1, S1-2, and S1-3 on the rear of the TS 800. Make sure the TS 800's baud rate matches that of the central service processor. If you are using the TS 800 with the TS 806/20 or TS 816/40, DIP switches, S1-1, S1-2 and S1-3 should be closed. These settings are for 9600 baud rate. Refer to Switch Settings in Chapter 2.

**NOTE!** If you are not connecting a printer or modem and are ready to use your system, go to the Checklist of Installation Procedures at the end of this chapter before continuing with Chapter 3, Power On.

If you wish to connect a printer or modem to your system, continue reading this chapter.

If you are adding a plotter or a mouse, please follow the installation instructions that accompany those devices. Also see Appendix L.

**CONNECTING PERIPHERALS**

Auxiliary serial devices such as printers, modems, plotters, and mice can be connected to the TS 800. Instructions are given here for connecting each of these. The serial printer interface allows the TS 800 to be used with most RS-232C-compatible serial printers currently available on the market, including both character-by-character and buffered printers. The TS 800 is also equipped with a serial modem port for data transmission to another location over telephone lines.

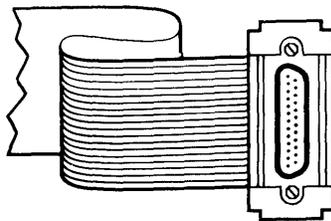
The Setup Program allows you to quickly and easily change the printer and modem port baud rate and data format to adapt to a variety of peripherals. You can also indicate to the operating system whether or not a mouse is attached. A complete description of the capabilities of the Setup Program, as well as step-by-step instructions for using it, are in Appendix L.

**Attaching Cables**

Cables are needed to connect the TS 800 to a printer or a modem. The types of cables needed are determined by the requirements of the device(s) attached to the TS 800. You can obtain the appropriate cables for attaching peripheral devices at your computer store. The technical specifications for each type of cable can be found in Appendix D.

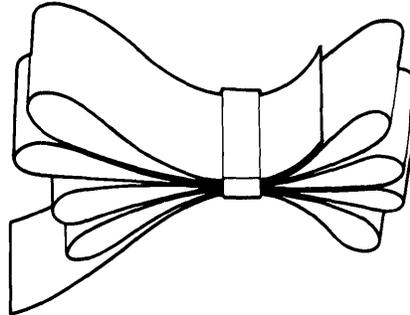
Cable connectors commonly have D-shaped end connectors. See Figure 2-7. These fit onto a D-shaped pin connector on the rear panel of the system. To install a cable, turn the connector end of the cable to fit the pin connector on the device, then gently push the cable on the pin connector. The screws can be finger tightened to prevent accidental cable disconnection.

**Figure 2-7  
D-Shaped Cable Connector**



Leave some slack as you connect the cables. If you are using a round cable, coil it loosely and secure it with a rubberband. If you are using a flat, ribbon cable, fold it accordion-style as shown in Figure 2-8. Coiling the ribbon cable can adversely affect system performance.

**Figure 2-8**  
**Correctly Folded Excess Ribbon Cable**



### **Connecting a Serial Printer**

The RS-232C serial port labeled **PRINTER** is ready to connect to a serial printer when the unit is shipped from the factory. The TS 800 is set to work with printers that run with DTR protocol. Refer to Appendices I and J for further information. Be sure to read the instructions that came with your printer for correct interfacing information. The TS 800 and printer should be within 50 feet of each other. Refer to Appendix D for cable specifications.

Attach one end of an RS-232C interface cable to the port labeled **PRINTER**. Attach the other end to the RS-232C pin connector on the printer.

**NOTE!** Addresses for RS-232C ports are given in Appendix G.

The computer and the peripherals must run at the same speed in order to work properly. This speed is called the baud rate. Baud rates are determined by the switch settings. Table 2-2 shows the proper switch settings for changing the baud rate to correspond with various printers and modems. The baud rate can also be changed by using the Setup Program as described in Appendix L.

**Table 2-2  
Printer and Modem Baud Rate Switch Settings**

DIP Switch Section			Baud Rate
1	2	3	
C	C	C	9,600 (default)
O	C	C	4,800
C	O	C	2,400
O	O	C	1,200
C	C	O	600
O	C	O	300
C	O	O	150
O	O	O	75

**Legend**

C = Switch closed (right)

O = Switch open (left)

**Changing the Default Printer Device**

To change the default printer device and to establish different power-up default values, refer to the instructions in Appendix I, or the Setup program in Appendix L.

**Connecting a Modem**

You can connect one modem to the TS 800. The RS-232C port labeled **RS 232** is ready to interface to a modem.

The TS 800 and modem should be within 50 feet of each other. Refer to Appendix D for cable specifications.

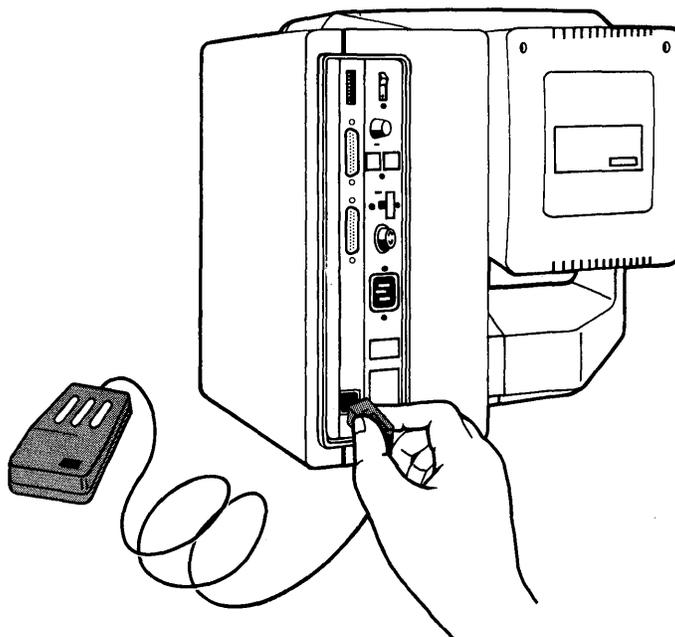
Attach one end of an RS-232C interface cable to the port labeled **RS 232**. Attach the other end to the modem's RS-232C pin connector.

Modem baud rate at default is 9600 baud, but it can be changed by the Setup program in Appendix L or by changing the switch settings. See Table 2-2.

**Connecting a Mouse**

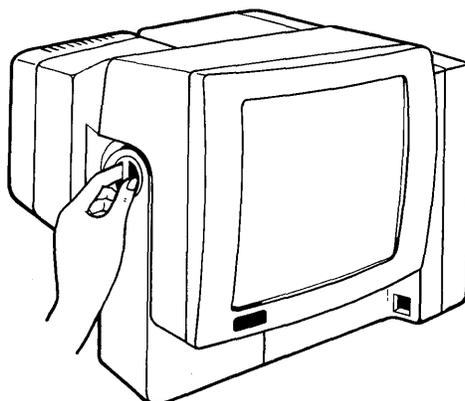
The TS 800 is equipped with a port already configured to accept TeleVideo's SuperMouse. To install the SuperMouse, plug the connector on the SuperMouse cord into the modular telephone-jack in the back of the TS 800 (See Figure 2-9). Use the Setup Program (Appendix L) to set the operating system default to "mouse attached." Follow the instructions supplied with the SuperMouse for operational information.

**Figure 2-9  
SuperMouse Connection**



Your TS 800 system is now installed. At this point you can position the computer where you want it and adjust the screen for your comfort by tilting it up and down. When it is in the position you wish, turn the flat knob on the left side of the screen in a clock-wise direction until it is tight. See Figure 2-10.

**Figure 2-10  
Screen Positioning Knob**



**CHECKLIST OF INSTALLATION INSTRUCTIONS**

Before you proceed with the operation of the system, check your installation.

1. Did you check the TS 800 for possible shipping damage?
2. Is the location that you selected:  
Supplied with a steady line voltage?  
Within comfortable temperature and humidity levels?  
Clean?  
Providing sufficient ventilation around the case?
3. Is the telephone-type coiled cord plugged into the keyboard?
4. Is the power switch turned off?
5. Is the power plug correct for the electrical power outlet?  
Is it plugged into a grounded electrical outlet?
6. Is the system properly connected to the Service Processor?
7. Is the switch S1 set correctly? For all peripheral devices?
8. If the TS 800 is connected to a serial printer and/or a modem, are they connected and located within the distance limits specified?

If the answer to all of these is YES, then you are ready to go on to Chapter 3, Power On.

### **3. POWER ON**

#### **INTRODUCTION**

This chapter gives a step-by-step guide for turning on your workstation, adjusting the contrast, and understanding and using the keys on the keyboard. There is also a section how to use applications programs. The last section shows you how to turn the computer off.

#### **INITIAL START UP**

This section describes the process of starting up the TS 800 in the MmmOST network.

##### **Powering Up the TS 800 as a Workstation**

1. Check the switch settings (refer to the section, Switch Settings, under Connecting the TS 800 as a Workstation).
2. Make sure the service processor is on and has successfully booted from the hard disk drive.
3. Locate the power switch on the rear of the TS 800. Power up the system. (See Figure 3-1.)
4. Look for this message on the TS 800 screen:

```
TeleVideo Systems xxk CP/M V2.2  
(c) 1983 TeleVideo Systems, Inc.  
Distributed Processor TS-800 V x.y  
Processor ID xx <=> y
```

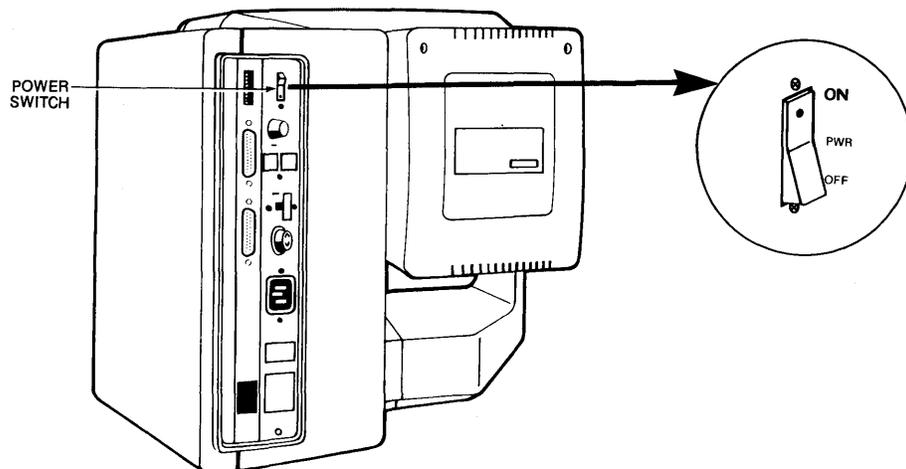
5. CP/M is now in the TS 800 memory and you are ready to operate.
6. If this message does not appear, refer to the troubleshooting chapter of the Central Service Processor.
7. If a hardware error message appears, refer to the section Self-Tests During Power On and Reset.

##### **Powering Up the TS 800 as a Service Processor Terminal**

1. Check the switch settings (refer to the section, Switch Settings, under Connecting the TS 800 as a Service Processor).
2. Locate the rocker on/off switch on the rear of the TS 800. Power up the system and adjust the contrast.

3. Power up the service processor.
4. Look for a sign-on message on the TS 800 screen. Refer to the central service processor manual for the correct message.
5. If the sign-on message does not appear on the screen or if a hardware error appears, refer to the central service processor manual for troubleshooting procedures.

**Figure 3-1**  
**Power Switch**



### Booting Up

Boot is a term that describes the process of the computer starting itself up. It is derived from the expression "pull yourself up by the bootstraps."

There are two types of boots - a **cold boot** and a **warm boot**. Each one affects your system in a different way.

A **cold boot**, or **cold start**, refers to the process of turning the workstation on and loading the operating system. When the power is turned on, the system performs a self-diagnostic test (described in the following section). When the diagnostic test is successfully completed, the system memory is cleared and the operating system is loaded into the workstation.

A **system reset**, or **reset**, is similar to the cold boot. A reset will terminate all current activity and then clear system memory and reload the operating system. All data in memory that has not been saved on disk is lost.

Restart the system if you have a problem with a program and you wish to start again, or if the system does not respond correctly. For example, you would reset the system when the cursor freezes.

To reset your system, press the **CTRL** and the **RESET** (^RESET) keys simultaneously.

## TS 800 User's Manual

A **warm boot** is primarily used to interrupt and stop the execution of a CP/M command. When you press **^C**, the warm boot command, the system prompt appears on the screen. Applications programs have their own warm boot commands to allow you to return to the operating system prompt.

To warm boot the TS 800, enter **^C** (press the **CTRL** and **C** keys simultaneously) either as the first character entered in response to a system prompt, or in applications programs when allowed.

### Self-Tests During Power On and Reset

When the TS 800 is first powered on, several tests are performed to check the system functions. These tests make sure there are no hardware problems that could prevent the operating system from loading, damage the user programs, or destroy data.

If there are any parts that do not pass the tests, an error message appears on the screen. This message states the problem and then says to contact your distributor. Try to reset the system again before calling your computer store.

**NOTE!** These tests are not performed when the TS 800 is warm booted - only at cold boot.

If no messages appear, reset the system by pressing **^RESET**. (If necessary, refer to the Troubleshooting section in Chapter 7.)

### Cursor

The blinking rectangular block on the screen is called the **cursor**. The cursor shows you where data typed on the keyboard will appear on the screen. As the cursor reaches the end of a line, it automatically goes down, or **wraps around**, to the beginning of the next line.

### System Prompts

On your TS 800, the system prompt for drive A of the service processor looks like this:

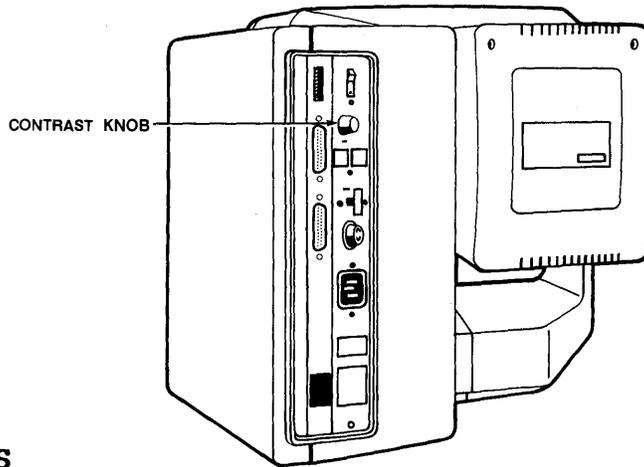
A>

Prompts vary from one computer system to another but almost always indicate that the operating system is ready for your response. While using an applications program, you may see a different prompt symbol; this will be explained in the applications program instructions. The letter before the prompt itself (A>) tells which drive is currently being used. This is called the **logged drive**.

**Adjusting the Contrast**

Adjust the contrast by turning the contrast knob on the rear panel of the system for the desired screen intensity. See Figure 3-2.

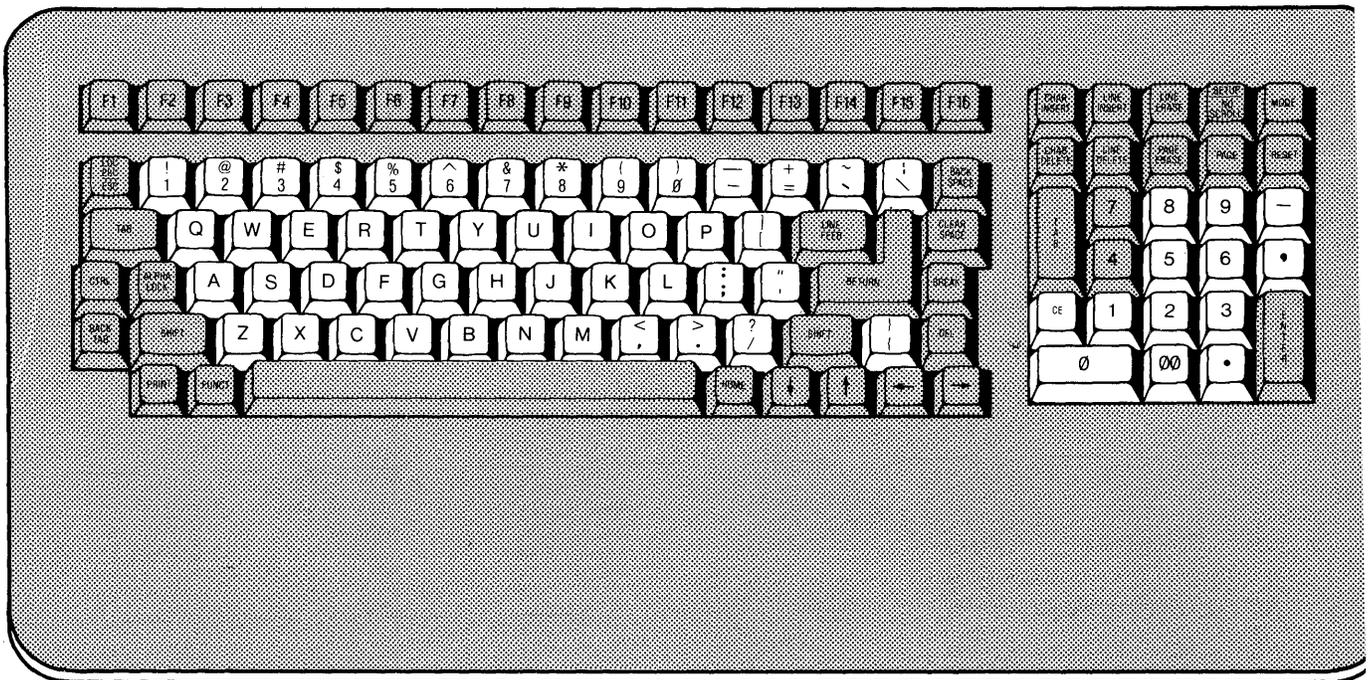
**Figure 3-2  
Contrast Knob**



**KEY DESCRIPTIONS**

The keyboard has a Selectric-style format with a separate numeric keypad for accounting applications. This means that the keyboard operates like a typewriter with many of the same special keys and capabilities to do tabbing and other typewriter functions.

