SECTION 1: TEF ANALYZER: AN INTRODUCTION

1.1 The TEF Analyzer

TECHRON's TEF Analyzer is a unique combination of computer, spectrum analyzer, and related software. It is capable of measuring and displaying the interrelationships of Time, Energy and Frequency. The TEF Analyzer allows acoustic and electronic measurement sessions to take place even with ambient noise present, and permits storage of all data and setups for later analysis.

1.1.1 TEF Measurements

The TEF Analyzer is designed to measure energy passing through acoustic and electronic systems. Measurements include accurate phase, frequency, time, and amplitude components, while data storage permits review of various combinations of these aspects.

1.1.2 The TEF Analyzer Components

The computer at the heart of the TEF Analyzer is a 1 Megabyte two-disk-drive computer with full capabilities for general computer operation in addition to the specialized TEF functions.

- **CPU & Disk Drives.** The CPU is a Z80 microprocessor enhanced by a special IC for faster number processing. 1 Mbyte of RAM is available, along with dual disk drives with 1.4 Mbyte of disk storage.
- **Keyboard.** A 92-character keyboard with separate numeric keypad and ten special function keys allows complete and easy operator control of TEF operation.
- **Printer & Other Devices.** Two RS232C serial data ports, along with one parallel port, allow the TEF Analyzer to drive printer(s), and/or modem.
- **Operating System.** The Operating System for the TEF Analyzer is a proprietary TECHRON-developed software called Tefdos. Tefdos handles file maintenance, disk utilities, and a range of other operations for all TEF applications.

- **Spectrum Analyzer.** The Spectrum Analyzer portion of the TEF Analyzer is software-controlled via three Z80 microprocessors, all timed from a common quartz clock. Software control provides great flexibility, while the microprocessors and quartz clock insure a high degree of accuracy in operation.
- **Sweep Oscillator.** The digitally-controlled sweep oscillator is capable of producing sinusoidal frequency sweeps from 0Hz to 31kHz, including sweeps through 0Hz. The operator may select the frequency range, rate, and delay of sweeps.
- **Filters.** The input portion of the Spectrum Analyzer utilizes variable-bandwidth linear filters, under operator control, for accurate readings of input energy.
- **Quartz Timing.** All components in the Analyzer portion of the TEF computer are timed by a quartz clock, insuring accuracy in phase, frequency, and time measurements.

1.2 Manual Organization

This operator's manual is organized in four parts:

1.2.1 TEF Analyzer

These first sections, **Sections 1** through **6**, cover the basic operation of the TEF Analyzer including:

- **Introduction. Section 1** introduces the specifications of the TEF Analyzer and the startup procedures for Tefdos and other TEF software.
- **Operation. Section 2** reviews the mechanical and physical handling of the instrument.
- **Input and Output. Section 3** shows you how to open and setup the TEF Analyzer and how to connect various peripheral equipment.
- **Operating System. Section 4** covers the basic commands of the Tefdos operating system.
- **Electronics. Section 5** provides a detailed analysis of the electronic architecture of the TEF Analyzer.
- **Tefdos Commands. Section 6** contains complete information on all Tefdos commands.

1.2.2 TEF 2.0 Software

The second part of the manual is devoted to a detailed discussion of the TEF software for Time Delay Spectrometry (TDS) applications. This second group of sections, **TEF 2.0 Sections 1 through 6,** covers both the theory and the application principles of acoustic measurements and analysis.

- **Overview. Section 1** is an overview of TEF 2.0 software that puts the TEF Analyzer to work as an energy analysis instrument.
- **Guided Tour. Section 2** is a step-by-step tutorial in setting up for and making sample measurements.
- **TDS Measurements. Section 3** looks at TDS analysis as an energy measurement tool.
- **TEF Operations. Section 4** is a complete review of all TEF menus, keyboard operations, and related routines such as cursor control and text entry.
- **Setup, Input, and Output. Section 5** explains how to set up measuring sessions and how to extract and analyze test results.
- **Advanced Applications. Section 6** discusses some of the underlying theory of TDS measurements and offers some setup options that will be of particular interest to the advanced user.

1.2.3 Appendix

The appendix sections contain a variety of background information that will aid in more efficient and broader application of the TEF Analyzer in energy measurement.

1.2.4 EasyTEF

EasyTEF is self-contained application software that bypasses some of the more complex acoustic principles and allows the typical new user to put the TEF Analyzer to work more quickly and easily than might be possible with TEF 2.0 Software. The fourth part of this manual contains the operating instructions for the EasyTEF software.

1.3 Manual Conventions

To make the distinction between what you should expect to see on the screen as a prompt for input and what you should type as input, this manual uses the following conventions:

> **SEE:**
> Your choice is (M, E, e)?

This indicates that the screen will display exactly what follows the colon after "SEE". At times, these "prompts" from the computer screen appear along with other screen information.

> **TYPE:**
> **DIR A:**

This instruction means that you are to enter exactly the following:

> DIR{space bar}A:
>
> Note: In most TEF operations, there IS a distinction between upper and lower case letters as commands. Follow manual instructions exactly when entering one-letter commands.

1.3.1 Keyname Commands

When the manual refers to a particular key, the name of the key will appear in brackets like this: {Keyname}. For the "Return" key, the manual uses the abbreviation "CR" (in brackets) for "Carriage Return." So when you see <CR> , press the "Return" key.

1.3.2 Screen Descriptions vs. Screen Text

When the manual simply describes what the screen shows, without reproducing the entire screen display, the description will appear in one of these ways:

1. SEE:
   A screen entitled "Main Menu" or like this:
2. SEE:
   [graph displaying data]

Example 1 indicates the screen title, while Example 2 describes in general terms what the screen shows.

1.3.3 F1 and F2 vs. {F1} and {F2}

{F1} and {F2} are Function keys, as indicated by the brackets { }. Menu choices **F1** and **F2** are two-key commands, requiring **letter** F and **number** 1 or 2.

1.4 Start Up

This section assumes that your TEF Analyzer is already open and set up. If it is not, you will need to use the Setup instructions in **Section 3** to open and set up your TEF Analyzer before you can use these start up instructions. If you are familiar with computer operations, you may want to speed through this start up orientation.

1.4.1 Brief Keyboard Orientation

1. Examine the keyboard, referring to **Illustration 1-1** as needed. Locate the following keys, for convenience in following upcoming instructions:
   a. {SHIFT}
   b. {SHIFT LOCK}
   c. {CAPS LOCK}
   d. {CONTROL}
   e. {ESC} (Escape)
   f. {RETURN}
2. Note the following special operating characteristics of some keys:
   a. **{CONTROL}** key has no function when used alone. **{CONTROL}** is always depressed **with** another key.
   b. **{CAPS LOCK}** causes all letter keys to produce capital letters, but leaves other characters, such as numbers, punctuation marks, and symbols, in lower case. Since most TEF commands consist of single capital letters, we recommend pressing **{CAPS LOCK}** for normal operation, then releasing it when a lower case letter is needed.

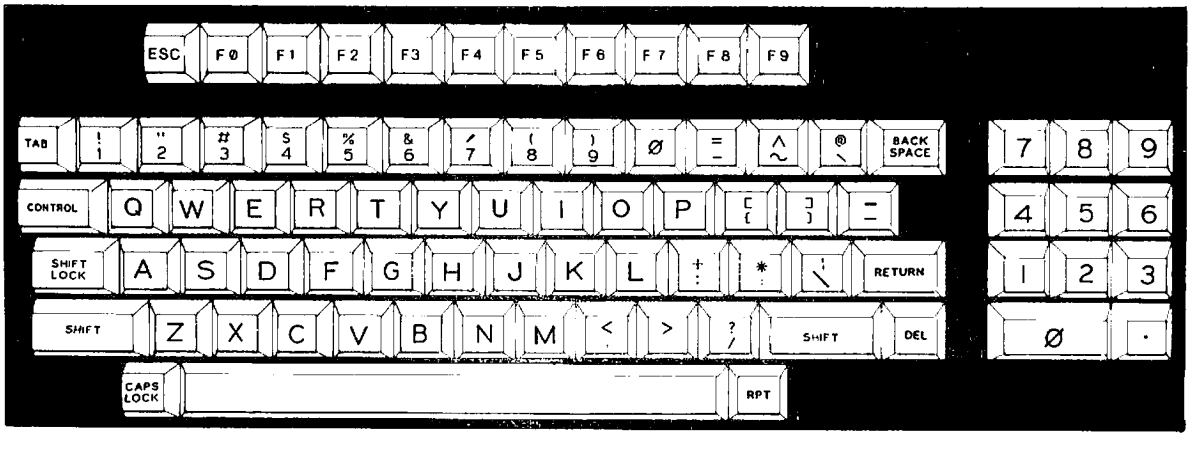


Illustration 1-1
TEF System 12 Keyboard

c. Most keys will repeat if held down more than 1/2 second. In other words, if you press "K" and hold it down, you'll soon see KKKKKKKKK. To **defeat** this feature, press the **{RPT}** key, located to the right of the space bar. **{RPT}** is a locking key. If you're not used to typing or using a computer keyboard, we recommend pressing **{RPT}** so keys will not repeat automatically.

Refer to **Section 2** for complete descriptions of all key functions.

1.4.2 Prepare for Power On

1. Examine the front panel, referring to **Illustration 1-2** as needed. Locate the following features on the front panel:
   a. Screen
   b. Disk Drives A: and B:
   c. Disk Drive doors (latches) (rotate 1/4 turn up/down to open/close)
   d. Power Switch
   e. Reset Button
2. Open doors on both disk drives.

