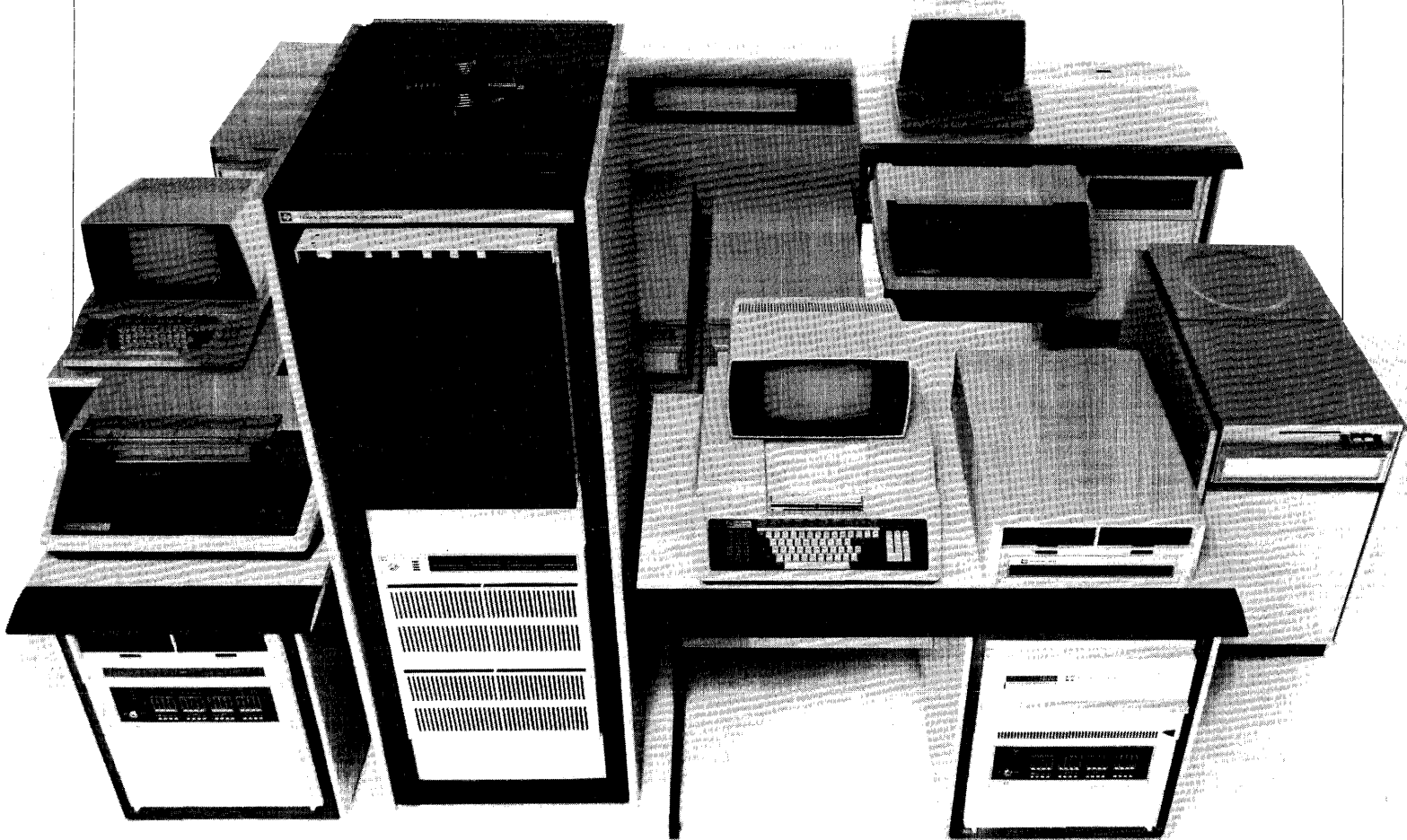# Texas Instruments

1979
Computer Family
Catalog

Texas Instruments reserves the right to change its product and service offerings at any time by adding or deleting items or by changing the specifications of existing items.

Contents

General Information

This catalog provides comprehensive purchasing information regarding the standard products[1] and services currently available for the Texas Instruments 990 Computer Family and Series 700* Distributed Processing Systems.

Product Descriptions

The Product Description section provides the technical information to select the system components that best fulfill the application requirements. Each description contains a brief summary of the major technical features and characteristics of the product. Hardware and software items that are prerequisites to proper operation are also identified. An item number and short, one-line title are listed for each kit or product that is offered for sale or license.

Configuration Guide

The Configuration Guide provides a complete set of technical guidelines to ensure that desired hardware/software system components can smoothly integrate into an operational configuration. Power usage, chassis slot, and cabinet space tables are included, which summarize the requirements of each item. A fill-in section is provided in each table to allow verification of the proposed configuration. It is intended that the fill-in sheets be attached to the customer purchase order where

customer configurations are required or specific rackmounting of equipment is desired.

Customer Services

The Customer Services section provides a comprehensive outline of training and technical services available to our customers.

Should additional technical and/or pricing information be required, please contact your local Texas Instruments field sales representative. Numerous equipment technical data sheets, brochures, and reference manuals are available locally at your request, and Texas Instruments welcomes the opportunity for our field sales engineers to discuss application requirements with you.

Field Service

The Field Service section provides detailed information on installation, warranty, maintenance, and fixed-price repair services available to our customers.

Ordering and Shipping

The Ordering and Shipping section provides detailed information on purchase order requirements, forms required for lease, software, and quantity purchase, method of shipment information, and verbal order policy.