**Figure 3-3  
Keyboard**



**Character Keys**

The character keys that are highlighted in Figure 3-3 are arranged as they are on a typewriter.

The character keys include all alphabet characters (A through Z), numbers (0 through 9), punctuation marks, and mathematical symbols. All character keys repeat when pressed for more than one-half second.

**Special Keys**

There are several special keys that make inputting information easier. The three sections on the following pages include descriptions of the special keys on each side of the main keypad and the special keys on the numeric keypad.

Many of the special keys are not programmed to be used according to their labels when you are using CP/M, the operating system. Therefore, if you use them you may see some symbols and characters on the screen that do not seem to make any sense. A programmer can customize these keys to a specific applications program.

The following descriptions are a general guide for what each key does when you are using CP/M. Programmers can refer to the Keyboard section in Chapter 6 for a more detailed description of the keys.

**Figure 3-4  
Special Keys 1**

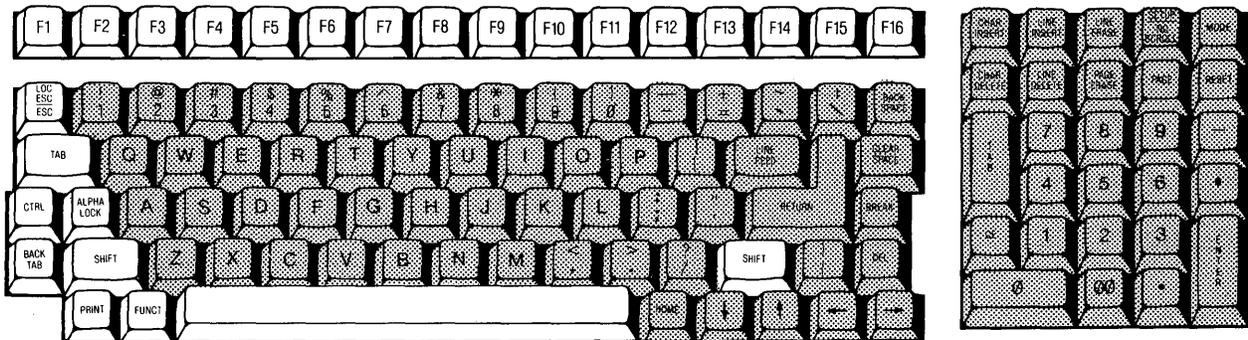


Table 3-1  
Special Keys 1

Key Name	Description
Space Bar	Works like the space bar on a typewriter.
SHIFT	<p>Like the SHIFT key on a typewriter it selects the upper character inscribed on a key, changes operation of most special keys, and capitalizes alpha characters.</p> <p>Like the typewriter SHIFT key, it must be pressed down simultaneously with the key to be shifted. In this manual, when you see <b>SHIFT/</b> it means to simultaneously press SHIFT and the key that follows the slash.</p>
ALPHA LOCK	Locks the SHIFT keys so that all alpha keys are upper-case characters. The key is pressed to lock and pressed again to release.
TAB	Moves the cursor forward one tab.
BACK TAB	Moves the cursor to the first column on the line when used in the key sequence SHIFT/LOC ESC, BACK TAB.
CTRL (Control)	<p>The control key combinations are used for special action by the computer and/or the applications program in the computer.</p> <p>The CTRL key is always used <b>simultaneously</b> with the other character in the command; the CTRL key is pressed first and held down while the other key is pressed. <b>Use of the CTRL key is indicated in this manual by the symbol ^.</b></p>
LOC ESC/ESC	<p>This key is generally used to momentarily leave (escape) an applications program in order to use a special feature or function. ESC is unshifted. <b>LOC ESC is shifted.</b></p> <p>The ESC key is used with another character(s) in the command sequence; <b>the ESC key is pressed and released before the second key is pressed.</b></p>
F1 through F16 (Function Keys)	Certain applications programs enable these keys to perform special functions.
PRINT	The PRINT key does not activate printing in CP/M. All print functions are software controlled.



## TS 800 User's Manual

DEL (Delete)	Deletes the character to the left of the cursor. The character(s) that are deleted are displayed (echoed) on the screen.
HOME	Pressing SHIFT/LOC ESC, HOME moves the cursor to column one of row (line) one. This position is referred to as the <b>home</b> position.
Arrow Up	Moves the cursor up one line when pressed in the sequence SHIFT/LOC ESC, arrow up.
Arrow Down	Moves the cursor down one line when pressed in the sequence SHIFT/LOC ESC, arrow down.
Arrow Right	Moves the cursor one character to the right when pressed in the sequence SHIFT/LOC ESC, arrow right.
Arrow Left	Moves the cursor one character to the left without deleting that character when used in the sequence SHIFT/LOC ESC, arrow left.  Moves the cursor one character to the left and deletes that character when used alone.
BREAK	The BREAK key is not used in CP/M.

**Figure 3-6**  
**Numeric Keypad Special Keys**

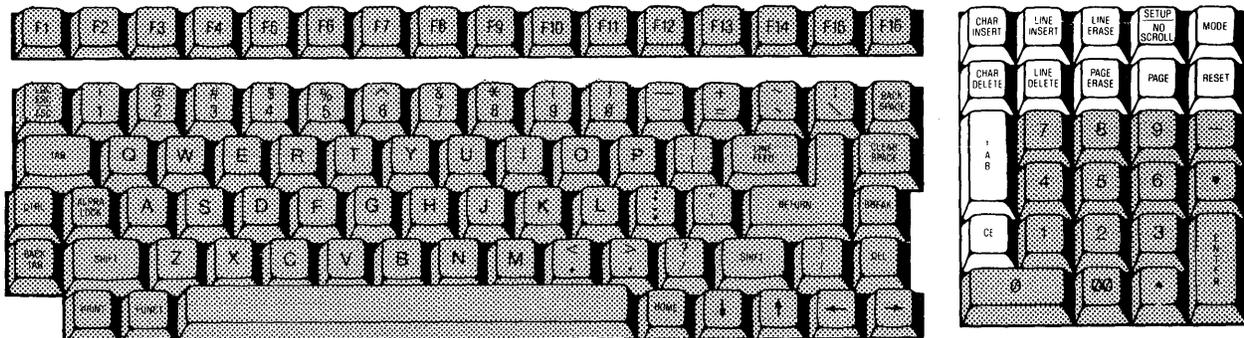


Table 3-3  
Numeric Keypad Special Keys

Key Name	Description
CHAR INSERT	When pressed in the sequence, SHIFT/LOC ESC, CHAR INSERT, causes character at the cursor to move right one column position and enters a space at the cursor position.
LINE INSERT	Inserts a line consisting of spaces at the cursor position when used in the sequence, SHIFT/LOC ESC, LINE INSERT.
LINE ERASE	Deletes all characters from the cursor to the end of the line when used in the sequence, SHIFT/LOC ESC, LINE ERASE.
CHAR DELETE	Deletes the character at the cursor position and moves all following characters left one position when used in the sequence, SHIFT/LOC ESC, CHAR DELETE.
LINE DELETE	Deletes the line at the cursor position and all following lines move up one line when used in the sequence, SHIFT/LOC ESC, LINE DELETE.
RESET	Used with the CTRL key to reset the system. In this manual, this sequence is written <b>^RESET</b> .
TAB	Causes the cursor to advance to the next set tab.
MODE	The MODE key enables the user to toggle the display from graphics to alphanumerics and vice versa without affecting the running program.
CE	The CE (clear entry) key erases the current line and moves the cursor back to the prompt.
PAGE	The PAGE key is not used on the TS 800.
PAGE ERASE	The screen is erased from the cursor position to the bottom of the screen when keys are pressed in the sequence, SHIFT/LOC ESC, PAGE ERASE.
SET UP/NO SCROLL	The SET UP/NO SCROLL key is not used on the TS 800.

**RUNNING APPLICATIONS PROGRAMS**

You may have purchased an applications program such as a word processing program or an accounting program for your system. The following procedures describe how to load the TeleWrite word processing program installed on the B drive of the central service processor.

In this example the command to call up TeleWrite is **TW**. Find the call-up command for you applications program in the documentation that accompanies it.

SYSTEM: Displays

A>

USER: To make B the logged drive, enter:

**b:<CR>**

SYSTEM: Displays

B>

USER: To start TeleWrite, enter

**tw<CR>**

At this point, TeleWrite (or your applications program) is loaded into the workstation from the B drive on the central service processor. From here, follow the instructions that came with the applications program.

**Using CP/M, the Operating System**

When you start the system and you see the A> prompt, you are in CP/M, the operating system for the TS 800. The operating system contains all the instructions that make the computer work. It also contains some programs and commands that can be useful to you as you use your applications programs.

When you type in commands, CP/M recognizes either upper- or lower-case letters even though its responses are in capital letters.

See Chapter 4 for a complete description of CP/M and its many uses.

#### 4. USING CP/M, THE OPERATING SYSTEM

##### INTRODUCTION TO CP/M

CP/M stands for "Control Program/Monitor" or "Control Program for Microcomputers." CP/M is a computer program, just like a word processor or accounts payable package. CP/M is called an **operating system** because it controls all the operations and programs in your computer.

CP/M controls the read and write operations to the network's disk drives. It loads the various applications programs that you want to run and supervises their execution. It organizes the data for communications to a printer or over a modem to a remote station. One way to think of CP/M is as the "personality" that resides in your computer; it is the over-all set of commands that you use to run everything else on your system.

##### CP/M TERMS

As you read through this chapter, look for the following technical terms:

cold boot	warm boot
system prompt	logged drive
resident command	transient command
command line	user memory area
operating system	

They describe some basic concepts in computing. By mastering these few terms you will find yourself inside the "computerese" club! To help you there is a review of the terms at the end of this chapter.

##### STARTING UP CP/M

There are several steps for starting your system and activating the operating system. Most of them were described in previous chapters. The following is a quick review of those steps as they relate to CP/M.

## Reset Command

The following paragraphs explain how to use the CP/M commands. If you enter a command that doesn't seem to work, or if the system "freezes" after you enter a command, remember that you can always re-start (cold boot) CP/M by pressing **^RESET**. The computer will clear memory and re-load the CP/M operating system. This is the same as turning the power on.

## SYSTEM PROMPT AND THE LOGGED DRIVE

When CP/M is successfully loaded into memory from the system, the system prompt is displayed at the left margin of your screen:

```
A>
```

The system prompt tells you that CP/M is waiting for your next command which will be displayed to the right of the **greater-than** character as you type it in. The **A** in the prompt tells you that the **logged drive** is disk drive A.

The **logged drive** is the disk drive that CP/M is currently **working from**. For example, if you want to look up the status using the **STAT** command for a file on disk, and you don't specify which disk drive the file is on, CP/M assumes that you mean the logged drive. You can change the logged drive with this command:

```
A>b:<CR>  
B>
```

The second line is CP/M's response, showing you that the logged drive is now B and that it is ready for another command.

## CP/M COMMAND LINES

CP/M takes your commands in the form of a **command line**. A command line is a string of characters that names the command and supplies any data necessary (such as a filename). The command line is terminated and sent to the computer for processing when you press the RETURN (<CR>) key.

CP/M also accepts several "control" characters, such as **^C**, as commands. These are directly interpreted without entering <CR>, and are useful for editing a command line or entering an override command.

### Upper- and Lower-Case

You may have noticed that CP/M accepted a lower-case "b" in the example above, but displayed an upper-case "B" in its response. CP/M does not distinguish between cases on characters that you type. You may find it convenient to enter commands in lower-case so that you can distinguish your entries from CP/M responses on the screen. When you name a file with lower-case letters, the name is displayed in upper-case letters in the diskette directory.

**NOTE!** Please note that this is only a characteristic of CP/M: other programs such as BASIC do not behave in the same way.

### Control Characters

The key marked **CTRL** (^) is the CONTROL key. To use the CTRL key, press the CTRL and a character key simultaneously. For example, the command to restart CP/M is:

^C

Press the CTRL and C keys simultaneously.

You use this command to abandon a program and to restart CP/M.

### Line Editing

CP/M has several control characters and single-key commands that allow you to edit a complex command line before you send it to the computer with a <CR>. Table 4-1 summarizes the available functions:

**Table 4-1**  
**CP/M Control Functions**

<b>Key</b>	<b>Function</b>
^C	System warm boot; doesn't clear user memory.
^E	Physical end of line; cursor wraps to beginning of next line, but <CR> not sent.
^H	Backspace; moves cursor back one space and deletes character that was there.
BACK SPACE	Same as ^H.

## TS 800 User's Manual

DEL Deletes character to the left of cursor. The character(s) that are deleted are displayed (echoed) on the screen.

^I Moves the cursor to the next tab (8, 16, 24... ).

^P Activates the printer; deactivates the printer with a second ^P (toggle).

^R Re-display command line; useful after DEL echoes deleted characters on command line.

^S After a file or a list starts to display on the screen, ^S is pressed to start or stop (toggle) the scrolling of the display.

^U Cancel current command line; positions cursor under command line for easy re-typing.

^X Backspace to prompt (erases current line). Works the same as the CE key.

RETURN Send command line to computer; <CR>.

^RESET System cold-boot; clears memory and reloads CP/M from drive A.

## DISK FILES

The **disk file** is the basic unit of organization in CP/M. All resident commands refer to file operations. A file can hold any kind of information: text, machine language program code, or graphics commands. Every file is labeled with a **unique filename**, so that the computer can always find the exact file specified in a given command. Refer to the MmmOST manual for more information about disk file organization.

### Filenames

A filename is composed of three parts:

drive prefix:filename.extension

A full unique filename might be:

A:ACCOUNTS.BAS

The **drive prefix** is a single letter that corresponds to the drive the file being referenced is loaded on. If you leave the drive prefix and colon off of the filename, CP/M assumes the currently logged drive.

The **filename** is a unique combination of letters and numbers that

identifies the file in the disk directory. You can use one to eight characters in the filename, mixing numbers and letters any way you want to arrive at a file-naming scheme that is useful to you.

The **extension** is designated by a period at the end of the filename followed by three characters. It is useful for identifying different types of files in the disk directory. Table 4-2 lists some common filetype extensions.

**Table 4-2  
Common Filetype Extensions**

<b>Extension</b>	<b>Definition</b>
.ASM	Assembly program source file
.BAK	Back-up file
.BAS	BASIC program source file
.COB	COBOL program source file
.COM	CP/M executable file (transient command)
.DOC	Document file
.HEX	Intel hexadecimal code file
.REL	Relocatable machine code file
.SUB	SUBMIT command file
.TXT	Text file
.\$\$\$	System temporary file

**Wildcard File References**

In the example above, you saw that you could leave off the drive prefix so that CP/M would supply the currently logged drive. This is handy for speeding up your file manipulation work. You can also insert special **wildcard** characters into a file specification so that CP/M can find multiple files based on a controlling prefix or extension.

- \* (asterisk) In the place of a filename or file extension means "substitute all directory entries here."
- ? (question mark) In the place of one or several character positions in the file specification means "substitute all possible characters here."

## TS 800 User's Manual

When CP/M finds a wildcard in a file specification it tries to do a file-match. It performs the desired command on all files that match the specification. For example:

```
A>STAT *.BAS<CR>
```

returns the status for all .BAS files on the logged drive (no drive prefix was given).

```
A>stat b:sam.*<CR>
```

returns the status for all files named SAM on drive B, regardless of their filetype extension. (Remember, CP/M converts lower-case to upper-case when you enter a command.)

Use the "?" wildcard for single- and multiple-character substitutions:

```
A>era d???.*<CR>
```

erases all files on the logged drive that begin with "d" followed by up to three characters. (It also erases files that begin with "d" and have less than four characters.) This is known as a file-match "mask." The following erases all files beginning with the letter d:

```
A>era d*.*<CR>
```

### RESIDENT COMMANDS

When CP/M is loaded into memory it includes a **kernel** (core group) of built-in or **resident** commands. These are executable directly from their "home" in memory.

CP/M also has a set of **transient commands** which stay in the system until they are needed. Transient commands are actually small programs that are loaded into memory when you call them with a CP/M command line; they are cleared from memory when they are through executing (that is why they are called "transient"). This section describes the CP/M command line format for each of the **resident commands**.

The resident commands discussed below are:

DIR	List a directory
ERA	Erase a file
REN	Rename a file
TYPE	Display or list a file on the screen

**Unrecognized Commands**

If you type in a command that is not recognized by CP/M, usually by making a typing error, CP/M repeats the command as you entered it on the next line followed by a question mark:

```
A>statt<CR>
STAT?
```

```
A>
```

**DIR -- List a Directory**

The DIR command displays a directory of the files on a drive.

```
A>dir x:filename.ext<CR>
```

Typing **dir<CR>** gives you a full directory listing for the currently logged drive. You can narrow the listing down, or list the directory for a different drive by supplying a file specification with or without "wildcard" characters.

**ERA -- Erase a File**

The ERA command erases the file or files specified.

```
A>era x:filename.ext<CR>
```

In the special case of "erase all files" on a drive:

```
A>era b:*. *<CR>
```

ERA responds with a safety verification:

```
ALL (Y/N)?
```

Type **Y** to erase all the files, **N** to cancel the command, followed by **<CR>**.

**REN -- Rename a File**

The REN command is used to rename a file in the directory.

```
A>ren newname.ext=oldname.ext<CR>
```

Notice that the replacement goes right-to-left, that is, the existing file comes second in the command line and will end up with the name at the beginning. This "parameter order" is important! See the transient command PIP also.

If you enter as a "new" name the name of a file that already exists, you get the message:

```
FILE EXISTS
```

## TS 800 User's Manual

If you enter an incorrect file to be renamed, the computer won't be able to find it, and displays the message:

NO FILE

### TYPE -- List a File on the Screen

This command displays the contents of a file on the screen:

A>TYPE x:filename.ext<CR>

The computer sends information to the screen as fast as it can scroll, so a long file seems to fly by. Use the ^S command to stop and start the scrolling action.