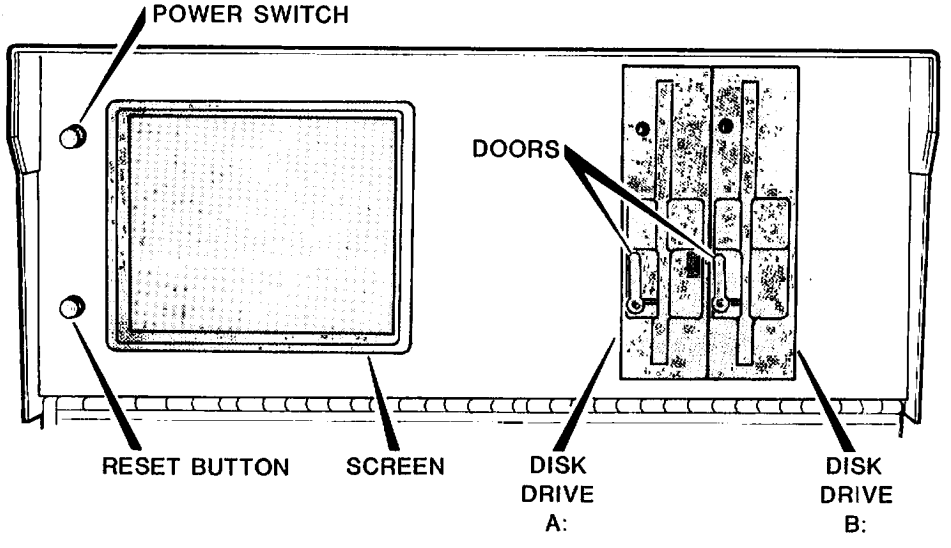


Illustration 1-2
Front Panel

1.4.3 Power On

There are three options for power on and log in. They vary in length and endpoint. You many want to try all three, or you can read the descriptions and decide which best suits your needs. **Table 1-1** shows the basic differences between the three.

OPTION	DISK	END POINT	LENGTH
1	Tefdos	Tefdos	Short
2	EasyTEF	EasyTEF Main Command Bar, may Quit to Tefdos	Short
3	TEF 2.0	TEF 2.0 MAIN MENU, may Exit to Tefdos	Longer, more options

Table 1-1
Power On Options

Option 1: Tefdos Startup

1. Depress the power switch button, turning power on.
2. Put the Tefdos disk in Drive A: (see **Illustration 1-3**)
3. SEE:
   Tefdos v1.oc, try "HELP"
   AO) \CONFIG.SYS
   AO) PREF 2
   AO) NODEFER
   AO) NOVERIFY
   AO) ACT
   AO) ____
4. Power on is complete. You are ready to use Tefdos commands.

Option 2: EasyTEF Startup

1. Depress the power switch button, turning power on.
2. Put the EasyTEF disk in Drive A:.
3. SEE:
   An initial display of information about the EasyTEF system, including copyright and author information, release date, and version number.

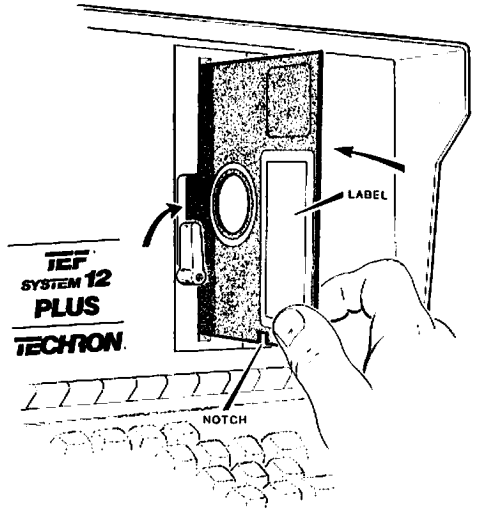


Illustration 1-3
Diskette Orientation

4. **SEE:**
   A blank screen with the Main Command Bar at the top.

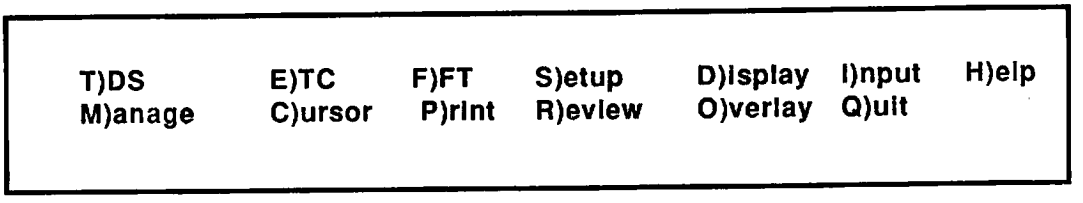


Illustration 1-4
EasyTEF Main Command Bar

5. Power on is complete. The Tef Analyzer is ready to use the EasyTEF software. To go to Tefdos, **TYPE**: Q for Q)uit.

Option 3: TEF 2.0 Startup

1. Depress power switch button, turning power on.
2. Put TEF 2.0 disk in Drive A:
   a. The screen may or may not flash briefly.
   b. The LED on Disk Drive A: should light.
   c. You'll hear whirring and clicking sounds from Disk Drive A:.
   d. A Tefdos message followed by the TEF Logo and other information will appear on the screen.
   e. At the bottom of the screen, you should see the instruction "Please type in your name."
3. **SEE:**
   Please type in your name.

   TYPE:

   Your Name

   Note: You have several options at this point. You may type in your first, last, or both names in all capital letters or upper/lower case, or you may skip this step by simply pressing **<CR>**. If you make a mistake while typing, press **{BACKSPACE}** to erase the mistake.

4. **SEE:**
   Are you experienced with TEF? (Y/N)

   TYPE:

   Y (for yes) or **N** (for no)
   (Don't press **<CR>**)

5. **SEE:**
   Please enter the date (MM/DD/YY)

   TYPE:

   MM/DD/YY

Note: The computer will accept any entry of up to 32 characters at this point. You may enter the date in any format and a brief comment.

Note: Any time you enter numbers, you may use either the numeric keypad to the right of the main keyboard, or the number row at the top of the main keyboard. These two sets of number keys are interchangeable.

6. **SEE:**
   The desired data drive is

   TYPE:

   B (don't press **<CR>**)

7. **SEE:**
   A series of messages as the computer loads data needed to begin operation.

8. **SEE:**
   If you typed Y in step 4, you will see a screen entitled "MAIN MENU."
   If you typed N in step 4 you will see a screen entitled "TEF INITIALIZING MODULE MENU" followed by:
   Your choice is (type M, R, or X)?

   TYPE:

   M
   (if the screen is the "TEF INITIALIZING MODULE MENU").

   Note: If you entered "Y" in step 4 above, you will not see this screen.

9. **SEE:**
   A screen entitled "MAIN MENU"

10. Log-on is now complete. The TEF Analyzer is ready to use TEF 2.0 for data review or testing. **TYPE: X** for eXit to go to Tefdos.

1.5 Specifications

The TEF Analyzer is packaged in a portable, convenient form. Its rugged metal case protects it from damage in transit, while internal components can withstand a surprising degree of abuse. Operationally, the TEF Analyzer can withstand a short drop to concrete, although cosmetic damage will result. Although the TEF Analyzer is built to travel, TECHRON does not recommend checking it through airline baggage systems without an adequately designed travel case.

1.5.1 TEF Analyzer

1. **Dimensions.**
   - **Closed:** 7 1/2H x 22D x 18W (inches)
   - **Open:** 10 1/2H x 26D x 18W (inches)
2. **Weight**
   - 47 pounds
3. **Environment**
   - **Operating temperature range:** 50° to 100°F (10 to 38°C)
   - **Storage temperature range:** -10° to 140°F (-25 to 60°C)
   - **Humidity:** Up to 90% non-condensing
   - **Shock and vibration:** Operating 0.5G 10ms and 0.5G (5-600Hz)
   - **Operating altitude:** up to 10,000 feet
   - **Shipping altitude:** up to 40,000 feet
4. **System Response**
   - **Frequency:** DC to 30kHz ± 0.3dB
   - **Phase:** DC to 30kHz ± 0.5°
   - **Test run:** 1V out and 12dB input amplifier gain.

1.5.2 Standard Equipment

1. **TECHRON TEF Analyzer**
2. **Operator's Manual**
3. **Disks (6)**
   - TEF 2.0 Disk
   - EasyTEF Disk
   - Tefdos Disk
   - Automatic Demonstration Program Disk
   - Automatic Demonstration Data Disk
   - Blank Data Disk
4. **5-pin XLR to 3-pin XLR adapter**
5. **Printer Cable**

1.5.3 Input and Output

1. **Input Preamplifier**
   - **Gain Range:** 0 - 66 dB ± 0.3dB in 6dB step ± 0.1dB
   - **Maximum Input Voltage:** 7.0 volts peak
   - **AC/DC Coupling:** Switch selectable
   - **Bandwidth:** DC: >100kHz at less than 66dB gain. AC: -3dB at 1.6 Hz High-pass
   - **Integration:** Single or double beginning at 4Hz
   - **Impedance:** DC: 100 MΩ
     AC: 1 MΩ ± 5%
   - **Connectors (input):** XLR balanced (5 pin)
     input
     BNC noninverting
     BNC inverting
2. **IF Filters**
   (Dual-LP Filters at baseband)
   - **Gain Range:** 0 - 45dB ± 0.2dB in 3dB step ± 0.1dB
   - **Bandwidth Gausian filter:** 4 pole 0.05° linear phase
     0.116 Hz 20,000 Hz on 1.027:1 frequency step
     ±5% absolute frequency setting
     ± 1% IF to IF match
   - **7 pole 6 zero elliptic filter:** 0.1dB pass band ripple
     75dB rejection in stopband
   - **"Brick wall" cut-off filter:** 2Hz-25,000Hz
     93dB/octave cut off
   - **Dual IF strip filtering:** Analytical signal (both real & imaginary parts)
     Synchronously sampled
     (12 bit A to D converters <8 µS per conversion)
   - **Data Storage:** On 5 1/4" floppy disk, 16 bit complex data from IFs. Dual disk drives standard.
3. **Test Oscillator**
   - **Frequency Range:** 0Hz to 31,620 Hz
   - **Output Voltage:** 0.01 to 2.55 Vrms open circuit
     15 milliamps peak at maximum current
     ± 0.25% of full scale at 1.0kHz
   - **Source Impedance:** 600Ω ± 1%
   - **Digitally Synthesized 16 bit Programmable Phase**
   - **Digital to Analog Converter:** 12 bit
   - **Reconstruction Filter:** Elliptic
   - **Oscillator Drift:** <2ppm

- **Frequency Range:** 0Hz to 31,620 Hz
- **Output Voltage:** 2.56 Vrms open circuit
- **Source Impedance:** 600 Ω ± 1%
- **Digitally Synthesized 16 Bit Programmable Phase**
- **Digital to Analog Converter:** 12 bit
- **Reconstruction Filter:** Elliptic
- **Oscillator Drift:** <2ppm
- **Tracking Offset Resolution:** 1.0μs steps
- **Phase:** Coherent with test oscillator

5. **Display**
   - **CRT:** 7" flat faced green raster scan
   - **Video Output:** Rear panel RS170 will drive two monitors
6. **Printer**
   - **Epson:** MX (with Graftrax), FX, RX series
   - **Hewlett-Packard:** Most plotters with special drivers
7. **Power Input**
   - **AC Voltage:** 100, 110, 120, 200, 220, 240
   - **AC Current:** 2 amp maximum at 120 volts
   - **Frequency:** 50-400 Hz
   - **DC Voltage:** 10-15 volts
   - **DC Current:** 10 amp maximum

1.6 Optional Accessories

TECHRON offers three optional accessories.