[1]Equipment not manufactured by Texas Instruments may be supplied by multiple vendors.

*Trademark of Texas Instruments.

Series 700*
Distributed Processing Systems

The Series 700 Distributed Processing Systems provide versatile, low-cost solutions to problems associated with distributed processing applications such as:

- Source data entry and update
- Local file maintenance
- Data Communications
- Local printing
- Local data preprocessing or processing.

The Model 770 and Model 771 Intelligent Terminals and the Model 774 Distributed Processing Systems also provide high-performance, economical data processing as small, stand-alone business computers.

The Model 770 and Model 771 Intelligent Terminals, with processing capabilities based on TI's 16-bit TMS 9900 Microprocessor, incorporate a 1920-character video display, ROM and/or random-access memory, integral communications, and a typewriter-style keyboard in a single, functionally designed unit. The Model 770 uses dual minicartridge magnetic tapes for storage,

and the Model 771 features dual diskette drives.

The Model 774 Intelligent Terminal Systems incorporate 1920-character video display terminals and an office-style control console that houses the processor with error-correcting, random-access memory, and two diskette drives. Options include additional diskette drives, hard disk drives, and matrix and line printers.

System operation is supported by a multitasking, memory-resident executive. This executive provides operator communications, basic file management, task scheduling and data input/output. TPL 700 is the application programming language developed specifically for VDT-oriented data entry and local preprocessing. It combines a powerful fill-in-the-blanks forms package for data entry applications with a high level, English-like procedure language for data processing applications. TX5 BASIC is also available to run on the Model 771 Intelligent Terminal providing for program development, editing, and multiuser execution.

Model 770
Standard Configuration

- TMS 9900 Microprocessor, 32K bytes of random-access memory and 32K bytes of read-only memory
- 1920-character video display unit with 96-ASCII character set
- Typewriter-style keyboard with separate programmable function keys, cursor control pad, numeric pad, and terminal status lights
- Dual minicartridge magnetic tape transports
- Two communication ports.

584 mm
(23 in.)

457 mm
(18 in.)
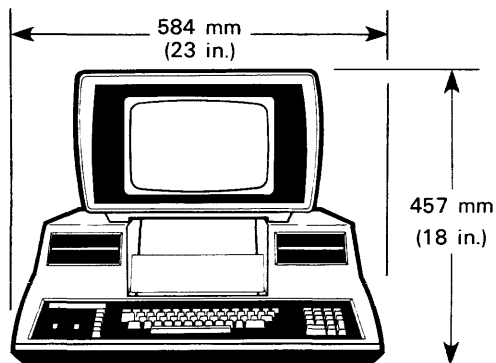
Model 771
Standard Configuration

- TMS 9900 Microprocessor and 64K bytes of random-access memory
- 1920-character video display unit with 96-ASCII character set
- Typewriter-style keyboard with separate programmable function keys, cursor control pad, numeric pad, and terminal status lights
- Dual diskette drives
- Two communication ports
- Licensed TPL System Software with one-year software subscription service

[1]For the purposes of this catalog, the terms diskette and flexible disk are used interchangeably.

*Trademark of Texas Instruments

1

Model 770 and Model 771 Options

- Internal 30-cps thermal printer (Items 5101, 5111 and 5113)
- Model 810A or 810B 150-cps impact printer (Items 6068, 6069)
- VDT graphics character set (Item 6050)
- Internal 202-compatible asynchronous modems for leased or dial-up lines, and auto-call support up to 1200 bps (Items 6051-6053)[1]
- Internal 201/208-compatible synchronous modems for leased or dial-up lines, and auto-call support up to 2400/4800 bps (Items 6054-6056)[1]
- Interfaces to synchronous or asynchronous modems, auto-call units, and EIA devices (Items 6057-6067)[1]
- Conversion upgrade kit to convert Model 770 to Model 771 (Item 5115)
- Model 770 TPL program development (Item 5230)
- TTY, 3780/2780, and 742 Emulators for 770 (Items 5232-5236)

- Auto-call unit communications software for 770 (Item 5238)
- Model 771 TPL System License (Item 5250)
- TTY, 3780/2780, and 742 Emulators for 771 (Items 5252-5256)
- TX BASIC License for 771 (Item 260).

Item	Description
5100	Model 770/1 Terminal without software
5101	Model 770/2 Terminal without software
5110	Model 771/1 Terminal
5111	Model 771/2 Terminal
5112	Model 771/1 Terminal without software
5113	Model 771/2 Terminal without software

[1]Items 6051-6062 are for the primary I/O port. Items 6063-6070 are for the auxiliary I/O port.

Model 774 Intelligent Terminal Systems

Three standard configurations are offered based on the amount of data storage and number of work stations required and are shown below:

- Model 774/2—Processor with 96K bytes of memory, a 911 VDT and dual single-sided, single-density diskette drives (512K bytes of storage)
- Model 774/3—Processor with 96K bytes of memory, a 911 VDT and DS10 disk drive (10M bytes of disk storage)
- Model 774/4—Processor with 160K bytes of memory, five 911 VDTs and DS10 disk drive (10M bytes of disk storage)

Installation of the standard system hardware and software is included along with the software license as part of the system price.