### TRANSIENT COMMANDS

CP/M comes with a set of very useful utility programs called **transient commands**. Some of them are powerful program development aids such as the text editor ED, a dynamic debugging monitor DDT, and a file printing routine called DUMP. You can see a list of the transient commands that are on your system by typing:

A>DIR \*.COM

The filetype extension **.COM** is used to denote a file that contains an executable CP/M program or "COMmand." Buying programs is a matter of adding to the number of .COM files available to your system. For example, the word processing program TeleWrite is usually stored in a file called "TW.COM." So the CP/M transient command to execute TeleWrite is:

A>tw<CR>

The program is loaded into the user memory area, or "Transient Program Area" (TPA), and begins execution. When you leave TeleWrite, the TPA becomes available again for another program.

Two of the transient command programs supplied with CP/M are very useful to the beginning computer operator, and they are described below. For a description of the more advanced program development tools, refer to one of the books recommended in Appendix C.

The two transient commands discussed below are:

STAT        List the STATus of a file. Use this to get an alphabetical column display of the files on your drive.

PIP         The Peripheral Interchange Program. Use this to move and to copy files.

**STAT -- List the Status of a File**

The STAT command is used for a variety of tasks. The primary function is to list the status of a file, or files, or an entire drive on the screen. STAT can also be used to change the protection status on a file or group of files. Finally, STAT can be used to change the status of the logical device assignments on your system.

To list the status of the files on a drive enter:

```
A>stat *.*<CR>
```

This causes a column listing of the drive files in alphanumeric order. This is often more useful than the DIR all-on-a-line listing. In addition to the sorted listing, STAT displays other useful information about each file. The STAT listing looks like this:

Recs	Bytes	Ext	Acc	
64	8k	1	R/W	A:ASM.COM
4	2k	1	R/W	A:DUMP.COM
58	8k	1	R/W	A:PIP.COM
41	6k	1	R/W	A:STAT.COM

where:

Recs is the number of 128-byte records in the file.  
Bytes is the length of the file in bytes.  
Ext is the number of logical extents (16k-byte blocks).  
Acc is the file access status.

The file access status can be used to protect valuable files from unwanted overwriting or accidental erasure. R/W means that a file can be Read from and Written to. R/O means that a file can be Read Only. To change the access status of a file use the command line:

```
A>stat x:filename.ext $R/O
```

By adding the \$R/O to the STAT you are adding a "parameter" to the command line. STAT relabels the file as Read Only. You can use the STAT command again to change the file back to Read/Write.

## TS 800 User's Manual

### PIP -- Peripheral Interchange Program

PIP is used to copy files from one drive to the other, or to copy a file to a different filename. The basic format for a PIP command is:

```
PIP y:file2.ext=x:file1.ext[zzz]<CR>
```

where:

file2.ext	is the "destination" file, where the copy will end up
file1.ext	is the "source" file, where the copy comes from
zzz	are "parameters" that allow special handling
x and y	are the disk drives

Notice that, like REN, the action proceeds from right-to-left on the command line.

If you wanted to copy a file from drive A to drive B, the command line would look like this:

```
A>pip b:=a:myfile.bas<CR>
```

There are now two copies of the same data, one in the file "MYFILE.BAS" on drive A, and one in file "MYFILE.BAS" on drive B. You may, or may not want to ERASE the old copy (disk space is a premium, so developing good housekeeping practices can help you get the most out of your system. Don't wait for a disk-full error!)

By omitting any drive specifications you can make copies of a file on the same disk.

One special parameter is very useful, and easy to append to the PIP command line:

v	causes PIP to verify that the copy is an exact duplicate of the original file by doing a byte-by-byte comparison. This may cause delays on long (200K plus) files.
---	--

If you wanted to use this parameter in the file transfer from the above example, the command line would look like this:

```
A>pip b:=a:myfile.bas[v]<CR>
```

This command assures that the file is copied with no errors. The parameters are enclosed in square brackets, and appended directly with no space to the end of the command line.

## **TS 800 User's Manual**

For more details about the PIP command, refer to one of the excellent CP/M books listed in Appendix C.

### **UTILITY PROGRAMS**

TeleVideo has supplied a set of maintenance utility programs with your networking system. For instructions on how to use these utilities and whether these utilities can be run from a workstation or must be run from the service processor terminal, refer to the MmmOST User's Manual for your networking system.

### **APPLICATIONS SOFTWARE**

CP/M is the most popular operating system for microcomputers. This means that the widest possible library of applications is available for your TS 800. You may want to purchase software for some of the following applications:

- \* word processing
- \* accounting
- \* financial analysis
- \* business graphics
- \* program development
- \* entertainment

A minimum of nine CP/M-compatible programming languages including ALGOL, APL, BASIC, C, COBOL, FORTH, FORTRAN, PASCAL, and PL/1 can be used on TeleVideo's systems for your programming applications.

Ask the computer software specialists at your computer store about what software programs and languages run well on your TS 800.

**REVIEW OF TECHNICAL TERMS**

The following is a brief list of some of the more important terms you should know when working with your computer.

**Table 4-3  
Technical Terms**

<b>Term</b>	<b>Definition</b>
Operating System	A collection of programs that give instructions to the computer for the execution of applications programs on a computer.
Cold Boot	On power-up, or system reset, this is the process the computer goes through of checking itself for hardware failures, clearing memory, and loading the operating system program or programs. On the TS 800, a cold-boot is started by turning on the power or by pressing ^RESET simultaneously.
Warm Boot	By entering a ^C you cause CP/M to re-start itself (press the CTRL and C keys simultaneously).
System Prompt	The system prompt looks like this:  A>  When it is displayed at the left side of your screen, CP/M is ready for you to enter your next command.
Logged Drive	The logged drive is the disk drive that CP/M is currently working from. The letter in the system prompt indicates the currently logged drive. If you enter a transient command, this is the drive that CP/M searches to load the command.
Resident Program	The kernel of CP/M is loaded once into a special area in memory, and resides there until memory is cleared with a cold boot or reset. The "resident commands" are a part of this kernel, so the system can execute them without referring to the service processor for more information.

**Transient Program** This is any applications program or CP/M command that is stored on the drive in a .COM file. When you issue a command to use the programs in these files, the programs are loaded into the user memory area (transient program area), executed, and then cleared from memory.

**Command Line** This is the text line that you type to the right of the system prompt. The format of the input line for each command is detailed in the description of each command in the Transient Commands and Utility Programs sections of this chapter. Commands for editing the command line before you send it to the computer with a <CR>, are described in the CP/M Command Lines section of this chapter.

**User Memory Area** The user memory area is the central region of the Random Access Memory (RAM) in your computer. The areas above (high memory) and below (low memory) are reserved for CP/M.

The user memory area is where transient programs are loaded and executed, while CP/M surrounds and supervises the execution. CP/M transient commands (such as STAT and PIP) and applications programs are held on the diskette in .COM files until they are called into memory by your command.

The user memory area is also called the "transient program area" or TPA.



**5. PROGRAMMING THE TERMINAL EMULATOR**

**INTRODUCTION**

This chapter explains the procedures that a programmer must follow to take advantage of the video attributes of the TS 800. Those users with little technical background need not read this information. They should carefully read the earlier chapters of this manual, as well as any documentation that accompanies the applications programs they want to run on the TS 800.

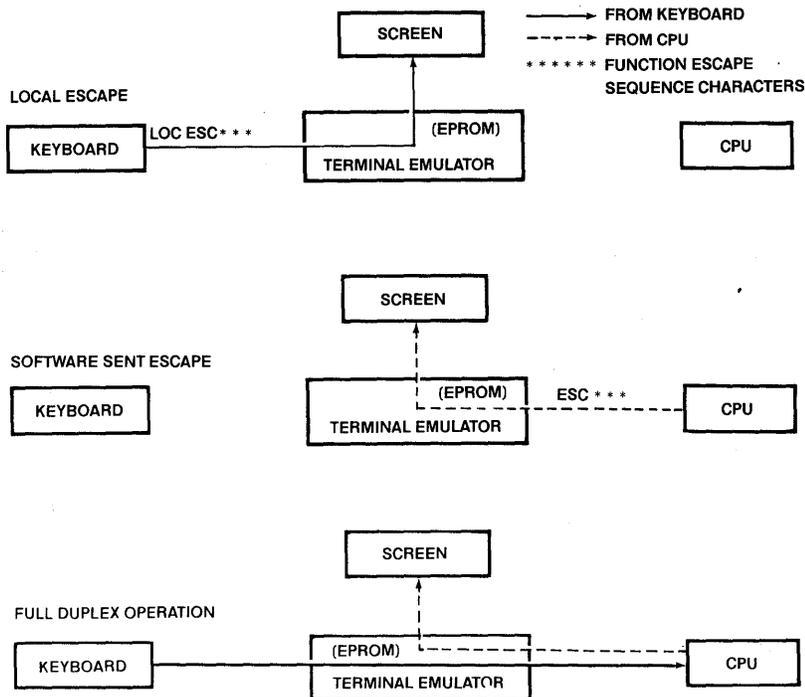
**SUBSYSTEMS OVERVIEW**

The TS 800 video display can be described as comprising several basic subsystems:

- CPU
- Terminal Emulator/Graphics Driver (EPROM)
- System RAM
- Graphics RAM

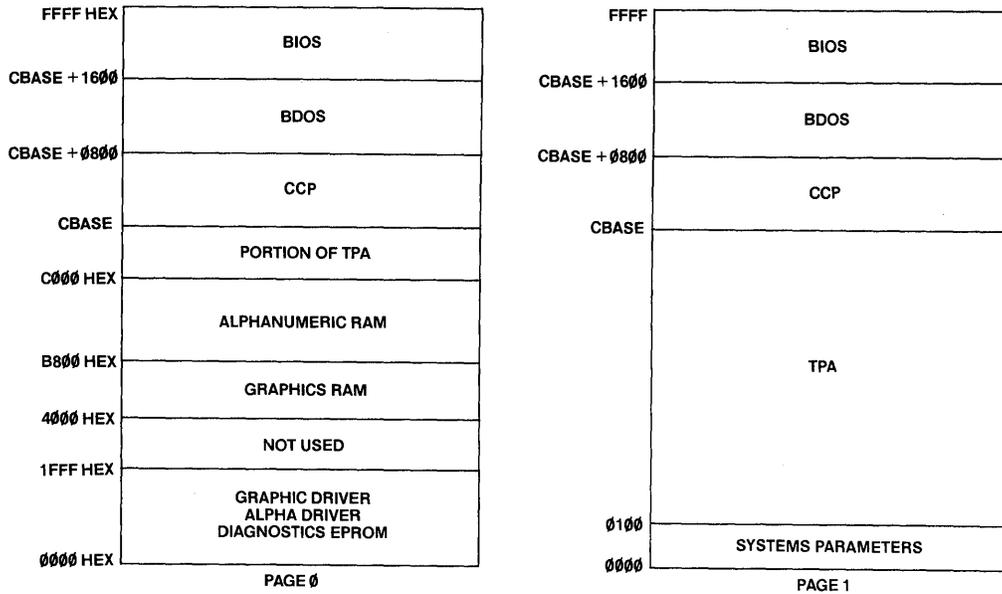
These subsystems operate together to control the video display for either screen I/O operations or display graphics. The sections of this chapter describe the various functions that are available to the programmer to control the video display. Figure 5-1 illustrates the relationships of these subsystems to one another.

Figure 5-1  
Subsystems Communications



The CPU is a ZILOG Z80A operating at 4 MHz. The system has three different kinds of memory: an 8K EPROM containing the system boot, diagnostics, and display control; a 32K block of video display memory which is divided into a 12K alphanumeric section and a 640 x 240 pixel bit-map or 80 x 24 line display; and a 64K block of system RAM. System logic and BIOS enhancements control the memory bank switching which is illustrated in Figure 5-2.

Figure 5-2  
Memory Architecture



When power is first turned on, or after system reset, the hardware automatically selects the memory configuration shown on the left of Figure 5-2. This includes the system EPROM at addresses 0000 - 1FFF, the graphics RAM block at 4000 - BFFF, and finally the upper 16K of system RAM at C000 - FFFF.

The EPROM contains all necessary initialization logic for loading the CP/M program. CP/M is loaded into the high RAM addresses above 48K. When loading is complete, the control logic switches to the full 64K RAM memory configuration and the software initializes the lower RAM system scratch space.

The EPROM then serves as a video display graphics driver. When special graphics functions, BIOS calls are made from applications software, the graphics memory configuration (PAGE 0) is swapped in, and the CPU fetches instructions from the EPROM firmware. The CPU then updates the graphics/alphanumerics RAM which it shares with the video controller on alternate cycles.

### Terminal Attributes Emulator

The video display on your TS 800 is controlled by firmware stored in the 8K on-board EPROM. The firmware has two sections: the Terminal Attributes Emulator, and a Graphics Primitives Driver. Both are easily accessed by the programmer. The Terminal Emulator controls all standard video terminal display functions, such as alphanumerics, as well as special video attributes and cursor addressing. For a description of function calls to the graphics driver, see Chapter 7, Video Graphics.

**Default Video Attributes**

The video display of the TS 800 can be set for "normal video" (green characters on a black background), which is the default setting, by closing the ninth section of the DIP switch. Reverse video (black letters on a green background) can be set by opening the ninth section of the DIP switch. Chapter 2 shows the location of the DIP switch and illustrates the procedure for changing a switch setting. See Table 2-2 for the switch settings.

The display intensity (brightness) can be adjusted with the contrast knob on the back panel of the main unit. See the section called Adjusting the Contrast in Chapter 3.

**Video Attributes**

The video attributes of each character as well as the spaces (blanks) on the screen can be controlled to define the appearance of the screen. The following attributes are available.

**Table 5-1  
Video Attributes**

<b>Attribute</b>	<b>Description</b>
Normal Video	Restores the background of the screen to that selected by rear switch settings.
Reverse Video	Changes the background of the screen to the reverse of that which appears at power on (default). If the screen is normally black with green characters, it will now be green with black characters.
Underline	Creates a solid line below all characters on the line (including the line created by the underscore key). This attribute starts with the cursor position and continues until another attribute is encountered.
Blink	Causes all characters to blink. This attribute starts with the cursor position and continues until another attribute is encountered.

- Invisible** Causes all data entered on the line to be invisible to you although the cursor moves and is transmitted to the computer. (A typical application might be payroll information.) This attribute starts with the cursor position and continues until another attribute is encountered.
- Half Intensity** Changes the intensity to half of normal on a character-by-character basis.

**NOTE!** Half intensity differs from other visual attributes in two ways:

1. Once it is set, it affects all characters entered, regardless of cursor position, until it is turned off.
2. This attribute character never occupies a character space.

### **Setting Video Attributes**

1. Your program should place the cursor one position **before** you want the attribute to start.

**NOTE!** Remember that each attribute occupies a character position. If your program types over the attribute, it is lost.

2. Your program should send the appropriate escape sequence as listed in Table 5-2.

**NOTE!** Escape sequences are shown with spaces. These spaces are included only for the sake of clarity and are not to be included in the sequence.

### **Escape Sequence Calls to the Terminal Emulator**

The Terminal Emulator is a gate array processor that intercepts escape sequences when they are sent from the CPU to the console device and sets the appropriate terminal attribute or function. These escape sequences are ASCII characters sent in a sequential array just as in normal terminal communications.

The typical escape sequence is indicated by an ASCII character 27 (decimal value) ESC. Some of the cursor control functions are represented by ASCII control characters. For example, the **cursor up** function is ^K, ASCII character 11 (decimal).

You can send a **local escape** to the Terminal Emulator directly from the keyboard (by-passing the CPU) by pressing the SHIFT and LOC ESC (SHIFT/LOC ESC) keys simultaneously. This allows you to experiment with the terminal attributes without a code-compile-run overhead problem.

**Table 5-2**  
**Escape Sequences for Video Attributes**

Attribute	Escape Sequence
Normal (default) video	ESC G 0
Invisible normal video	ESC G 1
Blink	ESC G 2
Invisible blink	ESC G 3
Reverse video (reverse of default)	ESC G 4
Invisible reverse	ESC G 5
Reverse and blink	ESC G 6
Invisible reverse and blink	ESC G 7
Underline	ESC G 8
Invisible underline	ESC G 9
Underline and blink	ESC G :
Invisible underline and blink	ESC G ;
Reverse and underline	ESC G <
Invisible reverse and underline	ESC G =
Reverse and underline and blink	ESC G >
Invisible reverse and underline and blink	ESC G ?
Half intensity on	ESC )
Half intensity off	ESC (

**Escape Sequences for Clearing the Screen**

The clear function is used to clear data from screen memory. Clear commands are summarized in Table 5-3.

**Table 5-3**  
**Clear Commands Escape Sequences**

Clear Command	Escape Sequence	Effect
Clear All to Nulls	ESC :	Clears all data on the page to nulls or to half-intensity nulls if half intensity is on.
Clear All to Half-Intensity Spaces	ESC ,	Clears all data on the page to half-intensity spaces.
Clear All to Spaces	ESC + or ^Z	Clears all data on the page to spaces or to half-intensity spaces if half intensity is on.

Clear All to Nulls and Reset Half Intensity	ESC *	Clears all data on the page to nulls. Resets half intensity.
---	-------	---

**Escape Sequences for Cursor Display**

The cursor display may appear any one of five ways. To change the appearance of the cursor, enter one of the following escape sequences.

**Table 5-4  
Cursor Display Escape Sequences**

<b>Appearance</b>	<b>Command</b>
Cursor not displayed	ESC . 0
Blinking block cursor	ESC . 1
Steady block cursor	ESC . 2
Blinking underline cursor	ESC . 3
Steady underline cursor	ESC . 4

**Cursor Control**

The cursor can be directed to a location on the screen by using the cursor control commands in Table 5-5, or by sending the cursor to a screen address as described in the section on Cursor Addressing in this chapter.

**Table 5-5  
Cursor Control Commands**

<b>Cursor Control</b>	<b>Control Code</b>	<b>Effect</b>
Up	^K	Moves the cursor up one line until it encounters the top of the screen. Once it reaches the top of the screen, receipt of further codes has no effect.
Down	^V	Moves the cursor down one line. If the cursor is on the bottom line of the screen, the code has no effect.
Left	^H	Functions the same as BACKSPACE. Moves the cursor to the left. If the cursor is currently in the first column of the line, it moves to the last column of the preceding line. If the cursor is on home, it has no effect.