TEF-M01

- Brüel & Kjær (B&K) Model 4007S Microphone
- Phantom Power Supply/Adapter
- 25 foot Microphone Cable

TEF-K01

- Complete set of connection cables and cable adapters
- Line to mic transformer attenuator set.
- Carrying Case

TEF-P01

- Epson 80 Column Dot Matrix Printer

1.7 Warranty and Service

During the warranty period, TECHRON provides factory service, including one-way shipping costs, for defects in the TEF Analyzer. After warranty expiration, TECHRON provides factory service at nominal rates.

SECTION 2: TEF ANALYZER: COMPUTER OPERATIONS

2.1 Introduction

This section looks at the mechanical and physical operation of the TEF Analyzer. Experienced computer users will already be familiar with most of the concepts presented here. But since there are likely to be a number of characteristics that are unique to the TEF Analyzer, we urge that all users look over this entire section, but at a level of scrutiny that they feel matches their computer experience.

2.2 Terms

Since computers respond to commands, perform tasks, give messages, and ask questions, it often seems that they have some kind of intelligence, even life, of their own. In reality, of course, computers do not "know" anything. Nor do they say, ask, learn, forget, remember, look at, read, or write anything.

Still, it's most convenient to use these terms when learning about the computer's functions. As long as we remember that these machines really only process information, and only according to specific patterns, there is no harm in using these terms in order to learn how to use the computer.

2.2.1 Hardware

The actual physical machinery of a computer is called **hardware**. Generally, anything you can touch is hardware. The TEF Analyzer, with its case, screen, keyboard, and disk drives, is an example of hardware. A printer, modem (for transmitting information over telephone lines), or other external device are other examples of hardware.

2.2.2 Software

Programs, which are orderly arrangements of instructions for specific tasks, are called **software**. They are intangible, yet essential to the computer's operations. Without software, the computer knows nothing and can do nothing.

The TEF Analyzer employs at least two different kinds of software packages or programs:

- **Tefdos** is the basic utility or operating program that controls the TEF computer and handles most data storage functions. **Sections 4** and **6** of this portion of the manual are devoted to Tefdos procedures and instructions. Also, see **Section 2.2.7** below for further discussion of an operating system.
- **TEF 2.0** and **EasyTEF** are application software. **TEF 2.0** is the primary application software for acoustic analysis using Time Delay Spectrometry. This manual includes a separate group of sections covering TEF 2.0 instructions. **EasyTEF** is a simplified version of TEF 2.0 which provides all but a few specialized capabilities. EasyTEF procedures are also covered in a separate part of this manual.

2.2.3 Data

Data differs from programs in that data is just information without any instructions. Data can be almost any type of information depending on the computer's task. Data for the TEF System is information from the testing sessions, stored in a form which allows the TEF System to process it in various ways.

2.2.4 How Software and Data Work Together

We have limited use for raw data. But when data is interpreted, sorted, displayed, compared, or otherwise processed, it can be very useful. Software contains instructions on how to process data. By changing software, the same computer can process the same data in different ways. Most computers allow several options in processing data without changing software.

2.2.5 Processing Information

The heart of the computer is the **CPU** (Central Processing Unit). If the computer adds 2+2, the CPU does the arithmetic. The CPU, however, only does work; it does not remember any information, nor does it know how to do anything on its own. Software gives the instructions, and memory stores the information and instructions.

2.2.6 Memory

The computer has several ways to store information and instructions:

1. ROM (Read-only Memory) is information the computer contains within itself. ROM does not change, and remains intact whether the power is on or off. ROM is usually rather small in capacity, and includes such instructions as what the computer should do when it is first turned on.

2. **RAM** (Random-access Memory) is "blank" memory which the computer can use for various purposes. The computer can place information in RAM and retrieve it any time. RAM clears each time power is turned off. The computer instantly forgets everything it has stored in RAM when it is turned off. Thus, RAM is the working memory for the computer.

2.2.7 The Operating System

The computer needs some rather extensive instructions in order to function. Since RAM is cleared each time the power is turned off, only ROM, with its limited capacity, remembers anything at all about how the computer should function.

The **Operating System** is a program, or group of programs, which contain all the instructions the computer needs in order to function. The Operating System is usually stored on a disk, since it would take an enormous ROM capacity to store it inside the computer itself. This disk storage of the Operating System keeps the computer's internal memory as free as possible for other uses.

The Operating System for the TEF Computer is called Tefdos and was developed to meet the specialized needs of TEF users. Tefdos is contained on the TEF system disk along with the TEF application program and sample job data.

To understand Tefdos' role within the computer, this image may be helpful:

1. ROM contains enough information to tell the computer that it is a computer.
2. Tefdos tells the computer how to be a computer.
3. TEF application software tells the computer what to do.
4. RAM is the memory the computer uses to carry out its instructions.

2.2.8 Additional Terms

Refer to **Table 2-1** on the following page for definitions, examples and references for computer terms.

TERM	DEFINITION	EXAMPLE	REFERENCE
Hardware	Physical machinery of a computer.	TEF Analyzer	2.2.1
Software	Programs, or sets of instructions for a computer.	Tefdos	2.2.2
Data	Information without instructions.	Test session data	2.2.3
ROM	Read Only Memory for permanent storage of information.		2.2.6
RAM	Random-Access Memory for temporary storage of data. Erased when computer is turned off.		2.2.6
Operating System	Software containing instructions the computer needs to function.	Tefdos	2.2.7
Application Software	Software containing instructions for special functions of a computer.	TEF 2.0	
Disk	Plastic Film which can be magnetized to store information.		2.4
Disk Drive	The part of the computer that holds the disk and reads the information stored on it. The name of a disk drive is also used to refer to the disk stored in that particular drive. Labeled with a letter.	A0:CONFIG.SYS ▲	2.5.2
Partition	Separations on the disk, similar to chapters in a book or the dividers in this manual. Labeled by numbers from 0 to 9.	A0:CONFIG.SYS ▲	2.5.3
File	A set of information magnetically stored on a disk. It can be a program or data from a test session. Name up to 8 letters long.	A0:**CONFIG**.SYS ▲	2.5
Type	The descriptor for a file. This three letter code tells what kind of information is in the file.	A0:CONFIG.**SYS** ▲	2.5.5
Filename	The name of a file. The filename has four parts, separated by punctuation: Disk letter, partition number, 8 letter name of file and file type.	**A0:CONFIG.SYS**	2.5.1

Table 2-1
Computer Terms

2.3 TEF as a Working System

One way to look at TEF as a working system is to follow the sequence of steps from turning the power on through to normal operation.

1. The computer is plugged in, but turned off.
2. Power on: When power first comes on, the computer knows virtually nothing. The ROM (Read-only Memory) includes instructions for the computer to look for the Tefdos operating system on Drive A: (left).
3. TEF disk is put in Drive A: and the drive door closed. When the computer finds the operating system on the disk in Drive A:, it reads or "loads" the operating system into RAM (Random-Access Memory).
4. Once the computer has read (loaded) the operating system, it is ready to go to work as a TEF Analyzer.
5. If the application software is on the same disk as the operating system (this is the way the TEF system disk is supplied), the now smart computer will automatically load the appropriate application files immediately.
6. Once the initial TEF files are loaded, the computer becomes the TEF system. It will now respond according to the TEF software. Each command will mean what the TEF application software says it means. Each question will be the TEF application software's question. In a very real sense, the TEF application software takes control of the computer, until the operator gives the command "exit to system."
7. When you are finished with the TEF application software and give the command "exit to system," the computer once again is controlled by the operating system.
8. When the computer is controlled by the operating system only, it can still do many tasks if given appropriate commands. See **Sections 4** and **6** of this part of the this manual for information on Tefdos utilities.

2.4 Magnetic Disks

TEF uses 5 1/4" diskettes (commonly called "floppy disks") for storage of programs and data files.

2.4.1 Disk Information

Disks are made of a plastic film with a coating of oxide which can be magnetized. This principle is the one used on magnetic recording tape. The disk shape permits rapid access anywhere on the disk (either side).

The computer reads and writes information on disks via a **Disk Drive**. The TEF Analyzer uses two such drives referred to as **A:** (left) and **B:** (right). The Drive includes a motor to rotate the disk and a head which can either read or write magnetic information on the disk. In the TEF System, a light on each disk drive indicates which drive the computer intends to use if it is asked to read or write on a disk. (In many other computers, the light indicates actual reading or writing in progress.)

Information on disks is stored in groupings called **files**. Each file has a name, and the computer can locate files by tracking the filenames. (See **Section 2.5.1** for information on filenames.)

2.4.2 Disk Formatting

Before new, blank disks can be used to store files or other records, they must first be formatted or prepared to accept TEF data. See **Section 4.5** for instructions.

2.4.3 Disk Capacity

The TEF Analyzer can use either high capacity or low capacity disks. A low capacity (usually labeled as "double sided/double density") disk holds 790 K or 790,000 bytes of information. A "High Capacity" disk holds 1.4 Megabytes of information.

Early versions of the TEF Analyzer and TEF application software employ low capacity disks. To allow older data files and measurements to be used in updated systems, current TEF Analyzers allow the use of both low and high capacity disks. When formatting, you must instruct the Analyzer about which type of disk you are using for the particular application.