M
•

—Model 774/2 upgrade kits (Item 1184, 1186)
—Model 774/3 upgrade kit (Item 1188)

- Printers—Model 810 Printer (Item 1200, 1220, 1222) and Model 2230 Printer (Item 1240, 1242) are available for hard copy output. Each 774/2 and 3 System may have up two printers; only one may be the Model 2230 Line Printer. Each 774/4 System may have up to five printers, but only one may be the Model 2230 Line Printer.
- Model 911 Video Display Terminals (Item 1300, 1320) each 774/2 and 3 System may have up to four 911 VDTs. Each 774/4 System may have up to eight 911 VDTs.
- Add-on FD800 Diskette Storage Drives:
  —774/1 and 2 System add-on FD800 Diskette Drives (Item 1400, 1410, 1420)
  —774/3 and 4 System integrated Dual FD800 Diskette Drive Kit (Item 1430)
- DS10 Secondary Disk Drive Kit (in Quietized Pedestal)
  —774/3 and 774/4 System only (Item 1440)
  ⁻⁻nal Communication Kit (Item 1500)
  ial 202 Communication Kit (Item 1510, 1512,

  ial 201 Communication Kit (Item 1520, 1522,

  3780 Emulator (Item 1709, 1710)
  Emulator (Item 1744, 1746)
  Transfer Utility (Item 1752)
- 774 System Software License, (Item 1700)
- TX BASIC (774/1 and 2 only) (Item 260)

2

Model 774/2 Standard Configuration

- Model 990/10 Minicomputer with mapping, 96K bytes of ECC Memory (48K bytes user), and disk loader ROM
- Model 911 Video Display Terminal with graphics set and dual port controller
- Dual FD800 single-sided, single-density diskette drives
- Licensed copy of 774 System Software on diskette media with one-year software subscription service
- Attractive office-style control console enclosure.

Model 774/2 Options
- All 774 options listed above
- Additional tabletop or secondary FD800 drive kit with dual controller (Item 1400, 1410, 1420)
- Up to three additional 911 VDTs (maximum of four) (Item 1300, 1320).

Item	Description	Comments
1020	774/2 Intelligent Terminal system without software	
1021	774/2 Intelligent Terminal system with software	Includes licensed 774 system software with installation, software and one-year software subscription service

571.5 mm
(22.5 in.)

723.9 mm
(28.5 in.)

508 mm
(20 in.)
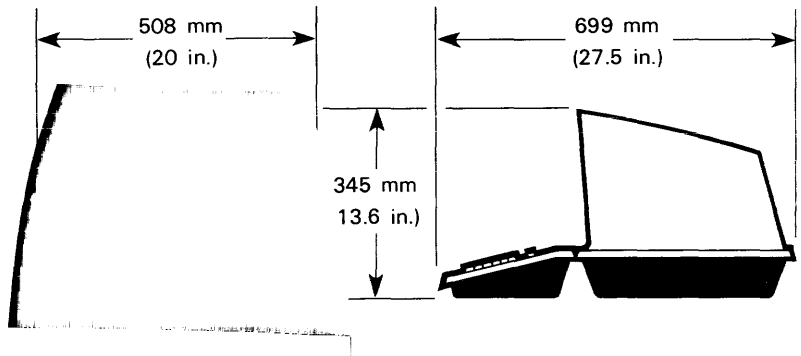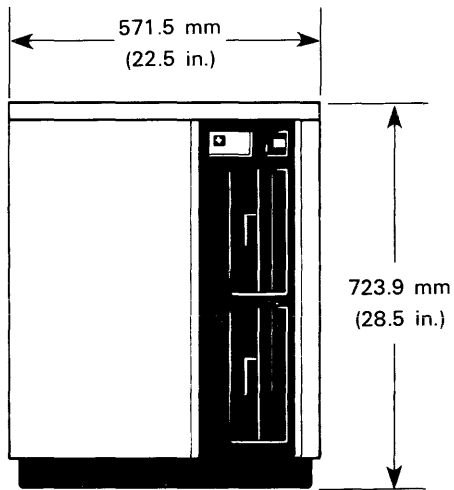
699 mm
(27.5 in.)

345 mm
13.6 in.)

Model 774/3
Standard Configuration

- Model 990/10 Minicomputer with mapping, 96K bytes of ECC memory (46K bytes user) and disk loader ROM.
- Model 911 Video Display Terminal with graphics set and dual port controller.
- DS 10 Disk Drive featuring 9.4M bytes of formatted mass storage partioned into one 4.7M-byte fixed disk and a 5440-type removable 4.7M-byte top-loading disk cartridge (Item 520)
- Licensed copy of 774 system software on diskette media with one-year software subscription service
- Attractive office-style control console enclosure

774/3 Options
- All 774 options listed above
- Integrated dual FD800 diskette drive kit (Item 1430)
- DS10 secondary disk drive kit in quietized pedestal (Item 1440)
- Up to three additional 911 VDTs (maximum of four) (Item 1300, 1320)

Model 774/4
Standard Configuration

- Model 990/10 Minicomputer with mapping, 160K bytes of ECC memory (104KB user) and disk loader ROM
- Five Model 911 VDTs with graphics set and three dual-port controllers
  DS10 disk drive in quietized pedestal featuring 9.4M bytes of formatted mass storage partioned into one 4.1M-byte fixed disk and a 5440-type removable 4.7M-byte top loading disk cartridge.
- Licensed copy of 774 system software on diskette media with one-year software subscription service
- Attractive office-style control console.

774/4 Options
- All 774 options listed above
- Integrated dual FD800 diskette drive kit (Item 1430)
- DS10 secondary disk drive kit in quietized pedestal (Item 1440)
- Up to three additional model 911 VDTs (Maximum of 8) (Item 1300, 1320)

Item	Description	Comments
1030	774/3 Intelligent Terminal system without software	
1031	774/3 Intelligent Terminal system with software.	Includes 774 sys with i softwa one-ye subscription service

Item	Description	Comments
1040	774/4 Intelligent Terminal system without software	
	774/4 Intelligent Terminal system with software	Includes licensed 774 System software with installation software and one-year software subscription service

470 mm
(18.5 in.)