Right	^L	Moves the cursor right one column. If the cursor is at column 80, the cursor moves to the first column of the next line. If the cursor is at the last column of the last line, it causes the screen to scroll up and moves the cursor to the first column of the new line.
Home	^^	Moves the cursor to column one of the first line. If the cursor is already at the home position, the code has no effect.
Carriage Return	^M	Moves the cursor left to column one of the current line.
Line Feed	^J	Moves the cursor down one line. If the cursor is on the bottom line, it causes the screen to scroll up one line. The cursor stays in the same position.

To move the cursor up one line (reverse linefeed), send

**ESC j**

A reverse linefeed moves the cursor up one line for each reverse linefeed code received. The screen scrolls down one line when the cursor reaches the top line of the screen. As the display scrolls down one line, a new line of data appears at line one of the screen and the last line of the display is deleted. The data consists of spaces.

### Cursor Addressing

The computer can also position the cursor to a specific location without repetitive cursor movement commands. This is called "loading" or "addressing" the cursor.

To address the cursor, enter

**ESC = r c**

where

r is the desired row (line). Refer to Table 5-6 to find the ASCII code representing the desired row.

c is the desired column. Refer to Table 5-6 to find the ASCII code representing the desired column.

**Note!** If your applications program inserts nulls between characters, loading the cursor does not function as described. Instead, the cursor goes to an unpredictable position.

For example, if you want the cursor to go to Row 9 of Column 50, send

ESC = ( Q

**Table 5-6**  
**Cursor Coordinates**

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

\*Row (line) value may not exceed 24.

## Tabs

The cursor may be moved on the screen to preset typewriter-style tabs. Tab controls are summarized in Table 5-7.

**Table 5-7**  
**Tab Controls**

Action	Control Code	Effect
Set tab*	ESC 1	Sets a typewriter-style column tab.
Tab	^I	Causes the cursor to advance to the next tab set. If no tabs are set, the code has no effect and the cursor does not move.
Back Tab	ESC I	Causes the cursor to go back to the previous tab position set. If no tabs are set or if the cursor is on the first tab position on the line, this code moves the cursor to the first column on the line.
Clear Tab**	ESC 2	Clears the tab where the cursor is located when this code is entered.
Clear All Tabs***	ESC 3	Clears all tabs regardless of the position of the cursor when the code is entered.

---

\*To set a tab, move the cursor to the column position where you want a tab. Be sure you enter a **numeral one**, not a lower-case L.

\*\*Position the cursor at the tab to be cleared before entering the sequence.

\*\*\*The position of the cursor when this code is entered is not important.

---

## Text Editing Functions

Changing text can involve the following three actions:

Replacing (ie., typing over) existing text; referred to here as **editing**

Inserting new text which pushes existing text to the right from the cursor position

Deleting existing text (by either character or line) by moving text backward toward the cursor

Editing, inserting, and deleting can occur within the line on which the cursor is positioned. Text which reaches the beginning or the end of a line by these actions are, if moved **further**, lost (fall off that line).

Table 5-8 summarizes the effects of the available editing commands.

**Table 5-8  
Editing Commands**

<b>Edit Command</b>	<b>Escape Sequence</b>	<b>Effect</b>
Character Insert	ESC Q	Causes character at the cursor to move right one column position and enters a space at the cursor position. As characters are inserted, characters reaching column 80 are lost. If half intensity is on, half-intensity spaces replace the erased characters.
Character Delete	ESC W	Deletes the character at the cursor position and moves all following characters left one position. At the end of the delete function, a space is written into the last position on the line. If half intensity is on, half-intensity spaces replace the erased characters.
Line Insert	ESC E	Inserts a line consisting of spaces at the cursor position. This causes the cursor to move to the start of the new line and all following lines to move down one line, resulting in the loss of the last line on the page. If half intensity is on, half-intensity spaces replace the erased characters.
Line Delete	ESC R	Deletes the line at the cursor position and all following lines move up one line. The cursor moves to column one of the line and spaces are loaded into the last line of the page. If half intensity is on, half-intensity spaces replace the erased characters.
Erase to End of Line	ESC T	Erases all characters from the cursor to the end of the line and replaces them with spaces. If half intensity is on, half-intensity spaces replace the erased characters.

## TS 800 User's Manual

Erase to End of Line with Nulls	ESC t	Erases all characters from the cursor position to the end of the line and replaces them with null characters. If half intensity is on, half-intensity nulls replace the erased characters.
Erase to End of Page	ESC Y	Replaces characters from the cursor position to the end of the screen with spaces. If half intensity is on, erased characters are replaced with half-intensity spaces.
Erase to End of Page with Nulls	ESC y	Erases all characters from the cursor position to the end of the page and replaces them with null characters. If half intensity is on, half-intensity nulls replace the erased characters.

You can erase characters **starting at the cursor position** to the end of the line or the page and replace them with either spaces or half-intensity spaces (if half intensity is on).

To erase all characters to the end of the line, send:

**ESC T**

To erase all characters to the end of the page, send:

**ESC Y**

### Monitor Mode

You can display all characters (including all escape and control sequences) sent from the keyboard or generated by a program. This feature is called **monitor mode**. Having the escape and control commands on the screen provides visual clues to make program debugging easier.

To enable monitor mode, send:

**ESC U**

To terminate the display of the control commands, send either

**ESC u or ESC X**

Table 5-9 lists the monitor mode control characters and shows the monitor mode control characters as they appear.

Table 5-9  
Monitor Mode Control Characters

Code	ASCII	Hex	Character Displayed
^@	NULL	00	none
^A	SOH	01	S H
^B	STX	02	S X
^C	ETX	03	E X
^D	EOT	04	E T
^E	ENQ	05	E Q
^F	ACK	06	A K
^G	BEL	07	B L
^H	BS	08	B S
^I	HT	09	H T
^J	LF	0A	L F
^K	VT	0B	V T
^L	FF	0C	F F
^M	CR	0D	C R
^N	SO	0E	S O
^O	SI	0F	S I
^P	DLE	10	D L

**TS 800 User's Manual**

^Q	DC1	11	D 1
^R	DC2	12	D 2
^S	DC3	13	D 3
^T	DC4	14	D 4
^U	NAK	15	N K
^V	SYN	16	S Y
^W	ETB	17	E B
^X	CAN	18	C N
^Y	EM	19	E M
^Z	SUB	1A	S B
^[	ESC	1B	E C
^\	FS	1C	F S
^]	GS	1D	G S
^^	RS	1E	R S
^_	US	1F	U S
DEL	DEL	7F	⏏

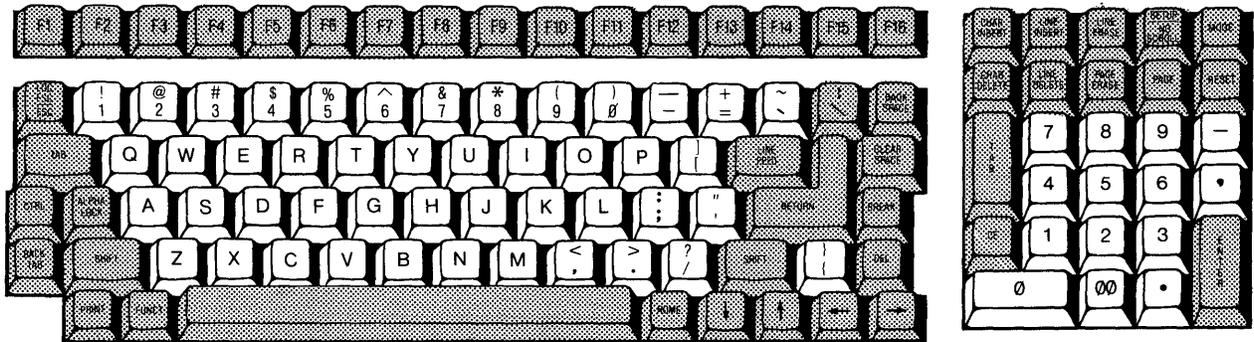
**KEYBOARD**

The keyboard itself can be programmed to suit applications programs. This section discusses the functions of the alphanumeric keys.

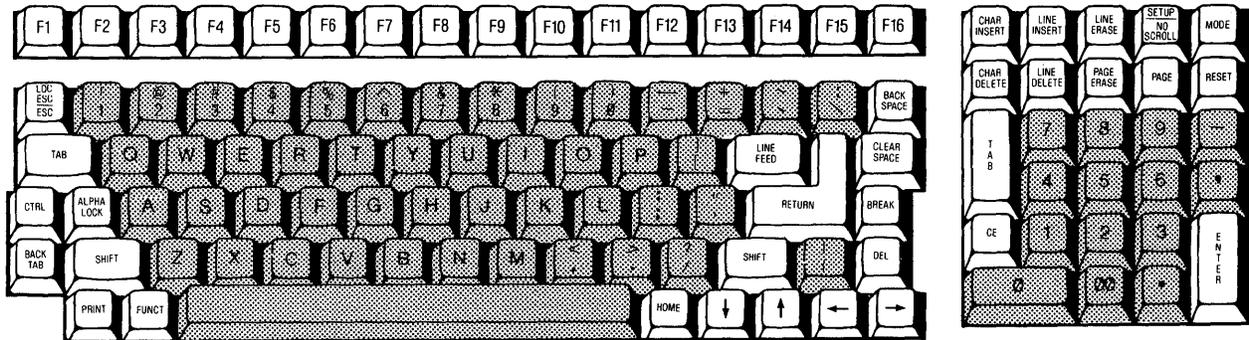
**Character Keys**

The character keys highlighted in Figure 5-3 include all alphabet characters (A through Z), numbers (0 through 9), punctuation marks, and mathematical symbols. All character keys repeat when pressed for more than one-half second.

**Figure 5-3  
Character Keys**



**Figure 5-4  
Special Keys**



**Special Keys**

Table 5-10 summarizes the function of the special keys which are highlighted in Figure 5-4.

**Table 5-10  
Function of Special Keys**

Key Name	Description
Space Bar	Causes a blank space to appear on the display and transmits an ASCII space code.
SHIFT	Selects upper character inscribed on a key, changes operation of most special keys, and capitalizes alpha characters.
ALPHA LOCK	Locks the SHIFT keys so that all alpha keys transmit codes for upper-case characters. The key is pressed to lock and pressed again to release.
TAB	Moves the cursor forward to typewriter tabs. The cursor moves to the next tab setting in that line. When it reaches the last tab setting in that line, it stops. If the cursor is beyond the last tab set on a line, pressing TAB has no effect.

BACK TAB Moves the cursor backward to typewriter tabs. If no tab has been set between the first column position and the cursor position, the cursor moves to the first column position.

CTRL (Control) Generates normally-nondisplayed ASCII control codes (32) when used with another key.

The control key combinations are used for special action by the terminal and/or the applications program in the computer.

When the CTRL key is used with an alpha or symbol key, the output data of the character which is typed becomes 00 through 1F Hex, thus changing the code transmitted by that character. For example, if M alone is pressed, the code for M is sent. If you press ^M, the code for <CR> is sent.

LOCAL ESC/ESC (Escape) The ESC key sends an ASCII code for escape to the display processor. The key is generally used to momentarily leave (escape) an applications program in order to use a special feature or function.

Another function of the ESC key is to display on the screen the next control character entered. This avoids having to use the system mode monitor feature.

When the display is in the alphanumeric mode, the SHIFT/LOC ESC key sequence allows you to change or access the display attributes without transmitting them to the computer. After the SHIFT/ESC key sequence is pressed, the next character entered will be interpreted as a command by the terminal.

**NOTE!** The ESC key is used with another character(s) in the command sequence; i.e., the ESC key is pressed and released before the second key is pressed.

RETURN and ENTER The RETURN and ENTER keys can be used interchangeably. They send the ASCII code for a carriage return <CR> to the display processor within the TS 800. Depending on the communication mode used, the code causes the display processor to transmit a <CR> to the computer.

**NOTE!** The terminal features an auto wraparound function that eliminates the need to manually enter a <CR> and a linefeed (LF) at the end of each 80-character line.

- HOME** Moves the cursor to column one of row (line) one. This position is referred to as the **home** position.
- LINEFEED** The LINEFEED (LF) key sends an ASCII code for a LF to the computer. The code causes the processor to transmit a LF code to the computer and/or the cursor to be moved down one line on the screen when echoed by the internal processor.
- BACKSPACE** Moves the cursor one character to the left. If the cursor is at home, it has no effect.
- Arrow Left** Moves the cursor one character to the left. If the cursor is at home, it has no effect.
- Arrow Up** Moves the cursor up one line. If the cursor is on the top line, it has no effect.
- Arrow Down** Moves the cursor down one line. If the cursor is on the bottom line of the screen, it has no effect.
- Arrow Right** Moves the cursor one character to the right. If the cursor is at the end of the line, it goes to the first column position of the next line. If the cursor is at the end of the screen, it scrolls up the screen.
- DEL (Delete)** The DEL key sends an ASCII DEL character to the computer. The cursor moves to the left and deletes the character to the left.
- CLEAR SPACE** Replaces all characters on the screen with spaces. If half intensity is on, the screen is cleared to half-intensity spaces. (Same as ESC ; or ESC + or ^Z.)
- Shifted CLEAR SPACE clears the graphics display whether or not the graphics is being displayed at the time.
- F1 through F16 (Function Keys)** Each function key sends a three-code sequence to the computer. This sequence may initiate a special form or subroutine in the program that causes the video display to display or perform a particular function.

## TS 800 User's Manual

MODE	This key enables the user to toggle the display from graphics to alphanumerics and vice versa without affecting the running program.
CHAR INSERT	Causes the character at the cursor to move right one column position and enters a space at the cursor position. As characters are inserted, characters reaching column 80 are lost. If half intensity is on, half-intensity spaces replace the erased characters.
LINE INSERT	Inserts a line consisting of spaces at the cursor position. This causes the cursor to move to the start of the new line and all following lines to move down one line, resulting in the loss of the last line of the page. If half intensity is on, half-intensity spaces replace the erased characters.
LINE ERASE	Deletes all characters from the cursor to the end of the line.
CHAR DELETE	Deletes the character at the cursor position and moves all following characters left one position. At the end of the delete function, a space is written into the last position on the line. If half intensity is on, half-intensity spaces replace the erased characters.
LINE DELETE	Deletes the line at the cursor position and all following lines move up one line. The cursor moves to column one of the line and spaces are loaded into the last line of the page. If half intensity is on, half-intensity spaces replace the erased characters.
RESET	Used with the CTRL key to reset the system.
CE	Erases the current line and moves the cursor back to the prompt.
PRINT	The PRINT key is not supported on the TS 800. All print functions are controlled by the computer.

## TS 800 User's Manual

These keys are not supported on the TS 800:

PAGE  
SETUP/NO SCROLL  
FUNCT  
BREAK

### DISABLING/ENABLING THE KEYBOARD

You can disable (lock) all keys and the function keys by using a command sent from the computer.

Once the keyboard is disabled, it can only be enabled by another command from the computer.

**STOP!** If your applications program echoes all codes, the keyboard may be accidentally disabled.

To disable the keyboard, send:

**ESC #**

The keyboard remains disabled until one of the following occurs:

The terminal emulator receives an ESC " sequence.

You reset the system by pressing ^RESET simultaneously.  
This might result in data loss.

### KEYCLICK AND BELL

You can control the keyclick (the noise made as each key is activated) and sound the bell with the following code sequences.

**Table 5-11**  
**Keyboard Audio Commands**

Function	Command
Keyclick on	ESC >
Keyclick off	ESC <
Ring bell	^G

**FUNCTION KEYS**

The function keys (F1 through F16) send a user-defined or default code. For example, the user-defined code may be a frequently-used escape or control code sequence in a text editing application.

There are sixteen function keys; using them in combination with SHIFT allows up to 32 sets of codes to be transmitted.

**Programming the Function Keys**

When the terminal is first turned on, the function keys are already programmed with default messages. If you do not program the function keys, the default values shown in Table 5-12 are transmitted by each function key.

**Table 5-12  
Default Function Key Values**

<b>Key</b>	<b>Unshifted Code</b>	<b>Shifted Code</b>
F1	^ A @ CR	^ A ' CR
F2	^ A A CR	^ A a CR
F3	^ A B CR	^ A b CR
F4	^ A C CR	^ A c CR
F5	^ A D CR	^ A d CR
F6	^ A E CR	^ A e CR
F7	^ A F CR	^ A f CR
F8	^ A G CR	^ A g CR
F9	^ A H CR	^ A h CR
F10	^ A I CR	^ A i CR
F11	^ A J CR	^ A j CR
F12	^ A K CR	^ A k CR
F13	^ A L CR	^ A l CR
F14	^ A M CR	^ A m CR
F15	^ A N CR	^ A n CR
F16	^ A O CR	^ A o CR

You may program the function keys by following the procedure described here.

Enter the following code in the exact sequence shown:

SHIFT/LOC ESC | p1 p2 message ^Y

where

p1 is the number of the function key. The values of p1 are in Table 5-13.

**Table 5-13  
Function Key Values**

Key	Unshifted	Shifted
F1	1	<
F2	2	=
F3	3	>
F4	4	?
F5	5	@
F6	6	A
F7	7	B
F8	8	C
F9	9	D
F10	:	E
F11	;	F
F12	G	L
F13	H	M
F14	I	N
F15	J	O
F16	K	P

p2 is the following value:

1 = Send to the computer

message can contain up to 63 bytes per key

^Y is the termination character

Because control, escape, cursor position, and similar function keys are not normally stored, a ^P embedded in the text of the function key message may be used to store the next character entered.

## TS 800 User's Manual

For example, assume that the message desired for key F1 is:

TURN ON THE PRINTER

Precede this message with the following:

SHIFT/LOC ESC |

The key number (1 for key F1)

The value 1 (for send to computer)

The entry is:

SHIFT/ESC | 1 1 TURN ON THE PRINTER <CR> ^Y

- NOTE!**
1. Entering the message followed by <CR> enters a carriage return at the end of the function.
  2. Entering the message without <CR> leaves the cursor at the end of the message.