2.4.4 Disk Handling

Because the disks store information by magnetic pulses, they are erasable by magnetic force as well. Because they are made of plastic film, they can be damaged by excess heat. Because they store so much information in such a small space, they must be kept clean and free of dust, dirt, and oil. In general, observe these precautions when handling disks:

1. Keep disks away from excess heat, direct sunlight, closed automobiles in direct sunlight, etc.
2. Keep disks free of dust. Store disks inside their protective sleeves in a box made for disk storage.
3. Don't touch disk surface. Handle only by plastic sheath.
4. Keep disks away from magnetic fields. Watch for hidden magnets, such as telephone handsets, telephone bell area, magnetic paper clip dispensers, radios, tape recorders, electric motors (especially inside other devices), etc.

2.5 Disk Files

Data and programs are recorded on the floppy disk in blocks called files. Each file consists of one or more sub-blocks called records. The surface of the disk is marked with timing marks (pulses) that segment it into identifiable sections much like pages and lines segment a notebook.

The disk is further sectioned into tracks and sectors. A particular location on the disk is reserved for a directory of the files on the disk. It contains the names of the files and a listing of the tracks and sectors where the files have been recorded.

2.5.1 Filenames

Each filename consists of four parts:

- Disk drive - a letter, usually A or B
- Partition - a number, 0 through 9 (optional)
- File name - up to 8 letters
- File type - up to 3 letters

Using the example **A0:CONFIG.SYS**

- **A** is the disk drive
- **0** is the partition
- **CONFIG** is the file name
- **SYS** is the file type

Notice that there is a colon between the partition and file name and a period between the file name and the file type. If the partition is left off, i.e. A:CONFIG.SYS, a partition of 0 is assumed

2.5.2 Disk Drive

The term disk drive really has two different meanings depending upon context in which the term is used. It could mean one of the vertical slots on the computer that hold the disk and read the information stored on it. But in referring to a disk drive, you are also referring to the disk that is placed within that drive.

The names of disk drives are letters, usually followed by a colon; for example, A: and B:. The disk drive part of a filename varies depending on where the disk is. The disk in drive A: can be named by using A:. But if you took that disk out of drive A: and put it into the drive called B:, that disk would now be called B:, and the files on it would therefore have B as the first part of their filename.

If the prompt is A and you want to do something with a file on B:, type **B:** after the A0) prompt. The next prompt will be B0).

2.5.3 Partitions

The **partition** is the designation for a portion of the space on the disk. The concept of a disk partition is similar to the dividers in a ring binder or divisions in a file drawer. You have a wide range of options in how you allocate space within the ring binder dividers, but you are limited to the total number of sheets that will fit in the whole binder. The dividers help organize the sheets of paper and make it easier to find what you're looking for.

Like ring binder dividers, disk partitions can hold variable amounts of information up to the size of the whole disk. Partitions are named with numbers from 0 to 9. If you don't specify a partition number, the whole disk will be in one big section, called partition 0. You can specify partitions for each file by giving them a partition number in their filename. Using partitions improves file management. If the partition number is left off, a partition of 0 is assumed.

2.5.4 File Name

The **file name** is an 8 letter identifier that serves as the title of the file. File name (two words) is different from filename, which is the whole, four-part name of a file described above. The file name is part of the filename. Job numbers, commands and document titles can all serve as file names.

2.5.5 File Type

The **file type** is a descriptor for a file. This three letter code tells what kind of information is in the file. For example, SYS means that the file contains instructions for running the systems, or basic operations of TEF; and COM indicates that a file is a command or a list of commands. See **TEF 2.0 Section 4.13** for more information on file type designations for TEF job data.

2.5.6 Using Filenames

There are a number of conventions that assist in the use of filenames, especially in using commands that specify the files to which the commands apply.

Files may often be specified without using their complete four-part filename. A common shortcut is to type only the 8 letter file name. There are several rules for naming files:

- You must give Tefdos enough information to identify the proper file. If there are several files with the same file name, you should include the disk, partition and type to be sure to get the right one.

- If your operation involves more than one disk (such as a COPY command between two disks), specify the disk drive letters along with the file name.
- You can use the symbol "*" as a wild card. Tefdos will interpret * as any character. If you want to use more than one file, and parts of their filenames are identical, replace the rest of the filename with asterisks. For example, to specify the 9 files with the names JOB01, JOB02 ... JOB09, you could type **"JOB0*"**.
- If you don't specify the disk drive for a file, Tefdos will assume that the file is on the disk in the default drive as noted in the first letter of the screen prompt. For example, if the prompt is A0), the default drive is A:. If you type a filename without specifying a drive, the computer will look for that file in the default drive.

2.6 Keyboard Functions

2.6.1 Introduction

All operator commands enter the computer through the keyboard. **Illustration 2-1** shows the TEF Analyzer keyboard.

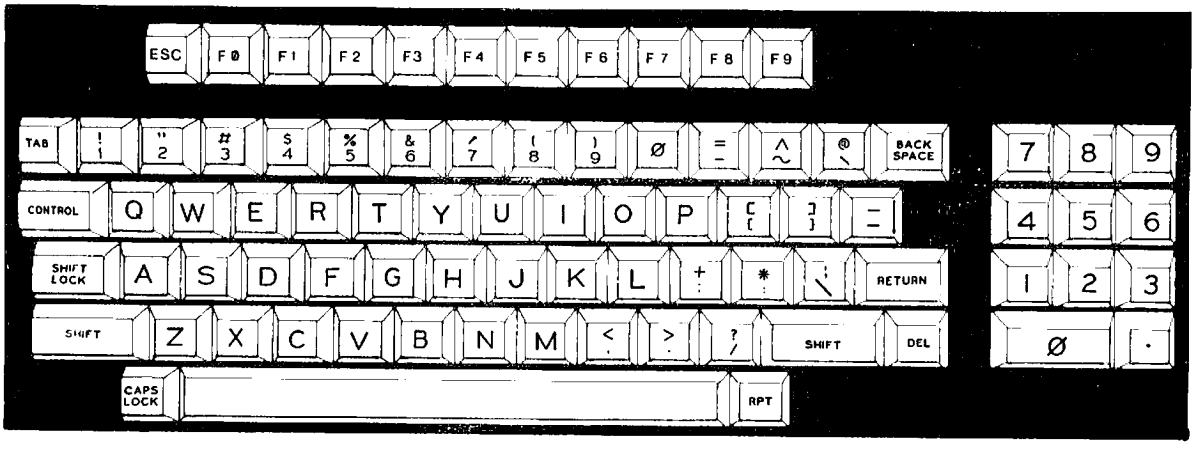


Illustration 2-1
TEF Analyzer Keyboard

2.6.2 General Characteristics of the Keyboard

The computer keyboard is similar to the typewriter keyboard, but has several additional keys. Similarities include the physical arrangement of the letter and number characters, return key, and space bar. Differences include the following:

1. Many of the non-letter keys have different shift characters than those on the typewriter keyboard.
2. There are additional keys on a computer keyboard. Control, Repeat, Escape, Caps Lock, the row of ten "Special Function" keys, and the numeric keypad are some examples.
3. Keys normally repeat when held down over 1/2 second. (See {RPT} function below for instructions on turning off this repeat feature.)

2.6.3 <CR>

The <CR> key is a "leftover" from the typewriter keyboard, since there is no carriage in the computer. The computer uses <CR> quite differently from the typewriter. <CR> is the key which tells the computer a command is complete, and to go ahead and perform according to the command. Because of this function, many computer users refer to this key as the "ENTER" key. In this manual the symbol <CR> (for "Carriage Return") means the RETURN key.

2.6.4 {CONTROL}

The {CONTROL} key has a unique function. {CONTROL} is always used along with another key. By itself, {CONTROL} has no function at all. But with another key, {CONTROL} can be very powerful. The software determines the function of the {CONTROL}-plus-key commands, so the function changes from one program to the next. This manual includes instructions for all the TEF functions for the {CONTROL} key.

When a command is to be entered using the {CONTROL} key, this instructions will indicate {CONTROL} with a "↑". When instructions indicate ↑K , for example, press {CONTROL} and hold it down while pressing K.

2.6.5 {CAPS LOCK}

{CAPS LOCK} has the useful function of keeping all letters in upper case, but leaving numbers, punctuation marks, and symbols in lower case. Since most TEF commands require capital letters, TECHRON recommends keeping {CAPS LOCK} on. {CAPS LOCK} does not "click" lock, but a small light shows when {CAPS LOCK} is engaged.

2.6.6 {SHIFT LOCK}

The {SHIFT LOCK} key works like its namesake on the typewriter. {SHIFT LOCK} clicks down when engaged, making all keys produce their upper case character. {SHIFT LOCK} has very little useful function in the TEF System. It is included in the keyboard mostly for consistency with other keyboards. In TEF operation, {CAPS LOCK} is much more helpful than {SHIFT LOCK}.

2.6.7 {RPT}

{RPT} (Repeat) is located just to the right of the space bar. Its function is actually just the opposite of its name. Normally, every key on the TEF (or nearly any computer) keyboard will repeat when held down for over 1/2 second. Since this is the usual way for computer keyboards to operate, engaging the {RPT} key causes all keys to **not** repeat. Operators who have trouble learning the relatively light, quick touch of the computer keyboard may use the {RPT} to prevent unintentional repeating of characters or commands. {RPT} is a locking key, and remains engaged until released.

2.6.8 {ESC}

The {ESC} (Escape) key, in some uses, has a function similar to its name. In many programs, {ESC} is used to cancel or back out of a command, and thus works the way its name suggests. In the TEF System, {ESC} is just another key, with various functions depending on the task at hand. The Command Chart and the various other sections of this manual contain instructions about the function of {ESC}.

2.6.9 Function Keys

Above the main portion of the keyboard, and slightly separated from the rest, are the "Function" keys, sometimes called "Special Function" keys. There are ten such keys, numbered from 0 to 9. These keys are called "{F0}" through "{F9}." These keys have different functions depending on the software. In the TEF System, the Function keys work according to the labeling strip included with the TEF System. The Command Chart and this manual contain complete instructions on the use of the Function keys.

Some software uses the Function keys along with the {SHIFT} or {CONTROL} keys. The TEF 2.0 Software uses {SHIFT} with the Function keys, but does not use {CONTROL} with any Function keys.

2.6.10 Numeric Keypad

For convenience in entering numbers, the TEF keyboard includes a numeric keypad to the right of the main keyboard. Many computer operators prefer this layout for number keys due to its ease of use. In the TEF System, the numeric keypad and the number keys on the main keyboard are completely interchangeable.