508 mm
(20 in.)

345 mm
(13.6 in.)

64 mm
34 in.)

699 mm
(27.5 in.)

571.5 mm
(22.5 in.)

723.9 mm
(28.5 in.)

4
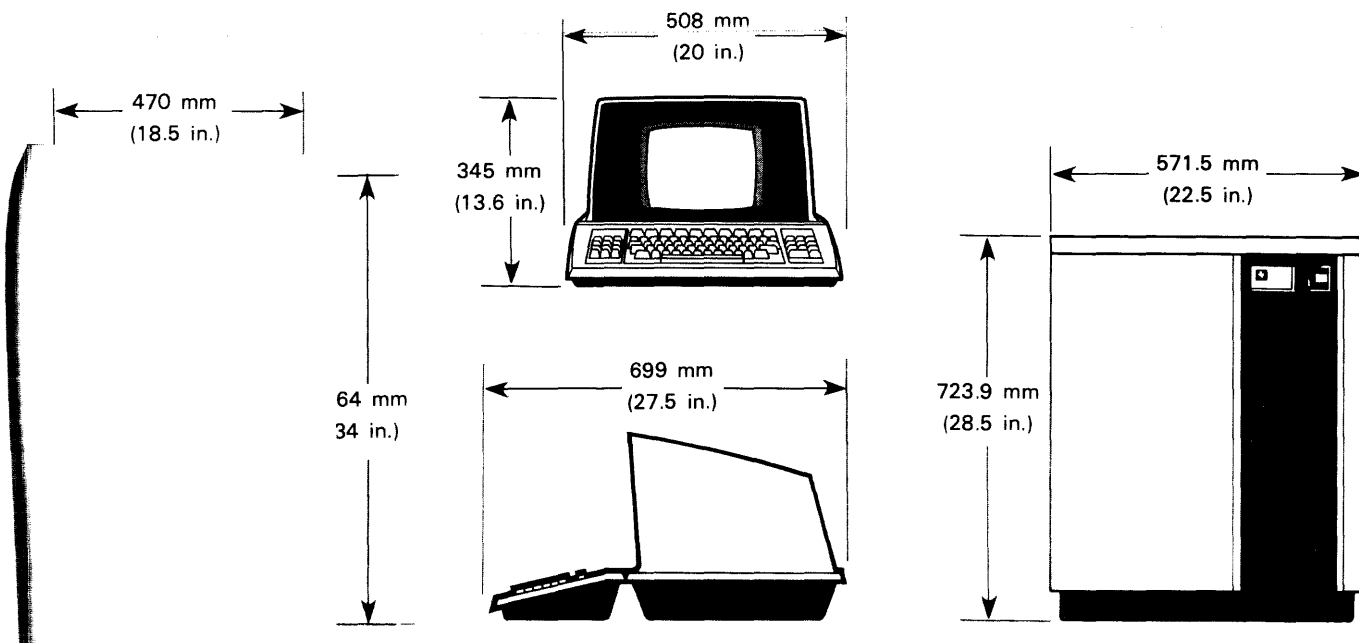
Packaged Systems

The packaged systems are coordinated hardware/software offerings. Users should be aware that the standard packaged systems are offered at a price that is less than the sum of the system components sold separately. In many cases, it will be more economical to select the packaged system that best meets the needs of the user application and add options or leave some features unused. Texas Instruments urges its customers to investigate the possible price advantages of this type of purchase. Note that substitutions are not permitted on the packaged systems.

FS990 Microcomputer Systems

The FS990 system provides the customer a facility for development, testing, and execution of applications programs in assembly language, BASIC, or FORTRAN. The dual diskettes[1] provide an economical mass storage capability for system programs, application programs, and user data. A video display terminal is provided for interactive software development and operator control of application programs.

The licensed TX990/TXDS software package provides a complete family of program development functions that run under control of an operating system executive. After the user programs are developed, they may be run under control of this same executive in the final application. The executive handles the system resource allocations, such as memory space, central processor time, and input/output, so that the user may concentrate on applications rather than system overhead. The operating system provides simplified logical input/output to the standard and optional devices specified for the FS990 systems. The software license includes a one-year software subscription service.

Texas Instruments strongly recommends the selection of an optional hard-copy device, such as the Model 810 Printer, to record listings of user programs and to allow off-line analysis of results.

Installation of the standard system hardware is included as part of the system price. Conditions of hardware installation are discussed under Customer Services.