## 6. VIDEO GRAPHICS

### INTRODUCTION

This chapter discusses how to access the graphics features, what graphics features are available, and how to access the SuperMouse support functions.

### GRAPHICS PRIMITIVES DRIVER

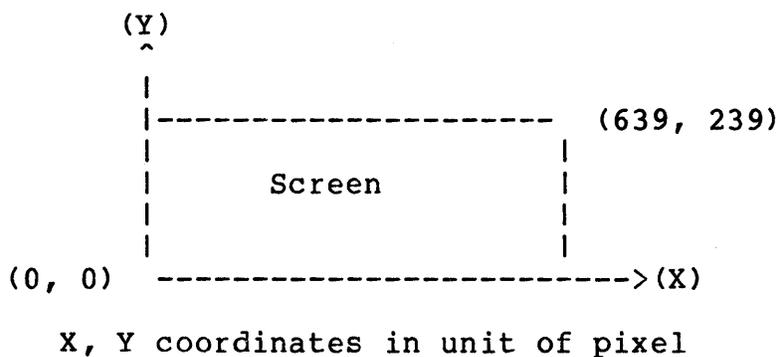
The firmware in the TS 800 serves three functions:

- System boot and diagnostic routines
- Alphanumeric Generator/Terminal Attributes Emulator
- Graphics Primitives Driver

The Graphics Primitives Driver is the lowest level interface to the graphics memory. The Graphics Driver accesses the 20K segment of the 32K graphic memory block as a 640 x 240 pixel bit map through the CPU, mapping the graphics to be displayed by the video controller. The CPU updates the display on alternate cycles with video controller access.

The programmer can have programs access the display memory with calls to the Graphics Primitives Driver. The following sections describe the procedures by which calls can be made to the graphics driver.

**Figure 6-1**  
**Graphics Display**



## TS 800 User's Manual

The TS 800 is also equipped with an optical MOUSE interface. The mouse has ten software-support functions which are described in the Mouse Support Functions section of this chapter. These functions can be directly accessed by the user through a single-entry point.

### CALLING THE GRAPHICS DRIVER

The following procedure enables you to access the graphics driver.

1. Load register "C" with the desired graphics function identifier as listed in Table 6-1.
2. Load the parameters as specified by Table 6-1 either into registers HL, and DE or into a **parameter array**.

**NOTE!** The address of the parameter array mentioned above is contained in address 0FF00h and 0FF01h.

0FF00h contains low byte of address.  
0FF01h contains high byte of address.

3. Perform a Restart instruction (RST 28h in Z80 or RST 5 in 8080). The restart instructions direct the call to a location in the BIOS. It then jumps to the graphics entry point in the EPROM where the graphics function will be carried out.

Notice that the array for an extended parameter list is stored in high RAM memory so that it is still available after the memory bank switches from graphics mode to alpha mode and vice versa.

The following is an example of how to access the graphics driver in Z80 code. A complete list of examples of how to access the graphics driver is listed in the section of this chapter called "Sample Graphics Access Program Using 8080 Assembly Code."

Suggestion: it is very useful to create a macro for access to the graphics output primitives.

```
grout      macro
           RST      28h      ;access graphics
           endm
```

## TS 800 User's Manual

This macro can be called each time the registers are set appropriately for a particular graphics function call.

Example 1: To draw a line in Z80 code.

```
CSEG
.Z80
ld      C,1      ;"initialize to graphics mode"
grout
ld      C, 11
ld      HL, 1    ;set line style to solid.
grout
ld      C, 12
ld      HL, 1    ;set line color to 1.
grout
ld      C, 14
ld      HL, 1    ;set writing mode to replace.
grout
ld      C,4      ;"move to" 0,0
ld      HL,0     ;
ld      DE,0     ;
grout
ld      C,5      ;"line to" 639,239
ld      HL,639   ;
ld      DE,239   ;
grout
END
```

The preceding program draws a diagonal line across the bit map from pixel 0,0 to pixel 639,239.

Example 2: To draw a graphics character string in Z80 code.

```

CSEG
.Z80
ld      C,1
grout
ld      C,13
ld      HL,1          ; set character color to 1.
grout
ld      C,14
ld      HL,1          ; set writing mode to replace.
grout
ld      HL,(0FF00h)   ; get pointer to string array
ld      (HL),5        ; put length of string into array
INC     HL            ;
INC     HL            ; point at string
ld      DE,string    ;
ld      b,5          ;
loop:   ld      a,(DE) ;
        ld      (HL),a ; load characters onto parameter
                                array.
        INC     DE
        INC     HL
        INC     HL    ; load one character per word.
        DJNZ   loop  ;
        ld      C,6  ; "draw string"
        grout      ;

string: Db 'Hello'
        END

```

See Figure 6-2 for the parameter array whose address is contained in FF00h and FF01h.

**Figure 6-2**  
**Parameter Array Contents**

Character count #	= byte 1
Not Used	= byte 2
Character #1 (H)	= byte 3
Not Used	= byte 4
Character #2 (e)	= byte 5
Not used	= byte 6
Character #3 (l)	= byte 7
Not Used	= byte 8
Character #4 (l)	= byte 9
Not Used	= byte 10
Character #5 (o)	= byte 11

**GRAPHICS DRIVER FUNCTIONS**

The TS 800 Graphics Primitives Driver supports the following functions. They are listed by function identification number (passed in register C).

**Table 6-1**  
**Graphics Driver Functions**

Function Number	Parameters	Description
0	C = 0	<b>Initialize to alphanumerics mode.</b> Does not clear display.
1	C = 1	<b>Initialize to graphics mode.</b>
2	C = 2	<b>Clear graphics screen (memory).</b>
3	C = 3 array	<b>Polyline.</b> Draws a connected sequence of lines in the current style, line color, and writing mode. The first point is taken as the current position. The last end-point of the sequence becomes the current position (CP).

The parameters are passed in an array. The address of the array is contained in locations 0FF00h and 0FF01h.

Parameter array contents:

```

word 0 = count (n vertex points)
word 1 = x1      ;move to vertex
                (x1, y1)
word 2 = y1
word 3 = x2      ;line to vertex
                (x2, y2)
word 4 = y2
word 5 = x3
word 6 = y3      ;line to vertex
                (x3, y3)
(etc.)
    
```

- 4            C = 4  
           HL = x  
           DE = y            **MoveTo.** Updates the current position. Used only with LineTo and DrawString.
- 5            C = 5  
           HL = x  
           DE = y            **LineTo.** Draws a line from current position to x,y then updates the current position. The current linestyle, line color, and writing mode are used.
- 6            C = 6  
           (array)            **DrawString.** Draws character string starting at current position. It does not update the current position when done. The string is stored in an array whose address is contained at memory locations 0FF00h and 0FF01h. Character count max = 126.

**NOTE!**            Address of parameter array is contained in 0FF00h, 0FF01h.

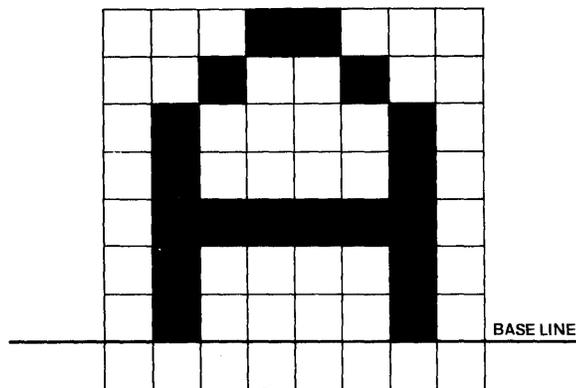
**Figure 6-3**  
**DrawString Parameter Array Contents**

Word 1 = Character count
Word 2 = Character 1
Word 3 = Character 2
"
"
Word n = Character n

**NOTE!**

A graphics character is formed by an 8-bit by 8-bit character cell. The graphics character string starts at the character cell's baseline at the current (X,Y) position. The current position can be changed by the MOVETO command.

**Figure 6-4**  
**8x8 Graphics Character Cell**



7

**Scan Out Horizontal Line.** This routine scans out a horizontal line with the current fill interior style, fill style index, and fill color. The end points of this horizontal scan line are passed in the array as shown:

**Figure 6-5**  
**Scan Out Parameter Array Contents**

Y - Coordinate	word 1
X1 - Coordinate	word 2
X2 - Coordinate	word 3

**NOTE!** Address of array is contained in 0FF00h and 0FF01h.

This routine internally adjusts the area style (i.e. pattern or crosshatch) according to the starting coordinate (X,Y) passed to it from the user. This routine is particularly useful for scanning out the horizontal sections of a polygon or bar fill.

**NOTE!** X2 must be greater than or equal to x1.

8

C = 8  
HL = 0 or 1

**Crosshr.** This function can be used to draw a cross-hair cursor of size specified by the user. This function overrides the current line style, line color and writing mode with solid line style, white line color and XOR writing mode. The current attributes are restored when exiting this function.

Reg HL = 0      Use data passed in parameter array.

HL = 1      Use data from last entry to this function (used for erasing)

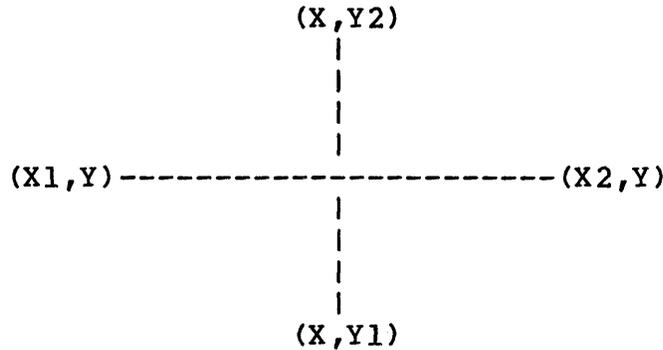
**NOTE!** The cross-hair is drawn using XOR writing mode, but the current writing mode remains the same.

The Parameters needed are passed in the array as follows:

**Figure 6-6**  
**Crosshr Parameter Array Contents**

Y Value of horizontal line of cross-hair	= Word 1
X1 Value of left endpoint of horizontal line	= Word 2
X2 Value of right endpoint of horizontal line	= Word 3
X Value of vertical line of cross-hair	= Word 4
Y1 Value of bottom endpoint of vertical line	= Word 5
Y2 Value of top endpoint of vertical line	= Word 6

Cross-hair Cursor

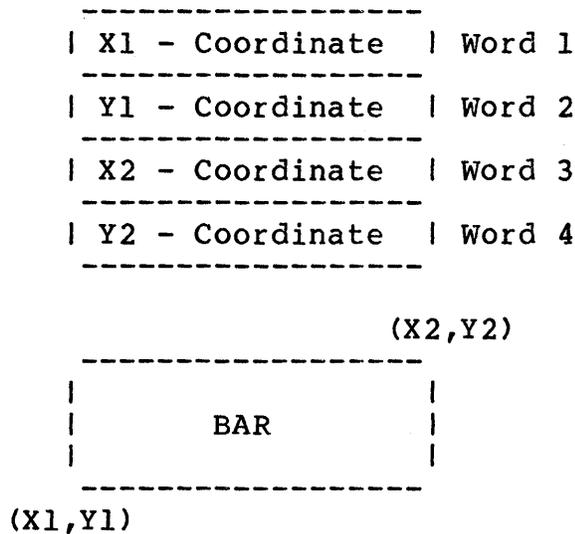


9

C = 9

This function fills a BAR with the currently selected fill attributes: fill interior style, fill-style index, and the fill-color index. The lower-left and upper-right corner coordinates are passed in the parameter array as in Figure 6-7.

Figure 6-7  
Parameter Array Contents



- |    |                      |   |
|----|----------------------|---|
| 10 | RESERVED             | RESERVED  |
| 11 | C = 11<br>HL = style | <p><b>Set LineStyle.</b> Valid parameters are 1 through 8:</p> <ul style="list-style-type: none"> <li>1 - solid</li> <li>2 - dashed</li> <li>3 - dotted</li> <li>4 - dash-dot</li> <li>5 - long-dash</li> <li>6 - short-dash</li> <li>7 - dot-dot-dash</li> <li>8 - long-dot</li> </ul> |
| 12 | C = 12<br>HL = color | <p><b>Set LineColor.</b> Valid parameters are 0 or 1:</p> <ul style="list-style-type: none"> <li>1 - white</li> <li>0 - black</li> </ul>  |
| 13 | C = 13<br>HL = color | <p><b>Set CharColor.</b> Sets the current character color. Valid parameters are 0 or 1:</p> <ul style="list-style-type: none"> <li>1 - white</li> <li>0 - black</li> </ul>  |

14 C = 14

Set Write Mode. Sets the current writing mode for all output primitives. Valid parameters are 1 through 8.

- 1 - Replace
- 2 - Logical <OR>
- 3 - <XOR>
- 4 - <NOT>
- 5 - Complement then Replace
- 6 - Complement then logical <OR>
- 7 - Complement then <XOR>
- 8 - Complement then <NOT>

**Writing Mode Logic**

- 1 - Plane = (Color Index) AND (Pattern)
- 2 - Plane = (Plane) OR [(Color Index) AND (Pattern)]
- 3 - Plane = (Plane) XOR [(Color Index) AND (Pattern)]
- 4 - Plane = (Plane) AND [(Color Index) AND (Pattern)]
- 5 - Plane = (Color Index) AND (Pattern)
- 6 - Plane = (Plane) OR [(Color Index) AND (Pattern)]
- 7 - Plane = (Plane) XOR [(Color Index) AND (Pattern)]
- 8 - Plane = (Plane) AND [(Color Index) AND (Pattern)]

**NOTE!** Plane refers to the Graphics Display. The Color Index and Pattern corresponds to the respective output primitive selected such as text, line, or fill.

15

**Get Fill Interior Style.** This routine sets the type of interior style to be used in the horizontal scan routine. The style selected is passed on the first word of the parameter array:

```

array      |-----|
           | Style # | word 1
           |-----|
    
```

**Table 6-2  
Fill Interior Styles**

Style #	Style
0	Hollow
1	Solid
2	Pattern
3	Cross-hatch

16

**Fill-Style Index.** This routine sets the style index of the currently-selected interior style. The style index only affects the pattern and cross-hatch interior styles. The style index is passed on the first word of the parameter array.

```

array      |-----|
           | Style Index | word 1
           |-----|
    
```

**Table 6-3  
Graphics Styles**

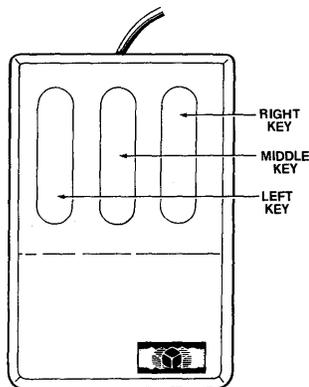
Current Interior Style	Style Index	Comment
Hollow	None	Style Index has no effect.
Solid	None	Style Index has no effect.
Pattern	0	Low Intensity
	1	
	.	
	.	
	7	

	<b>Cross-Hatch</b>	0	Vertical
		1	Horizontal
		2	Diagonal 45 degrees
		3	Diagonal -45 degrees
		4	Vertical/Horizontal
		5	Vertical/Diagonal 45 degrees
		6	Vertical/Diagonal -45 degrees
		7	Cross Diagonals
17	<b>C = 17</b>	<b>Fill Color Index.</b> This routine affects the area style to be written into memory in the following way:	
		1 = white	
		2 = black	
		array	-----   Color Index   Word 1 -----
18	<b>RESERVED</b>	<b>RESERVED</b>	
19	<b>C = 19</b>	<b>GetPix.</b> Returns all of a scan line of pixels. Returns the scan line in the array. Bytes in the array are packed with the most significant bit corresponding to the lower x value. The bytes are loaded into the array in order of increasing x (from left to right) on the scan line.	

**THE MOUSE**

The TS 800 provides ten mouse support functions which you can access. The SETUP program allows you to attach or detach the mouse from the system. Once the mouse is attached, the mouse must be initialized (function 1) before all the support functions become operational. The mouse opens a completely new dimension in human interface to the computer.

**Figure 6-8  
SuperMouse**



## TS 800 User's Manual

Once the mouse is attached through the SETUP program, the following configuration is set automatically.

Printer Baud Rate	1200
Data Format	8 data bits 1 stop bit No parity

The user may alter the system configuration through the SETUP program on the TS 800 system diskette. When the mouse is detached, the mouse configuration remains in memory. This can be changed through the SETUP program.

### MOUSE SUPPORT FUNCTIONS

You can access the mouse functions by following these instructions:

1. Load register "C" with the function number identifier (see Table 6-4).
2. Input/Output parameters are passed in registers HL, DE, and Register A as listed in the mouse functions below.
3. Perform a RESTART instruction.

RST 6 - for the 8080 instruction set.  
RST 30h - for the Z80 instruction set.

There are ten mouse support functions that the user may access. These are listed in Table 6-4.

**Table 6-4**  
**Mouse Functions**

Function Number	Function
C = 0	INQUIRE. Inquire if Mouse is available. Inquire if hardware cursor available.
USER:	Enters nothing
SYSTEM:	Returns
Reg A - 0	Mouse not available.
- 0FFh	Mouse available.
Reg B - 0	Hardware cursor not available. (Not applicable to current hardware)
- 0FFh	Hardware cursor available (Not applicable to current hardware)

This function returns to the user a flag (Register A) which indicates if a mouse is available or not. This flag is initially set in the TS 800 SETUP program.

C = 1 INITIALIZE. This is to initialize the Mouse.

USER: Enters

Reg. - HL Initial X-coordinate position  
of mouse (0 to 639).

Reg. - DE Initial Y-coordinate position  
of mouse (0 to 239).

SYSTEM: Returns nothing

This function enables the mouse interrupt, and sets the initial position of the mouse.

**NOTE!** When the mouse is initialized the default ASCII characters for the mouse keys are implemented and the mouse key mode is set at 0.

Mode 0 means that the pressing of the mouse key is treated as a keyboard entry and that the mouse stops tracking its movement until the key is released.