2.7 External Devices

The TEF System can operate other computer-related devices, such as printers or a modem. The TEF System can operate without these devices, but each makes a significant contribution to its overall usefulness.

The TEF Analyzer can drive most common external devices. But since it is a computer with a specialized purpose, the TEF Analyzer can drive several external devices which are not common to other computers. The TEF Analyzer has output connections for sound and other signal output, and input devices used in measuring the systems under test.

This section explains in general terms how these devices work. **Section 3** covers input and output functions in more detail.

2.7.1 Printer

A Parallel Printer Cable comes with the TEF Analyzer.

The computer can operate either a parallel or serial printer. The TEF Analyzer is set up to drive the following printers:

1. Epson FX-86, 286
2. Epson RX-80
3. Epson MX 80, 100 (with Graftrax Plus)
4. Epson FX 80, 100
5. Epson LQ 800, 1000

The printer requires AC power via its own power cord, and a data connection with the computer. The TEF Analyzer includes appropriate data connections for most printers.

The TEF Analyzer can print screen displays which include text, graphs, or combinations of both. In addition, the TEF Computer can perform printing tasks similar to any other computer of its type and capacity.

2.7.2 Modem

A modem allows the computer to communicate with another computer via communication links such as telephone lines. "Modem" is an abbreviation for "Modulate - Demodulate," which is a way of saying that the modem translates information from the computer into a standard form for transmission. When receiving, the modem performs the reverse operation, translating standard communications transmissions into information its computer can use.

2.7.3 Optional Accessories

TECHRON offers three optional accessories.

TEF-M01

- Brüel & Kjær (B&K) Model 4007S Microphone
- Phantom Power Supply/Adapter
- 25 foot Microphone Cable

TEF-K01

- Complete set of connection cables and cable adapters
- Line to mic transformer attenuator set.
- Carrying Case

TEF-P01

- Epson 80 Column Dot Matrix Printer

SECTION 3: SETUP OF TEF SYSTEM 12

3.1 Introduction:

Whenever you unpack a new computer, move it to a test location, or connect new external devices such as printers, you must follow certain setup procedures. Once you have informed the computer about the setup you are using, you can begin to use your TEF SYSTEM 12 for its variety of applications. This section provides instructions for:

- Opening and setting up the TEF computer
- Identifying rear panel ports and jacks
- Using the DEVICE command to configure the TEF computer
- Attaching external input and output devices
- Making electrical connections for test setups

3.2 Open and Setup

3.2.1 Remove Rear Cover

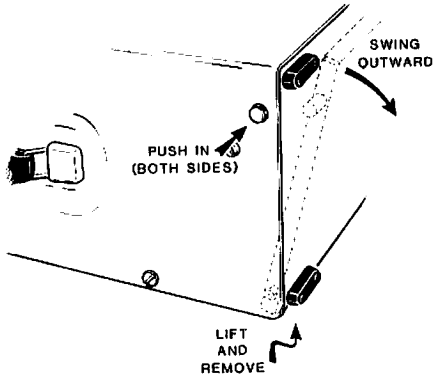


Illustration 3-1
Rear Cover

1. Set TEF Analyzer horizontally on its rubber feet.
2. Depress latches, one on each side, and swing rear cover outward until latch posts clear rear edge of side panels. (See **Illustration 3-1.**)
3. Lift rear cover slightly, allowing slots at bottom to clear pegs inside, then remove rear cover completely.
4. Remove AC power cord from inside rear cover and attach female end to AC connector on rear panel of TEF computer.

3.2.2 Open Front Cover/Keyboard

1. With TEF computer sitting horizontally on work surface, slide top two rubber feet on front cover inward, releasing latches. (See **Illustration 3-2.**)
2. Swing front cover downward while lifting the main body of the TEF computer slightly.
3 When front cover/keyboard is fully open, TEF computer body will be angled upwards with front higher than rear.

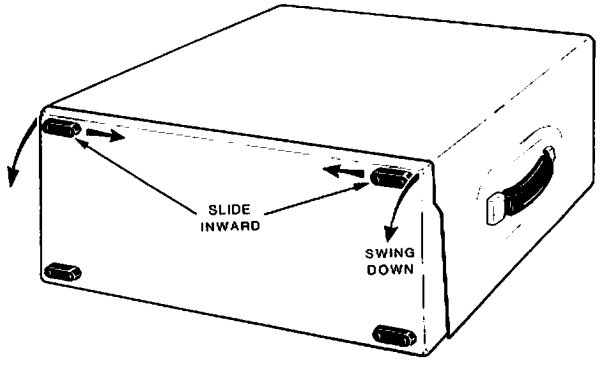


Illustration 3-2
Front Cover

3.2.3 AC Voltages

The TEF Analyzer, as shipped, is wired to use domestic line voltage (120V). If you are not using a 120V line, you must adjust the wiring to accommodate alternative voltage situations.

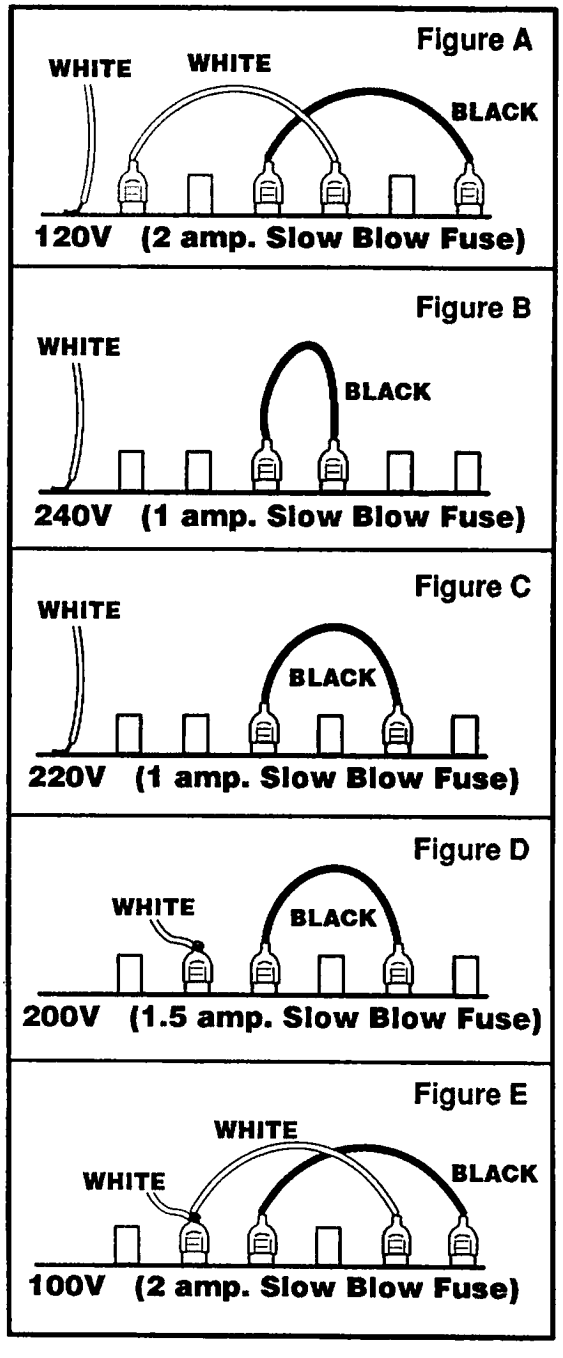


Illustration 3-3
Terminal Strip

WARNING

YOU MUST UNPLUG UNIT FROM AC POWER BEFORE CHANGING INTERNAL CONNECTIONS.

FAILURE TO FOLLOW INSTRUCTION STEP #1 BELOW COULD CAUSE DEATH.

Instructions:

1. Unplug the AC power cord from the power source if you have plugged it in. Disconnect the AC power cord from the rear panel.
2. Remove the top of the TEF Analyzer by unscrewing the screws that hold it in place, then lifting the top off.
3. Locate the terminal strip in the left rear corner.
4. Figure A of **Illustration 3-3** shows the wiring on the terminal strip as shipped. Figures B through E show wiring adjustments for alternative voltage situations.
5. If you will be using 240V, 220V, 200V or 100V, adjust the terminal strip wiring to correspond to the appropriate figure.
6. Replace the top of the TEF Analyzer. Replace the screws. Re-attach the AC power cord to the rear panel.

3.3 Rear Panel Connection Sites

Illustration 3-4 shows the rear panel of the TEF computer. The input and output jacks and the data ports are used to connect various printers, modems and testing equipment to the computer. Each connection site is briefly identified here. For instructions on attaching external devices, consult the sections noted.

RS-232C Data Ports - A (top) and B (middle)

A is used for connecting modems. (See **Section 3.6.**)

B is used for connecting serial printers. (See **Section 3.5.**)

Parallel Data Port - (bottom)

Use this port for connecting parallel, or Centronics, printers. (See **Section 3.5.**)

Test Output Jack - This test oscillator output jack sends an oscillating test signal through a cable to an electronic device such as an amplifier or loudspeaker. (See **Section 3.8.**)

5 Pin Balanced Input Jack - This instrumentation amplifier input jack is a connection point for a microphone or sound level meter. (See **Section 3.8.**)

Unbalanced Input Jacks - These instrumentation amplifier input jacks are connection points for microphone or sound level meters. One is a Non-Inverting BNC jack. The other is an Inverting BNC jack. (See **Sections 3.8** and **3.9.**)

Video Output Jack - This jack will send a signal to an external video monitor. (See **Section 3.7.**)

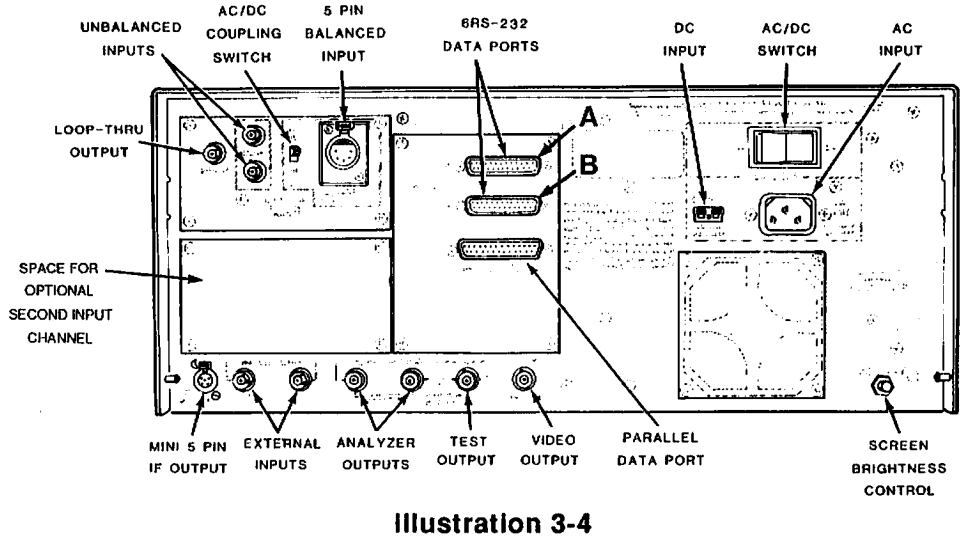


Illustration 3-4
Rear Panel

3.4 Device Command

Use the DEVICE command to assign input and output devices. Configuring the computer lets Tefdos know the sources and destinations of its information. After changing or adding external equipment such as a printer or a modem, you must use the DEVICE command to reconfigure the system. The DEVICE command allows advanced applications such as adding another computer to the system, attaching two printers, or using an external video monitor.