FS990 systems are offered in two versions, the FS990/4 system and the FS990/10 system. The FS990/4 uses the economical Model 990/4 Microcomputer as the system central processor. The FS990/10 uses the faster Model 990/10 Minicomputer as the central processor.
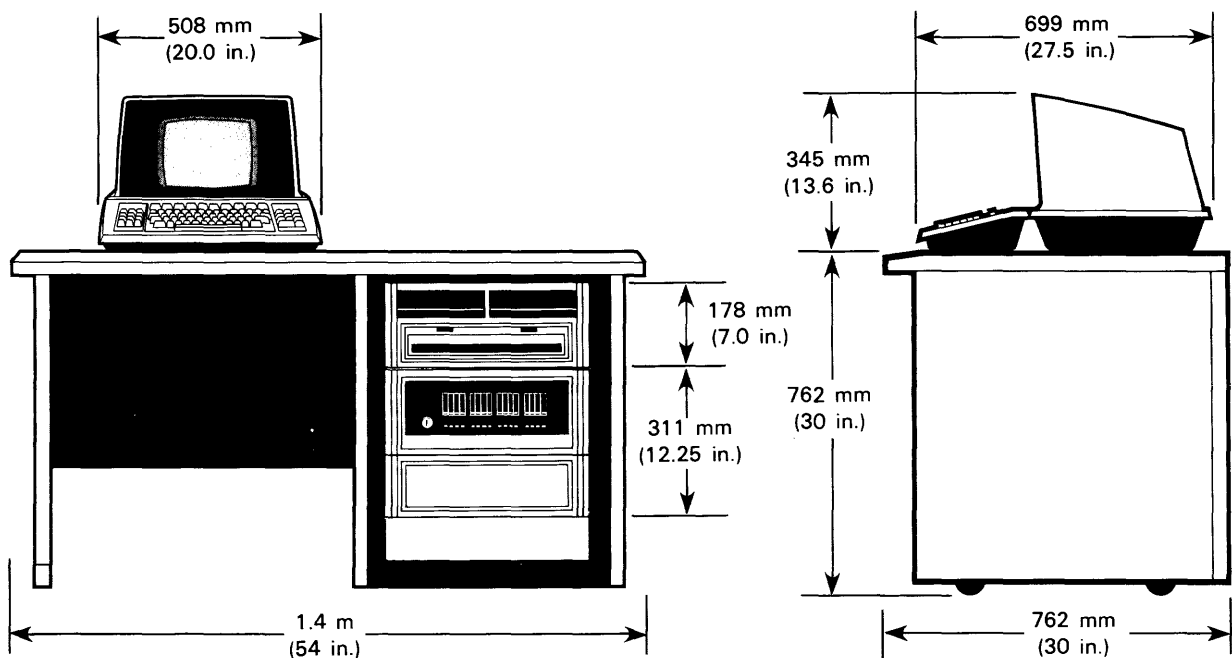
[1]For the purposes of this catalog, the terms diskette and flexible disk are used interchangeably.

FS990/4 Standard Configuration

- Model 990/4 Microcomputer with 48K bytes of parity memory in a 13-slot chassis with programmer panel and diskette loader/self-test ROM
- Model 911 Video Display Terminal (1920 character) with dual port controller
- Dual FD800 Flexible-Disk Drives
- Attractive, office-style, single-bay desk enclosure
- Licensed TX990/TXDS System Software with one-year software subscription service.

FS990/10 Standard Configuration

- Model 990/10 Minicomputer with 64K bytes of error-correcting memory and mapping in a 13-slot chassis with programmer panel and diskette loader/self-test PROM (Mapping not supported by TX990)
- Model 911 Video Display Terminal (1920 character) with dual port controller
- Dual FD800 Flexible-Disk Drives
- Attractive, office-style, single-bay desk enclosure
- Licensed TX990/TXDS System Software with one-year software subscription service.

Options

- Model 810 Printer (Item 630)
- TXDS FORTRAN IV License (Item 240)
- FS990 BASIC License (Item 260)
- Communications

Extensions

These extensions can be supported by the TX990 terminal executive, if the customer performs a system generation operation. The system generation operation consists of selecting and linking system component modules into a customized operating system. System generation (sysgen) is supported by the documentation and software supplied with the operating system.

NOTE: Although the user may generate a customized operating system that allows execution of application program on multiple terminals, the program development functions of TX990/TXDS are limited to one terminal only.

- *Model 804 Card Reader (Item 660)*
- *Up to two additional Model FD800 Diskette Drives (Item 502 or 503)*
- *Model 2230 Line Printer (Item 650)*
- *Model 2260 Line Printer (Item 651)*
- *Model 733 ASR Data Terminal (Item 621)*
- *Model 743 KSR Data Terminal (Item 620)*
- *Additional Model 911 Video Display Terminals (Items 610-612)*

Item	Description	Comments
110	FS990/4 Tabletop System	Includes licensed software and hardware installation. Refer to software policy in software section.
111	FS990/4 Tabletop System without software	Does not include software or installation.
112	FS990/4 Single-bay Desk System	Includes licensed software and hardware installation. Refer to software policy in software subsection.
113	FS990/4 System without software	Does not include software or installation.
114	FS990/10 Single-bay Desk System	Includes licensed software and hardware installation. Refer to software policy in software subsection.
115	FS990/10 System without software	Does not include software or installation.

PROM Programmer

The PROM Programmer is a tabletop device that provides the correct signal levels and timing for programming PROM and EPROM devices. The interface card requires a half slot in the 990 chassis and interfaces to the CRU bus. Adapters plug into the PROM Programmer to provide the correct sockets and signals for particular devices.

The PROM Programming Adapter plugs into the PROM Programmer and programs SN74S287, 471, and 472 devices.

The EPROM Programming Adapter plugs into PROM Programmer and programs TMS 2708 and TMS 2716 devices.

Item 133, EPROM Erase Kit, provides an ultraviolet lamp for erasing EPROM devices.

Item	Description	Comments
130	PROM Programmer Kit (Tabletop)	Ships with adapter selected below mounted in unit
131	PROM Programmer Adapter	Requires Item 130
132	EPROM Programmer Adapter	Requires Item 130
133	EPROM Erase Kit	

180 mm (7.0 in.)

360 mm (14.0 in.)

225 mm (8.8 in.)