The ASCII character associated with the mouse key can be altered through mouse function 6.

The character placed in the keyboard queue because of the mouse key depression can be retrieved through a BDOS call such as BDOS function 6.

Use a CP/M BDOS CALL to access the characters placed in the keyboard queue.

For example: BDOS CALL FUNCTION 6

```
ld      c, 6      ;direct console
                    Input/Output
ld      e, 0ffh   ;set input flag.
call    5         ;BDOS CALL
                    ;BDOS returns character
                    in Register A or loads
                    Register A with 0 if no
                    character is available.
```

The current status of the mouse keys (up/down) can be inquired through mouse function 3.

The default ASCII characters are as follows:

Mouse Key(left) - ASCII character 32 (space)  
Mouse Key(middle) - ASCII character 33 (!)  
Mouse Key(right) - ASCII character 34 (")

C = 2 RANGE. Inquires for the Mouse's coordinate range.

USER: Enters nothing  
SYSTEM: Returns

Reg. - HL Mouse's X-coordinate range (640).  
Reg. - DE Mouse's Y-coordinate range (240).

This function returns to the user the (X,Y) coordinate range of the mouse.

C = 3 INPUT. This returns the mouse coordinates to the user.

USER: Enters nothing  
SYSTEM: Returns

Reg. - HL Mouse's current X-coordinate position.  
Reg. - DE Mouse's current Y-coordinate position.  
Reg. A - 0 No change in mouse coordinate position since last input or no mouse key has been pressed.  
- 0FFh New mouse coordinate position or mouse key has been pressed since last input.  
Reg B Mouse Key Status. Contains mouse key status in bits 2, 1, and 0 for the left, middle, and right mouse keys respectively.

If bit returned is:

1 - key is depressed

0 - key is not depressed

## TS 800 User's Manual

C = 4      **TERMINATE.** This terminates the mouse.

USER:      Enters nothing  
SYSTEM:    Returns nothing

This function terminates the mouse interrupt.

C = 5      **Mouse Key Mode**

USER:      Enters

Reg. A    - 0      The tracking of movement by the mouse is discontinued until the mouse key is released. The ASCII character associated with the mouse key that is pressed is placed in the keyboard queue (single character per key depression).

          - 1      The tracking of movement by the mouse continues even while the mouse key is pressed. The ASCII character associated with the mouse key that is pressed is "not" placed in the keyboard queue.

SYSTEM:    Returns nothing.

**NOTE!**      In both modes the status of the three mouse keys can be inquired through mouse function 3.

C = 6      **Mouse Key Programming**

USER:      Enters

Reg. H            Contains ASCII character to be associated with left mouse key.

Reg. L            Contains ASCII character to be associated with middle mouse key.

Reg. D            Contains ASCII character to be associated with right mouse key.

SYSTEM:    Returns nothing.

C = 7      **Move.** This moves the mouse.

USER:      Enters

Reg. HL            New X-coordinate position of  
mouse.

Reg. DE            New Y-coordinate position of  
mouse.

**SYSTEM:**       Returns nothing.

**NOTE!**           This function will clip the new coordinates  
to the screen resolution.

X = 0-639

Y = 0-239

C = 8            Enable Hardware Cursor (Not applicable to current  
hardware)

C = 9            Disable Hardware Cursor (Not applicable to current  
hardware)

**Example Mouse Program**

The program below uses the mouse to continuously draw dots on the screen. The first dot is drawn at coordinate location 0,0. When the mouse is moved, a dot is drawn at the mouse's new location.

When the SuperMouse is correctly attached to the TS 800 and installed using the Setup Program, you can run this program. See Appendix K for how to use the Setup Program.

```

bdos      equ      05h          ; Bdos call entry point

          org      100h

start:    mvi      c,1          ; Initialize graphics
          rst      5
          mvi      c,2          ; Clear graphics screen
          rst      5
          mvi      c,11         ; Set to solid line style
          lxi      h,1
          rst      5
          mvi      c,12         ; Set to white line color
          lxi      h,1
          rst      5
          mvi      c,14         ; Set to replace write mode
          lxi      h,1
          rst      5
          mvi      c,1          ; Initialize the mouse to (0,0)
          lxi      h,0
          lxi      d,0
          rst      6
          call     draw         ; Draw dot at (0,0)
loop:     mvi      c,3
          rst      6
          ana      a            ; If mouse has moved then update dot
          jz       loop        ; or else wait until mouse moves
          shld    mousx        ; Load new X-coordinate
          xchg
          shld    mousy        ; Load new Y-coordinate
          call    draw         ; Draw new dot
          mvi      c,6          ; CP/M call direct console I/O
          mvi      e,0ffh      ; Set input flag
          call    bdos
          ana      a            ; If key has been depressed then quit
          jz       loop        ; or else continue.
          mvi      c,0          ; Initialize to alpha mode.
          rst      5
          jmp     0            ; Warm reboot to operating system
    
```

# TS 800 User's Manual

```
draw:      lhld      mousy
           xchg
           lhld      mousx
           mvi       c,4
           rst       5
           lhld      mousy
           xchg
           lhld      mousx
           mvi       c,5      ; Draw dot
           rst       5
           ret

mousx:     dw        0      ; Mouse's current X-coordinate.
mousy:     dw        0      ; Mouse's current Y-coordinate.
           end
```

## GRAPHIC CHARACTER FONT

Table 6-5 is a map of the graphic characters associated with each ASCII character. The font is stored in the EPROM. Each cell of the font can be individually accessed through the DRAWSTRING function.

Internally, this is done as follows:

1. The ASCII character sent by the USER through the DRAWSTRING routine in Table 6-1 is used as an index into the graphics character font as shown in Table 6-5.
2. From the font, the graphics routines can access the bytes that comprise the graphics character desired (as shown in Figure 6-4).

**NOTE!** Sixteen area fill styles have also been stored in the FONT. These styles were stored in place of sixteen non-printable control characters (as shown in Table 6-5).

**Table 6-5**  
**Character Font**

Contents	ASCII Code	Description
NULL	0	Control codes
SOH	1	
STX	2	
ETX	3	
Fill Style Index 0 Fill Style Index 1	4	Half-tone patterns

## TS 800 User's Manual

Fill Style Index 2	5	
Fill Style Index 3		
Fill Style Index 4	6	
Fill Style Index 5		
Fill Style Index 6	7	
Fill Style Index 7		
		Cross-hatch patterns
Fill Style Index 0	8	Vertical
Fill Style Index 1	9	Horizontal
Fill Style Index 2	10	Diagonal 45 degrees
Fill Style Index 3	11	Diagonal -45 degrees
Fill Style Index 4	12	Vertical/Horizontal
Fill Style Index 5	13	Vertical/Diagonal 45
Fill Style Index 6	14	Vertical/Diagonal -45
Fill Style Index 7	15	Cross diagonals
		Marker symbols
.	16	Dot
+	17	Plus Sign
*	18	Star
(octagon)	19	Octagon
x	20	x
	21	
	22	
	23	
	24	
	25	
	26	
	27	
	28	
	29	

	30	
	31	
		Printable ASCII characters
SP	32	
!	33	
.		
.		
.		
~	126	
DEL RUB	127	

**SAMPLE GRAPHICS ACCESS PROGRAM USING 8080 ASSEMBLY CODE**

```

cseg
main:   org      100
        call    start    ;initialize graphics, clear screen.
        call    text     ;draw graphic text.
        call    line     ;draw a line, using moveto and lineto.
        call    plylin   ;draw using poly-line.
        call    fill     ;fill a square using horizontal scan.
        jmp     0        ;exit to CP/M

;
;How to initialize to graphics mode and clear the graphics display
;
start:  mvi     c, 1     ;initialize to graphic mode.
        rst     5
        mvi     c, 2     ;clear graphics display.
        rst     5
        mvi     c, 14    ;set writing mode
        lxi     h, 1     ; to replace mode.
        rst     5
        ret

```

```

;
;How to set the line style attributes and then draw a line
;from (x1,y1) to (x2,y2).
;
line:    mvi        c, 11        ;set line style
         lxi        h, 1        ;solid line style.
         rst        5
         mvi        c, 12        ;set line color
         lxi        h, 1        ;set to white. ( 0 for black )
         rst        5
         mvi        c, 4         ;move to (x1,y1) = (0,50)
         lxi        h, 400       ;load x1 coordinate
         lxi        d, 50        ;load y1 coordinate
         rst        5
         mvi        c, 5         ;line to (x2,y2) = (100,50)
         lxi        h, 500       ;load x2 coordinate
         lxi        d, 50        ;load y2 coordinate
         rst        5
         ret

```

```

;
;How to execute the polyline function.
;   move to (x1,y1) = (0,50)
;   line to (x2,y2) = (100,50)
;   line to (x3,y3) = (200,150)
;
plylin:  mvi        c, 3         ;polyline function
         lxi        h, 0FF00h
         mov        e, m
         inx        h
         mov        d, m
         xchg
         ;hl now points to the top of
         ;the parameter array.
         ;load vertice's count.
         mvi        m, 4
         inx        h
         mvi        m, 0
         inx        h
         mvi        m, 100       ;load low  byte of x1
         inx        h
         mvi        m, 0         ;load high byte of x1
         inx        h
         mvi        m, 120       ;load low  byte of y1
         inx        h
         mvi        m, 0         ;load high byte of y1
         inx        h
         mvi        m, 150       ;load low  byte of x2
         inx        h
         mvi        m, 0         ;load high byte of x2
         inx        h
         mvi        m, 150       ;load low  byte of y2
         inx        h
         mvi        m, 0         ;load high byte of y2
         inx        h
         mvi        m, 200       ;load low  byte of x3
         inx        h
         mvi        m, 0         ;load high byte of x3

```

```

        inx        h
        mvi        m, 120      ;load low  byte of y3
        inx        h
        mvi        m, 0       ;load high byte of y3
        inx        h
        mvi        m, 250     ;load low  byte of x4
        inx        h
        mvi        m, 0       ;load high byte of x4
        inx        h
        mvi        m, 150     ;load low  byte of y4
        inx        h
        mvi        m, 0       ;load high byte of y4
        rst        5         ;perform polyline.
        ret

;
;How to draw a string of graphic text.
; eg. draw 'Hello' starting at location (x=200,y=100).
;
text:   mvi        c, 4       ;move to command
        lxi        h, 400     ;load x coordinate
        lxi        d, 120     ;load y coordinate
        rst        5
        mvi        c, 13      ;set character color
        lxi        h, 1       ;set to white.
        rst        5
        lxi        h, 0FF00h
        mov        e, m
        inx        h
        mov        d, m
        xchg                               ;hl points to parameter array
        mvi        m, 5       ;load character count.
        mov        b, 5
        lxi        d, string
loop1:  inx        h
        inx        h
        ldax                               ;store character in array.
        mov        m, a
        inx        d
        dcr        b         ;decrement character count
        jnz        loop1
        mvi        c, 6
        rst        5         ;draw string...
        ret

string: db        'Hello'    ;character string to be drawn.

```

```

;
;How to fill a square with the selected fill attributes using the
;horizontal scan routine (c=7).
;Square's corner points (x1=100,y1=50), (x2=200,y2=50), (x3=200,y3=100),
;(x4=100,y4=100).
;
;
fill:      mvi          c, 15      ;Set fill interior style.
           lxi          h, 0FF00h
           mov          e, m
           inx          h
           mov          d, m
           xchg                    ;hl points to top of parameter table.
           mvi          m, 3      ;Select cross-hatch fill style
           rst          5
           mvi          c, 16     ;Set fill style index.
           lxi          h, 0FF00h
           mov          e, m
           inx          h
           mov          d, m
           xchg                    ;hl points at top of parameter table.
           mvi          m, 0      ;select vertical cross-hatch style.
           rst          5
           mvi          c, 17     ;Set fill color.
           lxi          h, 0FF00h
           mov          e, m
           inx          h
           mov          d, m
           xchg                    ;hl points to top of paramteter table.
           mvi          m, 1      ;select color = white.
           rst          5

           lxi          h, 0FF00h
           mov          e, m
           inx          h
           mov          d, m
           xchg                    ;hl points to top of parameter table.
           mvi          m, 50     ;load y coordinate.
           inx          h
           mvi          m, 0
           inx          h
           mvi          m, 100    ;load x1 coordinate.
           inx          h
           mvi          m, 0
           inx          h
           mvi          m, 200    ;load x2 coordinate.
           inx          h
           mvi          m, 0
           mvi          b, 50     ;load scan line count.
loop2:     push         b         ;save count
           mvi          c, 7      ;select horizontal scan routine.
           rst          5
           pop          b
           lxi          h, 0FF00h
           mov          e, m

```

## TS 800 User's Manual

```
inx      h
mov      d, m      ;hl points to top of parameter table.
xchg
inr      m
dcr      b
jnz      loop2     ;fill square from bottom to top.
ret
end
```

**7. PREVENTIVE MAINTENANCE, TROUBLESHOOTING, AND SERVICE**

**INTRODUCTION**

To keep your TS 800 in the best condition, it is a good idea for you to keep it clean, to inspect it periodically, and to know what to do if something seems to go wrong. This chapter talks about all of these topics plus how to service your TS 800.

**CLEANING**

Clean the TS 800 periodically. To clean the case:

1. Vacuum the keyboard with a soft brush attachment (or use a small soft brush).
2. Clean the housing with a soft, lint-free cloth.

**STOP! DO NOT use solvent-based or abrasive cleaners.**

3. If you spill liquids on the keyboard, unplug the system immediately and disassemble the keyboard and clean it with a soft cloth and water. Dry it thoroughly before using.

**INSPECTION**

Periodically check the cabinet and keyboard for damage or excessive wear.

1. Inspect the cabinet for cracks or breaks. On customized units, check the bezel for paint damage (peeling, cracking, or severe scratches).
2. Check each key for free movement.
3. Inspect the cables and pin connectors twice a year for damage. Inspect the interface cable connectors for kinks or other signs of excessive stress (such as stretching).

Refer any damage to the qualified service technician at your computer store.

**TROUBLESHOOTING**

The information provided in this section might help you resolve many operating problems without placing a service call. If your system does not work properly after you have followed the suggestions given here, place a service call to your computer store or service center.

**Table 7-1  
Troubleshooting Procedures**

<b>Problem</b>	<b>Action</b>
TS 800 IS NOT OPERATIONAL AFTER POWER IS TURNED ON	Unplug power cord and plug it in again.  Test for power by plugging something else in the same electrical outlet.  Check the line fuse as described in the section, Changing the Fuse, in this chapter, and replace it if necessary. <b>If the fuse blows again, call your computer store.</b>
SCREEN DISPLAYS SYSTEM PROMPT BUT DOES NOT RESPOND TO OPERATOR COMMAND	Check the keyboard connector.
TS 800 IS USED WITH MODEM AND DOES NOT RESPOND OR TRANSMIT TO CENTRAL SERVICE PROCESSOR	Unplug the modem and replug it. Turn its power on and off, and reconnect the modem to the TS 800 RS-232 port.  Check the modem cable and configuration
TS 800 APPEARS TO BE RUNNING BUT CURSOR DOES NOT APPEAR	Adjust contrast knob on rear panel.
TS 800 VIDEO DISPLAY ATTRIBUTES DO NOT CORRESPOND TO RECENTLY-CHANGED SWITCH SETTINGS	Reset the system by pressing "RESET" so software can scan new DIP switch settings.
TS 800 "LOCKED UP" (DOES NOT RESPOND TO KEYBOARD)	Check keyboard connector. Press <b>CTRL/RESET</b> . If that doesn't work, turn the power off and back on again.
TS 800 SCREEN IS DEAD; CURSOR MIGHT APPEAR	Turn TS 800 off and check the fuses.

## TS 800 User's Manual

PRINTER DOES NOT PRINT  
WHAT IS TYPED

Reconnect printer cable, being sure it is completely on the pin connector.

Check printer cable configuration and baud rate.

Check for printer fault (out of paper or ribbon).

HARDWARE ERROR MESSAGE  
APPEARS

Reset by pressing ^RESET.

ESCAPE AND CONTROL  
COMMANDS DO NOT FUNCTION  
AS ANTICIPATED

Reenter commands, paying particular attention to whether upper- or lower-case characters, ones or zeroes, are needed.

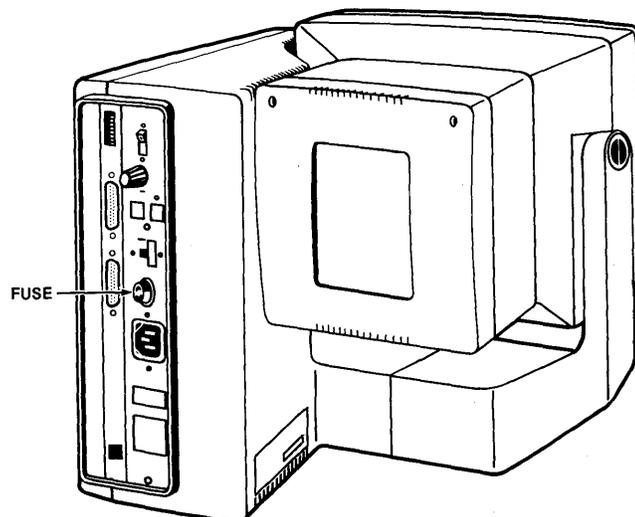
### CHANGING THE FUSE

The TS 800 has one exterior fuse which is accessible from the rear panel.

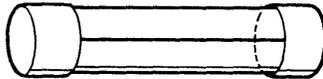
To check or change the exterior fuse, turn the power off, pull the plug out of the power outlet, and unscrew the fuse holder (see Figure 7-1).

The fuse is a small glass cylinder. If the thin wire inside the fuse is still intact, the fuse should be functional (see Figure 8-2). If the thin strip is broken and/or if the glass is slightly black, the fuse has blown and must be replaced (see Figure 7-3). If the glass is totally black, do not replace the fuse. The problem could be with the system or with the power outlet. Call your computer store.