This section assumes that you have some familiarity with computers. You must turn on the computer and get to Tefdos in order to use this command. If you are a new user, you may want to read **Section 1.8** now to get a more detailed introduction to starting up. **Section 4** may also be helpful. It contains instructions for using basic Tefdos commands. This section contains only enough information to access the DEVICE command. **Section 6.3.8** contains the specifications for the DEVICE command.

Before getting into detailed instructions, let's look at an overview of the general order of the procedure for changing DEVICE settings:

1. Attach external equipment
2. Start up the computer and get to Tefdos
3. Use the DEVICE command

3.4.1 Attach external equipment

Instructions for connecting basic equipment begin in **Section 3.5**. Follow the directions in the section for the particular device you are adding or changing, and then use the DEVICE command to inform Tefdos of the changes.

3.4.2 Start up the computer

There are three options for start up. They vary in length and endpoint. To use the **DEVICE** command, you must be in Tefdos. You many want to try all three, or you can read the descriptions and decide which best suits your needs. **Table 3-1** shows the basic differences between the three.

OPTION	DISK	END POINT	LENGTH
1	Tefdos	Tefdos	Short
2	EasyTEF	EasyTEF Main Command Bar, may Quit to Tefdos	Short
3	TEF 2.0	TEF 2.0 Main Menu, may Exit to Tefdos	longer, more options

Table 3-1
Start up Options

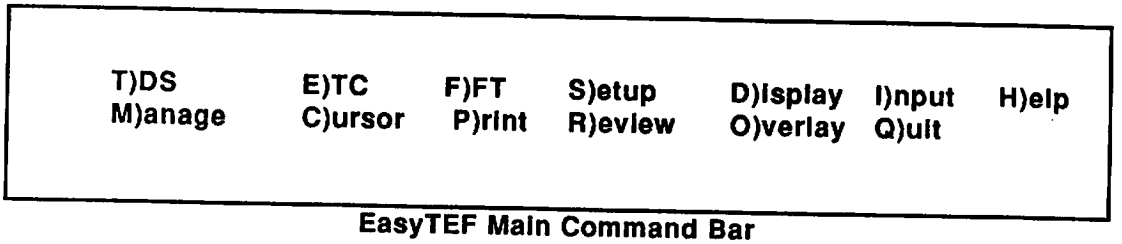
Option 1: Tefdos Startup

1. Depress the power switch button, turning power on.
2. Put the Tefdos disk in Drive A: (see **Illustration 1-3**)
3. **SEE:**
   Tefdos v1.oc, try "HELP"
   AO) \CONFIG.SYS
   AO) PREF 2
   AO) NODEFER
   AO) NOVERIFY
   AO) ACT
   AO) ____
4. Power on is complete. You are ready to use Tefdos commands.

Option 2: EasyTEF Startup

1. Depress the power switch button, turning power on.
2. Put the EasyTEF disk in Drive A:.
3. **SEE:**
   An initial display of information about the EasyTEF system, including copyright and author information, release date, and version number.

4. **SEE:**
   A blank screen with the Main Command Bar at the top.



EasyTEF Main Command Bar

5. Power on is complete. The Tef Analyzer is ready to use the EasyTEF software. To go to Tefdos, type:

   Q for Q)uit.

Option 3: TEF 2.0 Startup

1. Depress power switch button, turning power on.
2. Put TEF 2.0 disk in Drive A:
3. **SEE:**
   Please type in your name.

   TYPE:

   Your Name
4. **SEE:**
   Are you experienced with TEF? (Y/N)

   TYPE:

   Y (for yes) or **N** (for no)
   (Don't press <CR>)
5. **SEE:**
   Please enter the date (MM/DD/YY)

   TYPE:

   MM/DD/YY

6. **SEE:**
   The desired data drive is

   TYPE:

   B (don't press **<CR>**)

7. **SEE:**
   A series of messages as the computer loads data needed to begin operation.

8. **SEE:**
   If you typed Y in step 4, you will see a screen entitled "MAIN MENU."
   If you typed N in step 4 you will see a screen entitled "TEF INITIALIZING MODULE MENU" followed by:
   Your choice is (type M, R, or X)?

   TYPE:

   M
   (if the screen is the "TEF INITIALIZING MODULE MENU").

   Note: If you entered "Y" in step 4 above, you will not see this screen.

9. **SEE:**
   A screen entitled "MAIN MENU"

10. Log-on is now complete. The TEF Analyzer is ready to use TEF 2.0 for data review or testing.

11. Type: **X** for eXit to go to Tefdos

3.4.3 The DEVICE command

The DEVICE command has two functions. It instructs Tefdos to display the current settings, and it will execute changes in the settings.

To view the current settings, type **DEV** after the A0) prompt. The display will look like **Illustration 3-4.**

There are two parts to understanding this display: the difference between logical and physical devices, and what all the names for the devices mean. After understanding that, you will be ready to configure the TEF Analyzer.

3.4.4 The DEVICE display

When you enter the DEVICE command (See **Illustration 3-5**) you will see all of the switches for input and output assignments. The items on the left are called logical devices. The four switches to the right of each logical device are called physical devices. As an example of logical and physical devices, look at the last line of the display:

PRInter = COM2, VIDeo, CEN, BUFAXO

Printer is the logical device. The corresponding physical devices, COM2, VIDeo, CEN and BUFAXO, are the four possibilities for configuring printer output. By designating one of the four switches, you are instructing Tefdos to send printer output to the device connected to the port or jack specified by that switch. The highlighted switch shows the current setting. When this switch is set to match the way you have attached the printer (or whatever is acting as a printer), Tefdos can appropriately send information to and receive information from that device. The highlighted entries in the DEVICE display show the default switch settings.

DEV

CONsole	=COM1, **NORMal**, AXIPRIN, TERMinal
AXIn	=**COM1**, COM2, TERMinal, EOF1
AXout	=COM1, COM2, CEN, **VIDeo**
PRInter	=COM2, VIDeo, CEN, BUFAXO

Illustration 3-5
Device Display

3.4.5 DEVICE Switches

The four logical devices and the 16 switches that go with them are defined in this section. These definitions will aid in determining how to use DEVICE to configure the TEF Analyzer.

CONsole - Major input source and output destination device or devices

> ***COM1** - Serial Port A (top). For modem or terminal.
>
> **NORMal** - TEF keyboard is input, TEF screen is output.
>
> **AXIPRN** - Device designated as AXIn is input, PRInter switch is output.
>
> **TERMinal** - TEF keyboard is input, TEF screen is output, with another terminal or modem at COM1 (both NORMal and COM1).

AXIn - Auxiliary input device

> ***COM1** - Serial Port A (top). For modem or terminal.
>
> **COM2** - Serial Port B (middle). For serial printer.
>
> **TERMinal** - TEF keyboard is input, TEF screen is output, with another terminal or modem at COM1.
>
> **EOF 1** - Paper punch reader

AXOut - Auxiliary output device

> **COM1** - Serial port A (top). For modem or terminal.
>
> **COM2** - Serial port B (middle). For serial printer.
>
> **CEN** - Parallel port (bottom).
>
> ***VIDeo** - Video output jack.

PRInter - Output device serving as printer

> **COM2** - Serial printer attached at serial port B.
>
> **VIDeo** - Video monitor attached at video output jack.
>
> ***CEN** - Centronics/Parallel printer attached at parallel port.
>
> **BUFAXO** - Data and commands for printing go to a 64K print buffer, and then out through the auxiliary output. AXOut must be set with the switch that corresponds to printer connection location.

* indicates factory default switch settings.

3.4.6 Using DEVICE

Use the DEVICE command after attaching external equipment. The proper commands are given in the sections detailing instructions for each type of equipment. The basic command syntax is:

DEV (logical device) = (Physical device)

> IMPORTANT:
> Turn off and unplug the computer before making any electrical connections.

3.5 Printer Attachment

For text printing from word processing programs running on the TEF Analyzer, most printers will perform satisfactorily. However, the TEF software's special display characteristics require one of a few particular printers for proper performance.

The TEF Complete Measurement Package (optional at extra cost) includes an Epson FX-85 printer. To obtain satisfactory printouts of TEF data, use this printer or one of these Epson printers:

- FX 80 (or 100)
- RX 80 (or 100)
- MX 80 (or 100) with Graftrax Plus

Serial port B and the parallel port are both designed for printer connections. Which port you use depends on the printer. The Epson printer included in the TEF Complete Measurement package connects to the parallel port. If you are using a different printer, your printer manual will tell you whether it should be connected at a serial or parallel port. Some printers may be connected at either port.

Definitions of parallel and serial may help in determining the required assignment for your printer.

- **Parallel** - a data transmission technique that sends each bit (a digit in the computer's code) simultaneously over 8 lines. Therefore, it can send 8 bits, which is 1 byte, at a time. Centronics or Centronics equivalent printers and cables use parallel transmission.
- **Serial** - a data transmission technique that sends each bit sequentially over a single line. The serial port on the TEF Analyzer is an RS232C port, which is a 25 pin interface.