PROM | EPROM

990 Computer Chassis

Half Slot

PROM Adapter | EPROM Adapter | EPROM Erase Kit

PROM Programmer Interface

PROM Programmer

PROM Programmer Kit
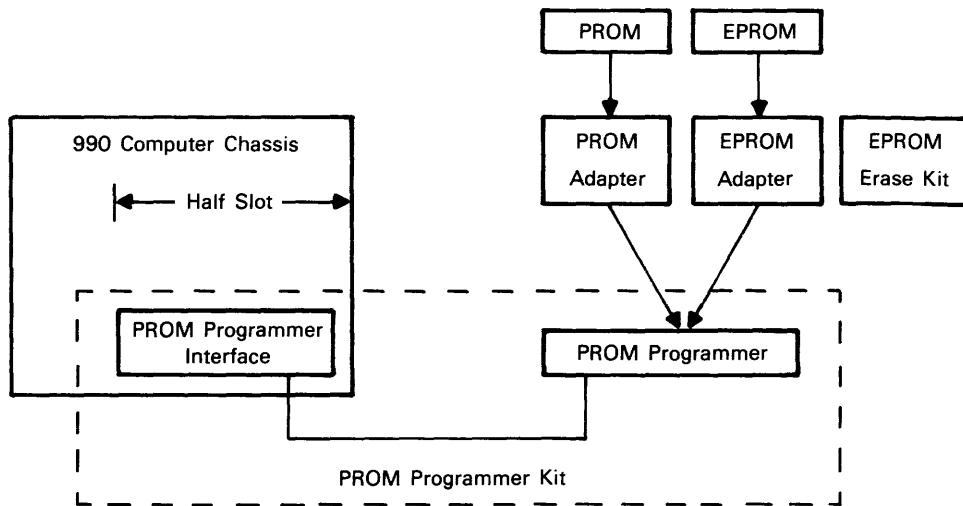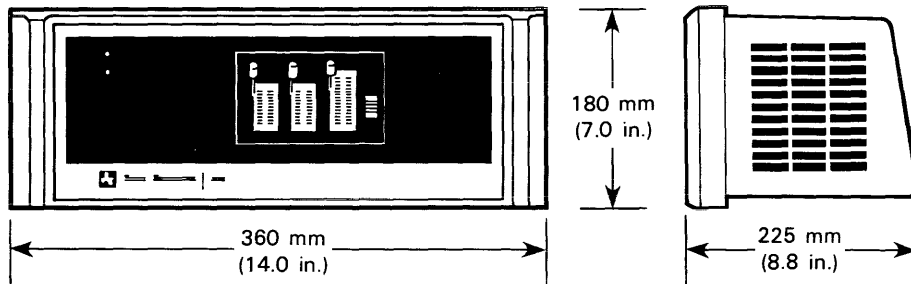
DS990 Diskette-based Systems

The DS990 Models 1 and 2 comprise the lower end of the DS990 Commercial Systems, sharing functional compatibility with the DS990 disk-based systems. The Models 1 and 2 feature double-sided, double-density diskette storage. Processing is accomplished by a TI 9900 or 990/5 processor. The DS990 Models 1 and 2 provide high-performance data processing for stand-alone small business applications or satellite operation in a network environment.

The DS990 Model 1 achieves functional compatibility with the higher members of the DS990 family using the TX5 Operating System. TX5 supports software development using TX5 BASIC and FORTRAN and execution of BASIC, FORTRAN, and Pascal programs developed on DS990 disk-based systems. The Model 1 is also compatible with the Series 700 Distributed Processing Systems using the TPL operating system. TPL supports program development using TPL 700 and 3780/2780, TTY†, and 742 communications.

The DS990 Model 2 utilizes up to two Model 911 Video Display Terminals or Model 820 KSR Terminals. Running under TX5, the Model 2 supports program development in TX5 BASIC or run-time BASIC programs from DS990 disk-based systems.

The DS990 Models 1 and 2 are offered in a co-ordinated package of hardware and software with hardware installation included in software version system purchase prices. They are also offered in standard hardware packages with installation and software packages optional.

DS990 Model 1 Standard Configuration

- TMS 9900 Microprocessor and 64K bytes of random-access memory with parity integrated into self-contained unit with video and keyboard
- 1920-character video display terminal with 96-ASCII-character set
- Licensed copy of TX5 Operating System on compatible diskette media, with one-year software subscription service (software version only)

- Typewriter-style keyboard with separate programmable keys, cursor control pad, numeric pad, and terminal status lights
- Two double-sided, double-density 1.15M-byte diskette drives in separate tabletop chassis.
- Two communication ports. (Interfaces and modems optional)

178 mm (7 in.) 483 mm (19 in.) 457 mm (18 in.) 584 mm (23 in.) 584 mm (23 in.)
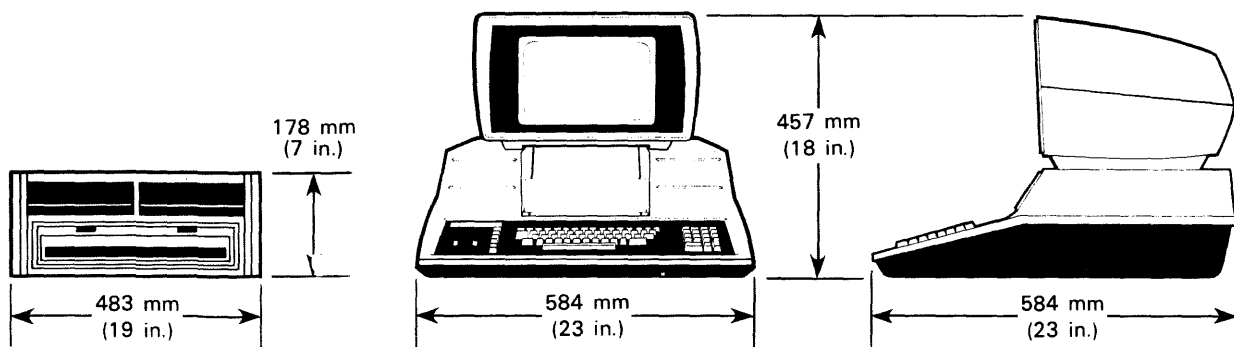
†Trademark of Teletype Corporation