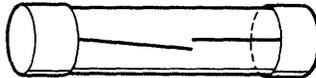
**Figure 7-1**  
**Exterior Fuse Location**



**Figure 7-2  
Good Fuse**



**Figure 7-3  
Blown Fuse**



To replace the fuse, slip the old fuse from the fuse holder and insert a new fuse. The fuse rating is shown on a label above the fuse holder. See the section called Inserting the Fuse in Chapter 2 for more information about fuses. You can purchase new fuses from your computer store.

If the newly-replaced fuse blows out immediately, do not replace it with another fuse. Call your computer store.

#### **HOW TO GET SERVICE**

Your TS 800 is under a limited warranty as described in Appendix B. Information about service before and after warranty is described in the following sections.

#### **Service During Warranty**

If you need service on your TS 800 while it is under TeleVideo's limited warranty, call your computer store. Computer store personnel will obtain a Return Material Authorization (RMA) number for you. (Refer to the Limited Warranty in Appendix B for a detailed description of service provided under warranty.)

In cases of emergency, you might want to either pay for overnight delivery to and from TeleVideo's factory or have the unit serviced by one of the third-party service centers. If a third-party service center repairs it under warranty, you will be invoiced by them for labor charges. Your computer store personnel can help you arrange for emergency warranty repair.

#### **On-Site Service After Warranty**

You can obtain on-site service after warranty from any of the third-party service centers.

#### **Information Needed for Service**

When you call for service, you will be asked for the serial number of your system. The serial number is located on a label at the top center of the rear panel (Figure 7-4).

## TS 800 User's Manual

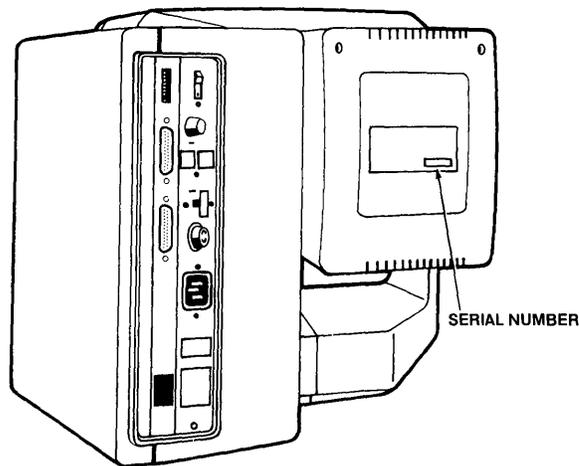
For future reference, note the serial number, the date you took delivery, and the name and phone number of your computer store and service center in the space below.

Model TS 800 Serial No. \_\_\_\_\_ Delivery Date \_\_\_\_\_

Dealer \_\_\_\_\_ Phone No. \_\_\_\_\_

Computer Store \_\_\_\_\_ No. \_\_\_\_\_

**Figure 7-4**  
**Serial Number**



### **TECHNICAL ASSISTANCE**

If you have any technical problems with your TS 800, call your computer store.

### **SHIPPING THE TS 800**

If you need to ship the TS 800, pack the unit in the original TeleVideo shipping container or use other suitable materials.



# TS 800 User's Manual

## APPENDIX A TS 800 SPECIFICATIONS

### MICROPROCESSOR/MEMORY

CPU	Z80A 8-bit microprocessor (processor speed 4 MegaHertz)
MEMORY	64 kilobyte dynamic RAM (expandable to 128K) 32K alpha and graphic display memory 8 kilobyte EPROM
OPERATING SYSTEM	CP/M

### INPUT/OUTPUT

SERIAL I/O	Two RS-232C serial ports, one RJ11C port for SuperMouse connection, one RS-422 port for connection to service processor. Asynchronous: Switch-selectable baud rates for printer/modem port (75, 150, 300, 600, 1200, 2400, 4800, 9600) Word structure: Eight data bits, one stop bit
------------	--

### POWER REQUIREMENTS

EXTERNAL	
U.S.	115 VAC (+/- 12 VAC)
INTERNATIONAL	230 VAC (+/- 12 VAC)
POWER CONSUMPTION	1.30 amp maximum at 115 VAC 0.65 amp maximum at 230 VAC
POWER CORD	NEMA standard 5-15R, 3-prong receptacle (US only)

### ENCLOSURE

DIMENSIONS	Height: 14.25 inches (36 cm) Width: 18.5 inches (47 cm) Depth: 15 inches (38 cm) deep plus 8-inch keyboard (20 cm) Weight: 51 pounds (23 kilos)
COMPOSITION	Injection-molded plastic

**ENVIRONMENT**

OPERATING 50 to 85 degrees Fahrenheit  
10 to 30 degrees Centigrade

Maximum humidity 95 percent relative,  
non-condensing

Maximum altitude 10,000 ft above sea level

NONOPERATING 32 to 120 degrees Fahrenheit  
(SHIPPING) 0 to 50 degrees Centigrade

**CRT SPECIFICATIONS**

SCREEN 14 inches measured diagonally  
Phosphor: P31

DISPLAYED 96-character ASCII upper- and lower-case  
CHARACTER alphabet  
SET 32 control characters in monitor mode  
24 lines  
80 characters per line  
1920 characters per screen  
Video attributes:  
Half intensity  
Invisible fields  
Blinking fields  
Reverse video  
Underlined fields

CHARACTER FONT 7 x 8 dot matrix  
8 x 10 resolution

REPEAT 20 cps auto-repeat

EDITING FEATURES Typeover  
Clear screen to space or null  
Character insert and character delete  
Line insert and line delete  
Absolute cursor addressing  
Erase to end of line or field  
Line edit

CURSOR CONTROLS Left, right, up, down, address

REAL TIME CLOCK Serial Timer Interrupt Controller (STI)

**GRAPHICS FEATURES**

RESOLUTION 640 pixels horizontal x 240 pixels vertical

FIRMWARE Built-in firmware for graphics

**APPENDIX B  
STATEMENT OF LIMITED WARRANTY**

TeleVideo Systems, Inc. ("TeleVideo") warrants to its distributors, systems houses, OEMs, and national accounts ("Buyer") that products, except software, manufactured by TeleVideo are free from defects in material and workmanship. TeleVideo's obligations under this warranty are limited to repairing or replacing, at TeleVideo's option, the part or parts of the products which prove defective in material or workmanship within 180 days after shipment by TeleVideo. That Buyer may pass along to its initial customer ("Customer") a maximum of 90 days coverage within this 180-day warranty period, provided that Buyer gives TeleVideo prompt notice of any defect and satisfactory proof thereof.

Products may be returned by Buyer only after a Return Material Authorization number ("RMA") has been obtained from TeleVideo by telephone or in writing. Buyer must prepay all freight charges to return any products to the repair facility designated by TeleVideo and include the RMA number on the shipping container. TeleVideo will deliver replacements for defective products or parts on an exchange basis to Buyer, freight prepaid to the Buyer or the Customer. Products returned to TeleVideo under this warranty become the property of TeleVideo. With respect to any product or part thereof not manufactured by TeleVideo, only the warranty, if any, given by the manufacturer thereof, applies.

**EXCLUSIONS**

This limited warranty does not cover losses or damage which occur in shipment to or from Buyer or Customer, or is due to, (1) improper installation or maintenance, misuse, neglect or any cause other than ordinary commercial or industrial application, or (2) adjustment, repair, or modifications by other than by TeleVideo-authorized personnel, or (3) improper environment, excessive or inadequate heating or air conditioning and electrical power failures, surges or other irregularities or (4) any statement made about TeleVideo's products by salesmen, dealers, distributors or agents, unless confirmed in writing by a TeleVideo officer.

THE FOREGOING TELEVIDEO LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESS, IMPLIED OR STATUTORY. IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE DO NOT APPLY. TELEVIDEO'S WARRANTY OBLIGATIONS AND DISTRIBUTOR'S REMEDIES HEREUNDER ARE SOLELY AND EXCLUSIVELY AS STATED HEREIN. TELEVIDEO MAKES NO WARRANTY WHATSOEVER CONCERNING ANY SOFTWARE PRODUCTS, WHICH ARE SOLD "AS IS" AND "WITH ALL FAULTS". TELEVIDEO'S LIABILITY, WHETHER BASED ON CONTRACT, TORT, WARRANTY, STRICT LIABILITY OR ANY OTHER

**TS 800 User's Manual**

THEORY, SHALL NOT EXCEED THE PRICE OF THE INDIVIDUAL UNIT WHOSE DEFECT OR DAMAGE IS THE BASIS OF THE CLAIM. IN NO EVENT SHALL TELEVIDEO BE LIABLE FOR ANY LOSS OF PROFITS, LOSS OF USE OF FACILITIES OR EQUIPMENT, OR OTHER INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

APPENDIX C  
SUGGESTED REFERENCES

The following books are useful references for using the CP/M operating system in addition to the basic concepts presented in this manual. Ask at your computer store for the availability of these books

1. Fernandez, Judi N. and Ruth Ashley, Using CP/M: A Self Teaching Guide, John Wiley and Sons, 605 Third Avenue, New York, NY 1980.

(This is an excellent self-teaching guide, highly recommended for the user unfamiliar with CP/M but perhaps familiar with computers. Assumes no prior knowledge about operating systems.)

2. Hogan, Thom, Osborne CP/M User Guide, 2nd ed., Osborne/McGraw-Hill, 630 Bancroft Way, Dept. UB, Berkeley, CA 94710.

(A complete book for the beginning computer operator. Covers all aspects of computer operation and CP/M use. Organization and presentation are outstanding.)

3. Zaks, Rodney, The CP/M Handbook with MP/M, SyBex, 2344 Sixth Street, Berkeley, CA 94710 (415/848-8233).

(Giving very complete details of CP/M, this book gives more detail than many beginners will want.)

4. CP/M Summary Guide for Versions 1.4 and 2.X, edited by Bruce Brigham, The Rosetta Stone, Post Office Box 35, Glastonbury, CT 06025, 203/633-8490.

5. Murtha, Stephen M. and Mitchell Waite, CP/M Primer, Howard W Sams & Co., Inc, 4300 West 62nd St., Indianapolis, IN 46268.

(An excellent introduction to both CP/M and microcomputers.)

6. Townsend, Carl, How to Get Started with CP/M, Dilithium Press, Post Office Box 606, Beaverton, OR 97075.

(A succinct discussion of CP/M. Also includes a listing of CP/M software suppliers.)

**TS 800 User's Manual**

7. CP/M User Manual, Digital Research, P.O. Box 579, Pacific Grove, CA 93950.

(Published by Digital Research, you can find this reference book at your computer store.)

8. Mostek (for the STI Chip), 1215 W. Crosby Rd., Carrollton, TX 75006.

9. GSX-80 User Manual, Digital Research, P.O. Box 579, Pacific Grove, CA 95950.

TeleVideo welcomes comments from you about these books as well as names of others which you find useful.

APPENDIX D CABLE SPECIFICATIONS

The cables that you use should be no more than 50 feet long.

Use of improper cables can result in noncompliance with FCC regulations.

Figure D-1  
RS-232C

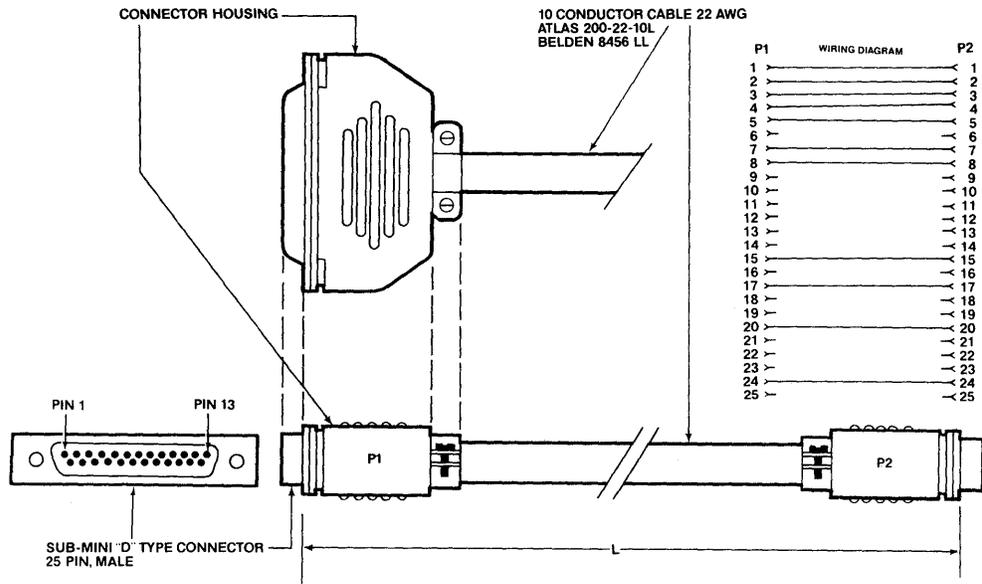
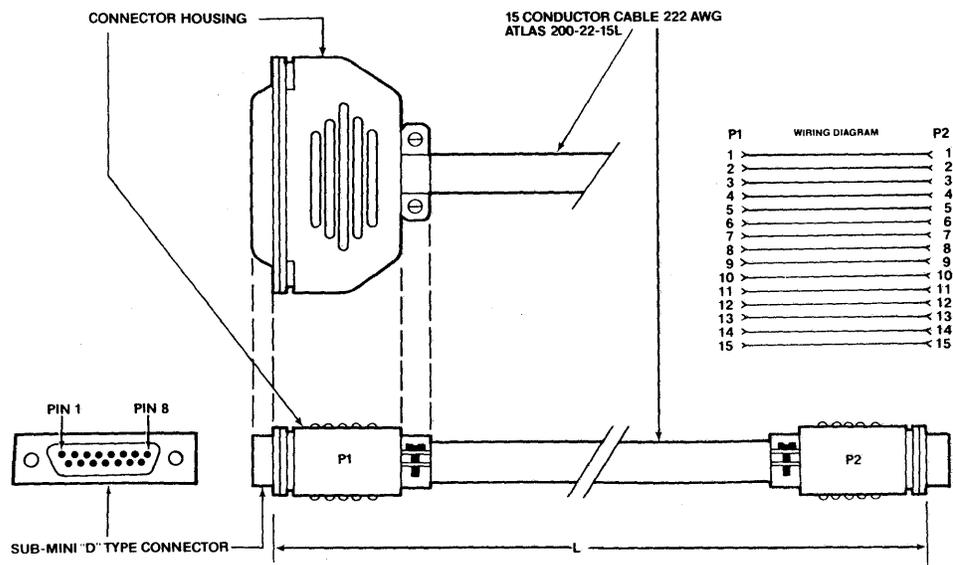


Figure D-2  
RS-422



**APPENDIX E CHANGING THE FUSE TO 230 VOLTS**

This appendix explains how to change the fuse and voltage switch to allow the TS 800 to be used on the 230 volt international power standard.

The TS 800 is shipped with the fuse installed to correspond to 115 volts. You will need a .75A fuse to operate on 230 volts.

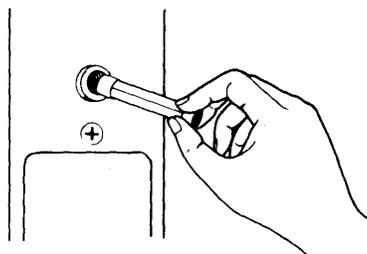
**Table E-1  
Fuse Table**

<b>Amperes</b>	<b>Maximum Fuse Voltage</b>	<b>Power Standards</b>
1.5	250V	115V U.S.
.75	250V	230V International

To change the fuse to correspond to 230V, be sure that the power is turned off and the power plug is not connected.

Unscrew the fuse holder from the back panel of unit and remove the 1.5A fuse. Place one end of the .75A fuse into the holder and insert the fuse into the unit. Press gently while screwing the holder back into place. See Figure E-1.

**Figure E-1  
Fuse**



**Changing the Voltage Switch to 230 Volts**

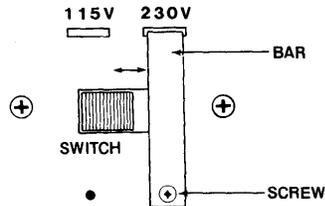
The system is configured at the factory for 115 Vac - 60 Hz. To change the voltage configuration to 230 Vac you need to change the voltage switch on the back panel of the system.

## TS 800 User's Manual

The voltage switch is locked into place with a removable bar. To remove the bar and switch from 115 Vac to 230 Vac, follow these directions:

1. Using a Phillips screw driver, remove the screw from the bottom of the bar that spans the 230V side of the switch. See Figure E-2.

**Figure E-2**  
**Voltage Switch**



2. Carefully remove the bar.
3. Firmly push the switch to the 230V position (to the right).
4. Fit the top horizontal section carefully into the slot above the 115V position. Match the screw hole of the bar with that under the 115V position.
5. Insert and tighten screw.

**STOP!** Contact your dealer if you are not sure that your power requirements match that of the unit. **Trying to operate the unit with the wrong power configuration can seriously damage the system.**

APPENDIX F  
USING A TWO-PRONG ADAPTER

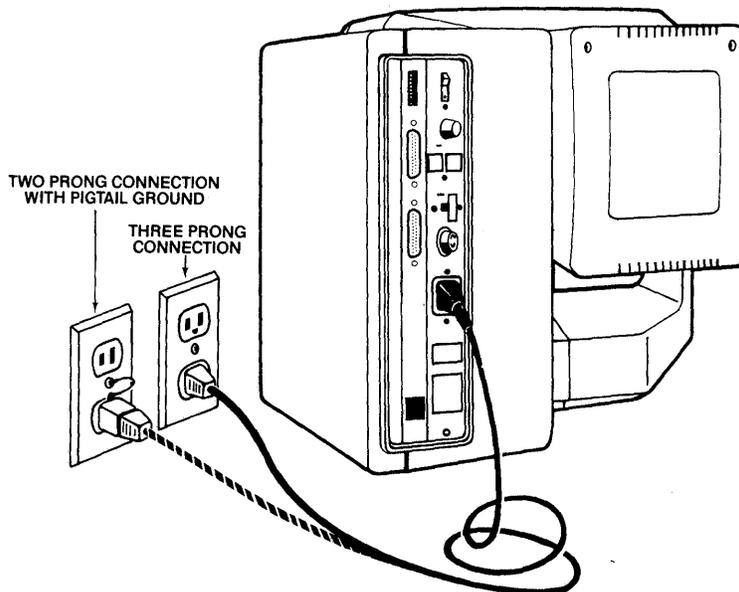
The TS 800 has a three-prong plug. If you use it with a two-prong adapter, ground it with a **pigtail**. See Figure F-1.