After you figure out whether your printer should be attached at the parallel or serial port, it is time to install it. There are four steps in printer installation:

1. Set printer options.
2. Set serial printer protocol.
3. Connect printer.
4. Use DEVICE command.

3.5.1 Set Printer Options

Setting the printer options is a procedure by which you tell the printer how to match the printing style of TEF and Tefdos. It is usually done using switches within the printer itself. The Epson printer included within the TEF Complete Measurement Package requires no user adjustment prior to operation. Users of other printers may need to select certain options within their printers. The following options must be set:

1. Select Fixed
2. Slashed Zero
3. Normal Type Font
4. Paper Sensor ON
5. Skip over Perforations OFF
6. LF (Line Feed) sent by Host Computer. (Not Auto LF with <CR>.)

Refer to your printer's instruction manual for instructions on how to set these options.

3.5.2 Set Serial Protocol

If you have a serial printer which you are going to attach at serial port B, you need to set the protocol for your printer. This is not necessary for a parallel printer. By setting the correct protocol for your printer, you are telling your printer the format of the information that will be transmitted through the interface. Use your printer's instruction manual to set your printer to correspond to the following protocol:

1. asynchronous operation
2. 8 bit word
3. 1 stop bit
4. no parity
5. 9600 Baud

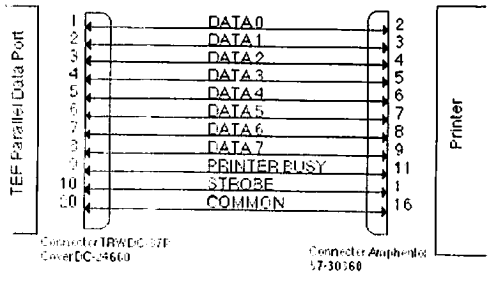


Illustration 3-6
Wiring Diagram, Parallel Cable

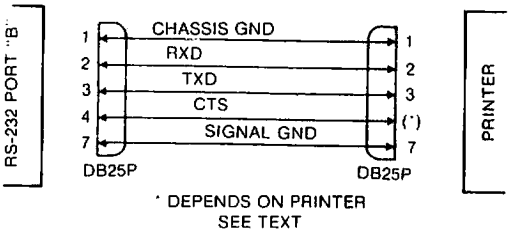


Illustration 3-7
Wiring Diagram, Serial Cable

3.5.3 Connect Printer

Parallel: The TEF Analyzer includes a parallel printer cable wired properly for immediate operation. The wiring diagram is shown in **Illustration 3-6.**

To connect the parallel printer to the computer, take the male end of the cable and insert it into the parallel port on the rear panel of the computer. Connect the female end to the computer. The cable will only fit in the correct orientation.

Serial: A serial printer can be connected to serial port B (the middle port) on the TEF computer.

Installation instructions for a serial printer are highly variable, depending on the printer. Refer to your printer's instruction manual for complete specifications and instructions.

In most cases one of the following installation methods will work:

1. Use an RS-232C cable between port B on the computer and the printer.
2. Use a DB-25P connector at the port and wire the connection according to the schematic in **Illustration 3-7.**

The cable should be kept as short as possible, not exceeding 25 feet in length.

Table 3-2 lists the functions of the wires in the printer interface cable. **Illustration 3-7** is a wiring diagram for the cable.

Pin No	Signal	Description
1	PGND	Chassis Ground
2	RXD	Data from Printer to Computer
3	TXD	Data from Computer to Printer
4	CTS	Clear to send. Printer busy = low
7	SIG GND	Signal Common (Ground)

Table 3-2
Pin Assignments, Serial Cable, Port B

Pin 4 "CTS" line: This line is known as a handshake line. It is used by the printer to signal the computer when it is busy or when it is ready to receive data. The clear-to-send condition exists when this line is at logic high, i.e. +3 volts or more. The busy condition exists when this line is at logic low, i.e. 0.8 volts to -12 volts. This is typically called Inverted Busy Handshaking. Configure the interface to match this requirement. Consult your interface instruction manual for exact details.

3.5.4 DEVICE Commands

Use the DEVICE command to inform Tefdos about the printer attachment you have made. See **Section 3-4** for instructions on using DEVICE.

If you have a parallel printer, the appropriate command is:

DEV PRI = CEN

If you have a serial printer, the appropriate command is:

DEV PRI = COM1

3.6 Modem Attachment

Port A is designed for the attachment of a modem. The modem must be Bell 212 A type and 103 compatible. The Hayes Smartmodem 1200 is a particularly good choice. There are normally 3 steps to the modem attachment procedure. Special cases may sometimes require a fourth step.

1. Set modem protocol.
2. Attach modem.
3. Use DEVICE.
4. Use BAUD.

3.6.1 Set Modem Protocol

Set the protocol within your modem to correspond with the format of information transmitted through the serial port A interface. Use your modem's instruction manual to set your modem to the following protocol:

1. asynchronous operation
2. 8 bit word
3. 1 stop bit
4. no parity
5. 1200 Baud

3.6.2 Attach Modem

Attach the modem to port A on the rear panel of the TEF Analyzer. Port A is the top serial port. The required cable has 6 wires, with a DB-25P connector at each end. The cable length should be as short as possible, not exceeding 25 feet.

Illustration 3-8 shows the wiring for a cable to connect a Hayes Smartmodem 1200 to serial port A. **Table 3-3** shows the function of each of the six wires in the cable.

Pin No.	Signal	Description
1	PGND	Chassis Ground
2	RXD	Data from Modem to Computer
3	TXD	Data from Computer to Modem
4	CTS	Request to send from Modem
5	RTS	Clear to send from Computer
7	SIG GND	Signal Common (Ground)

Table 3-3
Pin Assignments, Port A (Modem)

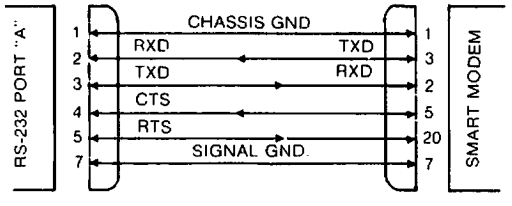


Illustration 3-8
Hayes Modem Interface
Cable-Wiring

3.6.3 DEVICE Command

Use the DEVICE command to inform Tefdos about the modem attachment you have made. See Section 3.4 for instructions on using DEVICE.

The appropriate command is:

DEV AXIn = COM1

3.6.4 BAUD Command

If, because of requirements of your modem or communications network, you need to set the Baud rate for serial port A at something other than 1200 Baud, use the BAUD command.

The possible Baud rates are: 50 75 110 135 150 300 600 1200 1800 2000 2400 3600 4800 7200 9600 19200

To set a new Baud rate for port A, type:

BAUD COM1 = (new Baud rate)

Port B is factory-set at 9600 Baud. Most users will not change that setting. See **Section 6.3.3** for complete documentation on the BAUD command.

3.7 Internal Wiring of Serial Ports

Illustration 3-9 shows the wiring of the serial port connectors. It is shown here for reference only. Note that it is possible to reconfigure the pin appearances of specific lines using the jumper blocks.

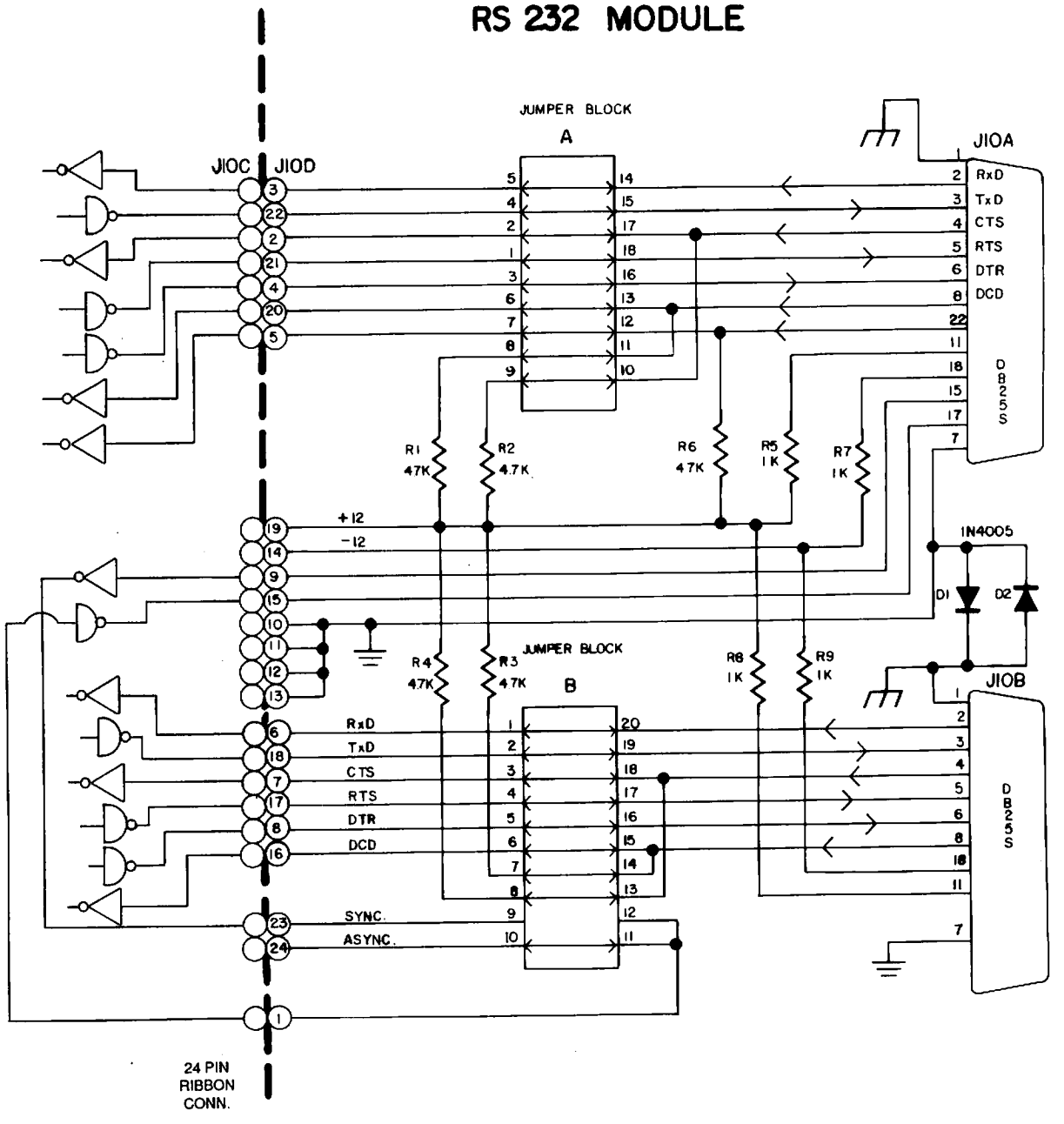


Illustration 3-9
Internal Serial Data Port - Wiring

3.8 Video

If you wish to use a larger screen than the CRT built into the TEF Analyzer, you can connect an external video monitor to the video connection jack on the rear panel. This jack provides a standard RS-170 Composite Video Signal which will drive an external television monitor.