8

DS990 Model 1 Options

- Internal 30-cps thermal printer (Items 6013, 6015, 6017, 6023, 6025, and 6027)
- Model 810A or 810B 150-cps impact printer (Items 6068, 6069)
- VDT graphics character set (Item 6050)
- Additional double-sided, double-density diskette drives up to a maximum of four for a total of 4.6M-bytes of mass storage (Items 6030-6032)
- Internal 202-compatible asynchronous modems for leased or dial-up lines, and auto-call support up to 1200 bps (Items 6051-6053)[2]
- Internal 201/208-compatible synchronous modems for leased or dial-up lines, and auto-call support up to 2400/4800 bps (Items 6054-6056)[2]
- Interfaces to synchronous or asynchronous modems, auto-call units, and EIA devices (Items 6057-6067)[2]
- Conversion upgrade kits to convert Models 770 and 771 Intelligent Terminals to standard dual drive DS990 Model 1 system (Items 5116 and 5117). Each kit includes all hardware necessary for field installation
- TPL operating system for program development using TPL 700 (Item 6038)
- 3780/2780, TTY, and 742 emulators for TPL systems (Items 6041-6047)
- TX5 BASIC with presysgened TX5 Operating System (Item 263)

- TX5 Operating System with 990 assembler (Item 226)
- TX5 FORTRAN (Item 265)
- TX5 3780/2780 Emulator (Items 266, 267)

Item	Description
6012	DS990 Model 1 with 2 drives
6013	DS990 Model 1 with 2 drives and thermal printer
6014	DS990 Model 1 with 3 drives
6015	DS990 Model 1 with 3 drives and thermal printer
6016	DS990 Model 1 with 4 drives
6017	DS990 Model 1 with 4 drives and thermal printer
6022	DS990 Model 1 with 2 drives without software
6023	DS990 Model 1 with 2 drives and thermal printer without software
6024	DS990 Model 1 with 3 drives without software
6025	DS990 Model 1 with 3 drives and thermal printer without software
6026	DS990 Model 1 with 4 drives without software
6027	DS990 Model 1 with 4 drives and thermal printer without software

DS990 Model 2 Standard Configuration

- Model 990/5 Microcomputer with 64K bytes of parity memory, two EIA asynchronous terminal interface ports
- Choice of either a 911 video display terminal (1920 characters) or an 820 KSR printer terminal as the system workstation

- Two Model FD1000 double-sided, double-density, flexible-disk drives, each storing 1.15M bytes of formatted data for a total of 2.3M bytes
- Choice of hardware enclosure in either a tabletop (6-slot) or 762-mm (30-in.) cabinet (13-slot)
- Licensed copy of TX5 Operating System Software on compatible disk media, with one-year software subscription service.

178 mm (7 in.)

178 mm (7 in.)

483 mm (19 in.)
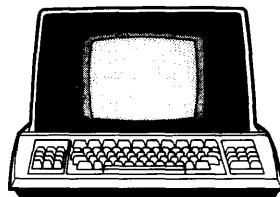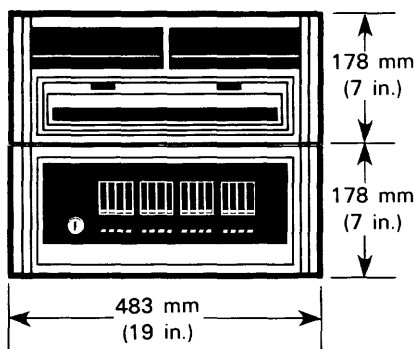
Choose 911 Video Display terminal or 820 KSR Printer terminal

[2]Items 6051-6062 are for the primary I/O port. Items 6063-6070 are for the auxiliary I/O port.

DS990 Model 2 Options

- An additional workstation (Items 615 or 640A)
- Up to two additional tabletop, FD1000 double-sided, double-density, flexible-disk drives (Items 554, 555, 556, 557)
- Model 810 Printer (Item 630A)
- Model DS10 Disk Drive in quietized pedestal (Item 522).
- Optional power supply (Item 863)
- Communications options (Items 700, 710-714)
- Workstation table (Item 809)
- TX5 BASIC (Item 263)
- TX5 FORTRAN (Item 265)
- TI990 Pascal Run-Time (Item 247)
- TX5 FORTRAN Run-Time (Item 265)
- TX5 3780/2780 Emulator (Items 266, 267)

The Model 2 provides software development capability with the optional TX5 BASIC, TX5 FORTRAN, and assembly language.

Item	Description	Comment
6100	DS990 Model 2 in tabletop enclosure with 911 VDT	Includes licensed TX5 Operating System software and installation
6101	DS990 Model 2 in tabletop enclosure with 820 KSR	Includes licensed TX5 Operating System software and installation
6105	DS990 Model 2 in 762-mm (30-in.) cabinet with 911 VDT	Includes licensed TX5 Operating System software and installation
6106	DS990 Model 2 in 762-mm (30-in.) cabinet with 820 KSR	Includes licensed TX5 Operating System software and installation
6115	DS990 Model 2 in tabletop enclosure with 911 VDT, without software	
6116	DS990 Model 2 in tabletop enclosure with 820 KSR, without software	
6120	DS990 Model 2 in 762-mm (30-in.) cabinet with 911 VDT, without software	
6121	DS990 Model 2 in 762-mm (30-in.) cabinet with 820 KSR, without software	

787 mm
(31 in.)