Internally, the power cord wires are color-coded as follows:

Green	Earth ground
Black	Primary power (hot)
White	Primary power return (neutral)

**STOP!** Incorrect or fluctuating line voltages can cause disk errors or damage to the system. If you have any doubt about the line voltages at your location, ask your dealer to check out your facility **before proceeding with the installation.**

Figure F-1  
Two Prong Power Cord Connection



**APPENDIX G  
PORT ADDRESSES**

**Table G-1  
Port Addresses**

Description	Hex Address	Read/Write
Dip switch	00H	
STI PORT*	20H - 2FH	(modem port)
<b>Dart Channel Description</b>		
Dart Channel A (Data)	30H	R/W (keyboard)
Dart Channel A (Command/Status)	32H	R/W (keyboard)
Dart Channel B (Data)	31H	R/W (print out,
Dart Channel B (Command/Status)	33H	R/W mouse in)
<b>SIO (Option Port)</b>		
Channel A (RS-422)		
data	40H	R/W
command/status	42H	R/W
Channel B (not used)		
data	41H	R/W
command/status	43H	R/W
<b>System Control Port 1</b>		
	10H	W
D0	LED 0 (active low)	
D1	LED 1 (active low)	
<b>System Control Port 2</b>		
	11H	W
D0	LED 2 (active low)	
D1	LED 3 (active low)	
<b>System Control Port 3</b>		
	12H	W
D0	RS 422 enable (active low)	
D1	RS 422 WAIT enable (active low)	
<b>System Control Port 4</b>		
	13H	W
D0 = 0 and D1 = 0	Enable memory bank 0	
D0 = 1 and D1 = 0	Enable memory bank 1	
D0 = 0 and D1 = 1	Enable memory bank 2	

\*See Appendix C for suggested references for the Mostek STI chip.

Control Register for Alpha or Graphics Mode Selection

		C4H	W
Bit 0 =	0	alpha mode	
	1	graphics mode	
Bit 1 =	0	page 1 (alpha mode only)	
	1	page 2 (alpha mode only)	
Bit 2 =	0	alpha memory access (round off)	
	1	graphics memory access (normal CPU address)	

**Table G-2**  
**CRT Controller Control Register Port**

Description	Read/Write
R0 Horizontal total characters number	W
R1 Horizontal displayed characters number	W
R2 Position of horizontal sync pulse	W
R3 Pulse width of horizontal sync pulse	W
R4 Vertical total character number	W
R5 Vertical total adjust	W
R6 Vertical displayed character number	W
R7 Position of vertical sync pulse	W
R8 Mode control	W
BIT 3 = 0	for video display RAM addressing straight binary
R9 Maximumscan line address	W
R10 Cursor start raster	W
bit 6,5 - 00	no blinking
01	no cursor
10	blink at 1/16 field rate
11	blink at 1/32 field rate
R11 Cursor end raster	W
R12 Start address high byte	R/W
R13 Start address low byte	R/W
R14 Cursor position high byte	R/W
R15 Cursor position low byte	R/W

APPENDIX H PIN CONNECTOR ASSIGNMENTS

Table H-1  
Board Connectors

Connector No.	Description
P1	RS-232C Modem Connector
P2	Serial Printer Connector
P5	Power Connector
P6	Video Connector
P9	Comp. Video Connector
P11	Keyboard Connector

Table H-2  
RS-232C Modem Connector

Pin No.	RS-232C Designator	Description	I/O
1	AA	Frame Ground	G
2	BA	Transmit Data	O
3	BB	Receive Data	I
4	CA	Request to Send	O
5	CB	Clear to Send	I
7	BA	Signal Ground	C
8	CF	Data Carrier Detect	I
15	DB	Transmit Clock	I
17	DD	Receive Clock	I
20	CD	Data Terminal Ready	O
24	DA	Transmit Clock	O

Legend:

- G = AC chassis ground
- I = Input
- O = Output
- C = Signal common

Table H-3  
Serial Printer Connector  
(Configuration as Shipped is for Printer)

Pin No.	Description	DCE
1	Frame Ground	G
2	Transmit Data	I
3	Receive Data	O
4	Request to Send	I
5	Clear to Send	O
6	Data Set Ready	O
7	Signal Ground	C
8	Data Carrier Detect	O
20	Data Terminal Ready	I

**Legend**

- G = AC chassis ground
- I = Input
- O = Output
- C = Signal common

# TS 800 User's Manual

## APPENDIX I CHANGING THE DEFAULT LST: DEVICE

The TS 800 arrives with the default LST: device set to TTY:  
(for devices using Data Terminal Ready as the printer busy status  
on the serial printer port, through the service processor).

Using the DDT program, you change a byte in the USERCPM4.DAT  
file, located on the the system drive of the service processor.

**NOTE!** It is a good idea to save a copy of the USERCPM.4DAT on  
another drive before you modify it. That way is is  
available in case you want the default LST advice set  
back to TTY: in the future.

Follow this procedure. User responses are shown in bold print.

USER: 1. Boot the system

2. Enter

**B:LOGON SYSTEM<CR>**

SYSTEM: 3. Displays

vers 2.11 A drive(s) logged to password account

USER: 4. Enter

**DDT USERCPM4.DAT**

SYSTEM: 5. Displays

DDT VERS X.Y  
NEXT PC  
WXYZ 0100

USER: 6. Enter

**S17DA**

SYSTEM: 7. Displays

17DA 15

## TS 800 User's Manual

USER: 8. ENTER

**95<CR>**

(where 15 is the code to enable TTY device and 95 changes it to LPT. Table G-1 lists the available device codes.)

**Table I-1  
Available Device Codes**

<b>Code</b>	<b>Device</b>
15	TTY: Serial printer, pin 20 for DTR through service processor
55	CRT: Second Serial printer through service processor
95	LPT: Parallel printer through service processor
D5	UL1: Serial printer, pin 20 for DTR in local station

SYSTEM: 9. Displays

17DB 0D

(This is the next hexadecimal address.)

USER: 10. Enter

**.<CR>**

(Be sure to enter a period before <CR>. This is entered because you do not want to change this address.)

SYSTEM: 11. Displays

-

USER: 12. Enter

**^C**

SYSTEM: 13. Displays

A>

USER: 14. To save the modified file, enter

**SAVE 52 USERCPM4.DAT**

## **TS 800 User's Manual**

SYSTEM: 15. Displays

A>

Now you can test your modified system by reloading MmmOST in service processor(refer to MmmOST reference manual) and by rebooting your TS 800 system.

APPENDIX J DEFAULT DEVICE ASSIGNMENT

- CON: = CRT:
- RDR: = TTY:
- PUN: = TTY:
- LST: = UL1:

UL1: device uses Data Terminal Ready (DTR) as the response to the printer busy status. Types of printers supported include Epson and Texas Instruments serial printers.

The cable to be used is an RS-232 straight cable.

Optional device assignment:

1. LST: = TTY:  
TTY: device uses DTR protocol for a modem port. Crossover cable must be used.
2. LST: = CRT:  
CRT: device uses XON/XOFF protocol for a modem port. Crossover cable must be used to connect modem port to the printer port.
3. LST: = LPT:  
LPT: device uses ETX/ACK protocol for a modem port. Types of printer supported are NEC Spinwriter and Diablo daisywheel. Crossover cable must be used.

Table J-1  
Crossover Cable Configurations

Modem Port Pin #	Printer Port Pin #
1	1
2	3
3	2
4	5
5	20
7	7
8	4
20	6 and 8

APPENDIX K ASCII CODE CHART

Figure K-1  
ASCII Code Chart

Bits	7 6 5 4 3 2 1				0 <sub>0</sub>	0 <sub>0</sub> 1	0 <sub>1</sub> 0	0 <sub>1</sub> 1	1 <sub>0</sub> 0	1 <sub>0</sub> 1	1 <sub>1</sub> 0	1 <sub>1</sub> 1	
	4	3	2	1	Column	0	1	2	3	4	5	6	7
0	0	0	0	0	0	NUL	DLE	SP	0	@	P		p
0	0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	0	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	0	4	EOT	DC4	\$	4	D	T	d	t
0	1	0	1	0	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	0	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	0	9	SKIP HT	EM	)	9	I	Y	i	y
1	0	1	0	0	10(a)	LF	SUB	*	:	J	Z	j	z
1	0	1	1	0	11(b)	VT	ESC	+	;	K	[	k	{
1	1	0	0	0	12(c)	FF	FS	,	<	L	\	l	
1	1	0	1	0	13(d)	CR	GS	-	=	M	]	m	}
1	1	1	0	0	14(e)	SO	HOME RS	.	>	N	^	n	~
1	1	1	1	0	15(f)	SI	NEW LINE US	/	?	O	_	o	DEL RUB

ASCII Code Table  
Abbreviations For Control Characters

NUL	null	FF	form feed	CAN	cancel
SOH	start of heading	CR	carriage return	EM	end of medium
STX	start of text	SO	shift out	SUB	substitute
ETX	end of text	SI	shift in	ESC	escape
EOT	end of transmission	DLE	data link escape	FS	file separator
ENQ	enquiry	DC1	device control 1	GS	group separator
ACK	acknowledge	DC2	device control 2	RS	record separator
BEL	bell	DC3	device control 3	US	unit separator
BS	backspace	DC4	device control 4	SP	space
HT	horizontal tabulation	NAK	negative acknowledge	DEL	delete
LF	linefeed	SYN	synchronous idle		
VT	vertical tabulation	ETB	end of transmission block		

APPENDIX L SET-UP PROGRAM

SETUP is a menu-driven utility software program for customizing the TS 800 hardware running under CP/M. SETUP provides capability to change systems attributes such as baud rate and printer protocol dynamically in semi-real time. For example, a user need only to specify the new baud rate to change the baud rate of the printer. SETUP makes the change to the system. This change can be made permanent in the operating system and would be effective after the next reset.

The capability of the SETUP program is as follows:

1. Change the default IOBYTE

After power-on or reset, a default physical device is selected for each logical device based on the value of the default IOBYTE. The default IOBYTE may be changed to select any one of the four physical devices associated with logical devices.

2. Configuration of modem port

Modem port can be configured to be used as a second printer port for different printer protocols.

3. Port attribute configuration

Port attribute configuration allows baud rate specification for external devices such as printers or modems, and the transmit/receive data format.

4. Turning on/off mouse hardware flag for graphics.

5. Autoload configuration

Any command file may be automatically executed during the cold boot. Cold boot occurs after power-on or a system reset has been performed.

## TS 800 User's Manual

The following example illustrates how to change the baud rate for the printer port.

Be sure that the file, SETUP.COM exists on the currently logged drive.

USER: 1. Enter

**SETUP<CR>**

SYSTEM: 2. Displays

SYSTEM SETUP Version V1.0 TeleVideo Systems, Inc.  
-----

Please select the following system type:

- 1) Stand alone TS-803
- 2) Stand alone TS-803H
- 3) Multi user TS-800
- 4) Multi user TS-803
- 5) Multi user TS-803H
- 6) Abort SETUP and return to CP/M

- <--Enter appropriate number followed by <CR>  
or CTRL-C to return to CP/M

USER: 3. Enter

**3<CR>**

SYSTEM: 4. Displays

SYSTEM SETUP Version V1.0 TeleVideo Systems, Inc.  
-----

Current system: TS-800  
Operating system: Multi user CP/M  
Current Mouse status: ON

Select modification category:

- 1) To attach mouse
- 2) To detach mouse
- 3) To change CP/M default I/O byte
- 4) To change Printer port BAUD rate
- 5) To change Modem port BAUD rate
- 6) To change Printer port data format
- 7) To change Modem port data format
- 8) To change Autoload file name
- 9) To save current configuration permanently and return to CP/M
- 10) To save current configuration temporarily and return to CP/M
- 11) To abandon this setup

-- <--Enter appropriate number followed by <CR>  
or CTRL-C to return to CP/M

# TS 800 User's Manual

USER: 5. Enter

**4<CR>**

SYSTEM: 6. Displays

SYSTEM SETUP Version V1.0 TeleVideo Systems, Inc  
-----

Current system: TS-800

Operating system: Multi user CP/M

Current Printer port BAUD rate: 9,600

Please select the following baud rate:

- 1) 9,600 BAUD
- 2) 4,800 BAUD
- 3) 2,400 BAUD
- 4) 1,200 BAUD
- 5) 600 BAUD
- 6) 300 BAUD
- 7) 150 BAUD
- 8) 75 BAUD
- 9) Set BAUD rate from switch
- 10) Use current BAUD rate and exit

-- <--Enter appropriate number followed by  
<CR> or CTRL-C to return to CP/M

USER: 7. Enter

**4<CR>**

(if you wish to change baud rate to 1200)

## TS 800 User's Manual

SYSTEM: 8. Displays

```
SYSTEM SETUP      Version V1.0  TeleVideo Systems, Inc.  
-----
```

```
Current system:      TS-800  
Operating system:   Multi user CP/M  
Current Printer port BAUD rate:  1,200
```

Please select the following baud rate

- 1) 9,600 BAUD
- 2) 4,800 BAUD
- 3) 2,400 BAUD
- 4) 1,200 BAUD
- 5) 600 BAUD
- 6) 300 BAUD
- 7) 150 BAUD
- 8) 75 BAUD
- 9) Set BAUD rate for switch
- 10) Use current BAUD rate and exit

-- <--Enter appropriate number followed by  
<CR> or CTRL-C to return to CP/M

USER: 9. Enter

**10<CR>**

SYSTEM: 10. Displays

```
SYSTEM SETUP      Version V1.0  TeleVideo Systems, Inc.  
-----
```

```
Current system:      TS-800  
Operating system:   Multi user CP/M  
Current Mouse status:  OFF
```

Select modification category:

- 1) To attach mouse
- 2) To detach mouse
- 3) To change CP/M default I/O byte
- 4) To change Printer port BAUD rate
- 5) To change Modem port BAUD rate
- 6) To change Printer port data format
- 7) To change Modem port data format
- 8) To change Autoload file name
- 9) To save current configuration permanently  
and return to CP/M
- 10) To save current configuration temporarily  
and return to CP/M
- 11) To abandon this setup

-- <--Enter appropriate number followed by <CR>  
or CTRL-C to return to CP/M

## TS 800 User's Manual

USER: 11. Enter

**9<CR>**

(if you wish to save current configuration permanently)

SYSTEM: 12. Displays

End of execution

A>

(if the system currently logged is drive A.)

USER: 13. Reset the system by pressing simultaneously

**^RESET**

The baud rate for the printer should now be permanently changed.

APPENDIX M PROGRAMMER'S QUICK REFERENCE GUIDE

Table M-1  
Escape Sequence List

Function	Command
<b>MONITOR</b>	
Monitor mode ON	ESC U
Monitor mode OFF	ESC X or ESC u
<b>DISABLE/ENABLE KEYBOARD</b>	
Disable keyboard	ESC #
Enable keyboard	ESC "
<b>CURSOR</b>	
Home	^^
Carriage return	^M
Linefeed/cursor down	^J or ^V
Cursor up	^K or ESC j
Backspace/cursor left	^H
Cursor right	^L
Cursor off	ESC . 0
Blinking block cursor	ESC . 1
Steady block cursor	ESC . 2
Blinking underline cursor	ESC . 3
Steady underline cursor	ESC . 4
<b>KEYCLICK AND BELL</b>	
Keyclick on	ESC >
Keyclick off	ESC <
Ring bell	^G

## TS 800 User's Manual

### VISUAL ATTRIBUTES

Default video (green on black)	ESC G 0
Invisible normal video	ESC G 1
Blink	ESC G 2
Invisible blink	ESC G 3
Reverse video (reverse of default)	ESC G 4
Invisible reverse	ESC G 5
Reverse and blink	ESC G 6
Invisible reverse and blink	ESC G 7
Underline	ESC G 8
Invisible underline	ESC G 9
Underline and blink	ESC G :
Invisible underline and blink	ESC G ;
Reverse and underline	ESC G <
Invisible reverse and underline	ESC G =
Reverse and blink and underline	ESC G >
Invisible reverse and blink and underline	ESC G ?
Half Intensity ON	ESC )
Half Intensity OFF	ESC (

### ADDRESS/READ CURSOR

Address cursor (row column)	ESC = r c
-----------------------------	-----------

### TAB

Set (column) tab	ESC 1
Tab	^I
Back tab	ESC I
Clear tab	ESC 2
Clear all tabs	ESC 3

### EDITING TEXT

Character insert	ESC Q
Character delete	ESC W
Line insert	ESC E
Line delete	ESC R
Erase to end of line	ESC T
Erase to end of line with nulls	ESC t
Erase to end of page	ESC Y
Erase to end of page with nulls	ESC y

# TS 800 User's Manual

## CLEAR

Clear all to spaces           ESC + or  
                                  ^Z  
Clear all to nulls            ESC :  
Clear all to half-            ESC ,  
  intensity spaces  
Clear all to nulls and        ESC \*  
  reset half intensity

## FUNCTION KEYS

Program function keys        SHIFT/LOC ESC | p1 p2 message ^Y  
(p1=number of function key  
  p2=1  
  ^Y= termination character)

**Table M-2**  
**Switch Setting List**

Section	Setting	Function
1	closed (right)	Baud rate
2	closed (right)	Baud rate
3	closed (right)	Baud rate
4*	closed (right)	
5	closed (right)	Workstation
	open (left)	Service processor terminal
6*	open (left)	
7*	closed (right)	
8	Not used	
9	open (left)	Green on black screen(default)
	closed (right)	Black on green screen
10	Not used	

\* required settings

**Table M-3**  
**Baud Rate List**

Switch	Section	Baud Rate
1	2 3	
C	C C	9,600
O	C C	4,800
C	O C	2,400
O	O C	1,200
C	C O	600
O	C O	300
C	O O	150
O	O O	75

C=closed

O=open



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