Make connections using 75ohm coaxial cable with BNC connections. Set the monitor for the widest bandwidth available. Your monitor will probably require readjustment because the standard overscan of picture onto the CRT will be too much. The "safe area" of the picture extends out to the edges of the video raster.

3.9 Electrical Connections for Test Setups

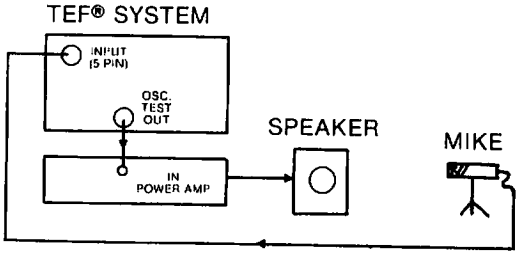


Illustration 3-10
General Acoustic Measurement Setup

Illustration 3-10 shows a general test setup for an acoustic measurement. **Illustration 3-11** shows the wiring details. When the system under test is an electrical device, the typical setup is as shown in **Illustration 3-12**.

Output for a test goes to the test output jack, where an oscillating signal is sent out through the connected output device. There are three jacks which are designed for input from the test. They lead to the instrumentation amplifier input. These input and output jacks allow connection of a variety of instruments, depending on the requirements of the test setup.

Remember that output from the TEF Analyzer is input for the system under test, and input for the TEF Analyzer is output from the system under test.

Complete Input and Output specifications are in **Section 1-5**.

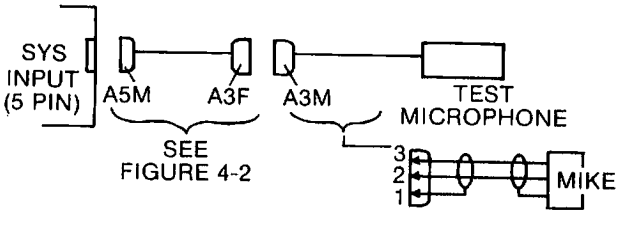


Illustration 3-11
Wiring for Acoustic Measurements

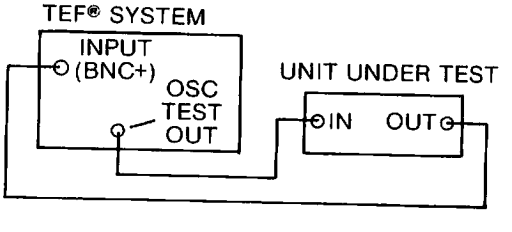


Illustration 3-12
Electronic Device Testing - Wiring

3.9.1 Test Output

The test output is an oscillating signal. It is an unbalanced output and requires a cable with a BNC-type connector. The optional TEF Complete Measurement Package includes all necessary cables and connectors.

To test an electronic device, connect the TEF test output jack to the input jack of the device under test.

When making acoustic measurements, connect the TEF test output jack to the input jack of an audio power amplifier driving a loudspeaker.

The Test output provides from 0.01 to 2.55 Volts RMS behind a true 600 ohm (±1%) source resistance, with signals in the frequency range of 0 to 32kHz.

3.9.2 Test Input

The 5 pin balanced input jack and the two unbalanced input jacks are wired in parallel and lead to the TEF Instrumentation Amplifier. **Illustration 3-13** shows the input circuitry. A slide switch selects AC or DC coupling of the inputs.

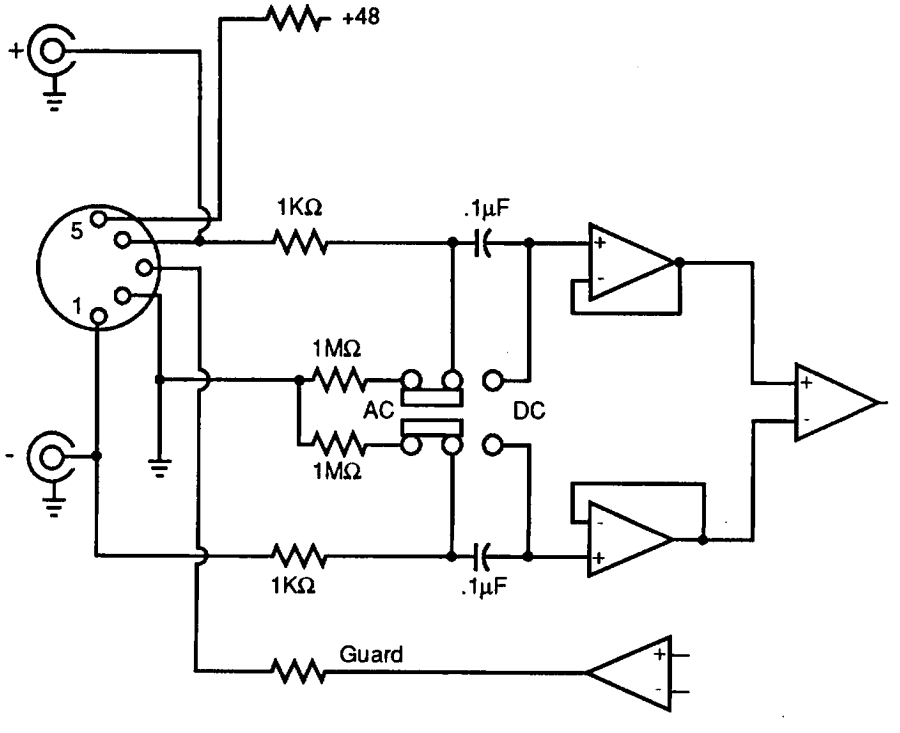


Illustration 3-13
Amplifier Input Circuitry - Wiring

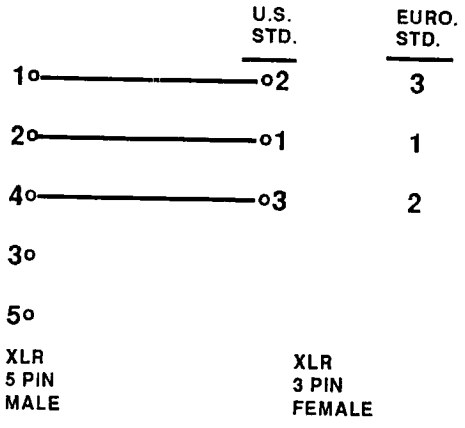


Illustration 3-14
5-pin XLR to 3-pin XLR - Wiring

The balanced input uses a 5-pin connector, fitting a Switchcraft type A5M plug. The pin assignments of the 5-pin input connector are not wired to industry standards. **Table 3-4** lists the function of each pin. To wire the 5-pin XLR to a 3-pin XLR, refer to the wiring diagram in **Illustration 3-14**.

The unbalanced input jacks are a non-inverting BNC jack and an inverting BNC jack.

The input amplifier may also be filtered with A, B, or C ANSI weighting filters or an externally attached filter when programmed for sound level meter functions.

Internal detectors for the full-wave average, the positive peak, the negative peak, and the greatest peak are available for preprocessing of the signal.

Pin	Function
1	INPUT (-)
2	GROUND (for shield)
3	GUARD (Driven Shield for special Hi-Z Transducers)
4.	INPUT (+)
5	48 Volts DC @ 50 mA maximum (to polarize microphones and vibration transducers)

Table 3-4
Pin Assignments, 5-pin XLR Input

3.9.3 AC and DC Input Impedance

The position of the rear panel AC-DC switch on the Instrument Amplifier is very important for proper EasyTEF operation. Unless you specifically want to make DC or very low frequency (less than 5 Hz) measurements, you should keep this switch in the AC position. Note that in the DC position the Instrument Amplifier has an extremely high input impedance (in the giga ohm range!) and can cause spurious overloads and strange readings if the inputs are not properly connected. If the switch is in the DC position, insure that all enabled inputs have connections made to them. The input impedance in the AC position is 1 (one) meg ohm.

3.10 Sound Level Meters

Use caution when connecting the output of a sound level meter to the TEF Analyzer. The one megohm resistors in the input circuit (R34 and R35) sometimes do not allow enough leakage current from the SLM output. Premature input overload errors usually indicate this condition.

In addition, be sure to have a clear understanding of the interrelationship of the magnitude of the signal appearing at the output of the SLM and the range settings of the SLM. Consult the manual supplied with the sound level meter before attempting an accurate calibration.

SECTION 4: TEFDOS OPERATING SYSTEM

4.1 Introduction

This section explains the basic Tefdos commands that the TEF Analyzer needs to operate and work with the disks. The Tefdos operating system is included on the TEF disk supplied with the TEF Analyzer.

Since this section serves as an introduction to Tefdos, we will only cover the more basic and commonly used commands and related Tefdos language. (**Section 6** contains a complete listing of all Tefdos commands.) **Table 4-1** on the following page is a reference of important terms used in this section. In addition to an example and a definition, the table also contains appropriate references to other manual sections where you can find additional information.

Before explaining the seven most important Tefdos commands, we will first review turning on the Analyzer and describe the two available Tefdos **HELP** screens. The simple **HELP** screen is a summary of all of the same basic commands that will be explained in this section. The other, more detailed screen called **HELPALL** is a comprehensive listing of available Tefdos commands and conventions.