622 mm
(24.5 in.)
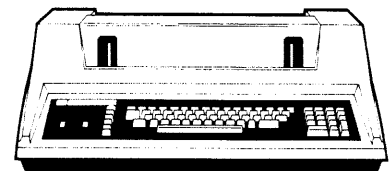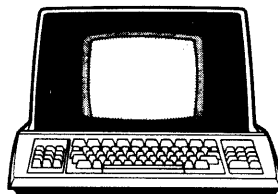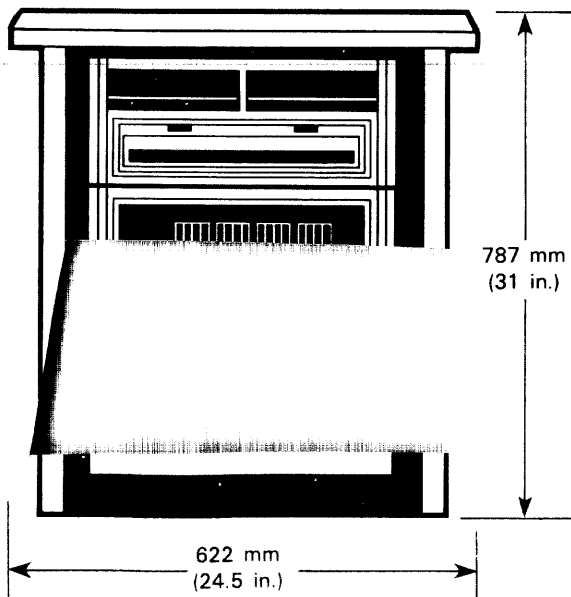
Choose 911 Video Display terminal or 820 KSR terminal Printer

DS990 Disk-Based Systems

The DS990 Disk-based System offers many development features plus many features that facilitate concurrent operation of multiple applications programs run from multiple interactive user terminals. High-level languages are available as options. Processing power for the DS990 system is supplied by the Model 990/10 and Model 990/12 Minicomputers which feature TILINE* asynchronous high-speed data bus and hardware address mapping for up to 2048K bytes of memory. File management and allocation of resources among multiple tasks is performed by the licensed DX10 Operating System.

Five standard systems are offered and are suited for the following purposes:

- Model 4—Small software development system medium-scale application system using 10M bytes disk storage.
- Model 6—Dual 25M-byte disk-based system for medium-scale software development an cation systems.
- Model 8—Dual 50M-byte disk-based system for medium- to large-scale software develop application systems.
- Model 20—50M-byte disk-based system cache memory for medium-to large-scal development and application systems.
- Model 30—200M-byte disk-based system cache memory for large-scale software de and application systems.

Also available are the commercial system feature the base Models 4, 6, or 8 plus a printer, extra VDTs, and a choice of languages:

- Model 4 Commercial System—Basic Model 4 with dual 911 VDTs, an 810 printer, DX10, Sort/Merge, and a choice of either RPG II or COBOL.
- Model 6 or 8 DBM System—Basic Model 6 or 8 with four 911 VDTs, a 2230 Printer, 160K bytes of error-correcting memory DX10, Sort/Merge, COBOL, and DBMS.

The differences between these systems are based on the amount of disk storage required for the different applications and CPU. Physical packaging differences between the models are based on the space requirements of the disk storage units.

Installation of the standard system hardware and DX10 software is included along with the software license as part of the system price. Additional conditions of hardware installation are discussed under Customer Services.

³160K bytes standard with Models 6 or 8 Commercial Systems

*Trademark of Texas Instruments

DS990 Models 4, 6, and 8 Systems
Standard Configuration
- Model 990/10 Minicomputer with mapping³, 128K bytes of error-correcting memory (16K RAM) in a 13-slot chassis with programmer panel and disk loader ROM
- Model 911 Video Display Terminal (1920-character) with dual-port controller
- Copy of DX10 Operating System on compatible disk media, with one-year software subscription service

application
- Printer—Model 810, 2230, or 2260 printers (Item 630, 650, or 651); highly recommended for hardcopy output
- Model 804 Card Reader (Item 660)
- Model 979A Magnetic Tape Drive 800/1600 bpi (Item 550 or 552), requires rackmount cabinet
- Model 820 KSR (Item 640)
- DX10 COBOL License (Item 242)
- DX10 FORTRAN IV License with ISA extensions (Item 241)
- DX10 990 BASIC License (Item 243)
- DX10 Sort/Merge Utility License (Item 244)
- DX10 Pascal License (Item 247)
- DX10 DBMS 990 License (Item 248)
- 3780 Communications License (Items 231 & 232)
- 2780 Communications License (Items 231 & 232)
- DX10 3720 ICS License (Items 233 & 234)
- RPG II License (Item 246)
- Query License (Item 249)
- TIFORM License (Item 250)

11

DS990 Model 4 Standard Configuration

- Model 990/10 Minicomputer with mapping, 128K bytes of error-correcting memory (16K RAM) in a 13-slot chassis with programmer panel and disk loader ROM
- Model 911 Video Display Terminal (1920-character) with dual-port controller
- Licensed copy of DX10 Operating System on compatible disk media, with one-year software subscription service

- DS10 disk drive featuring 9.4M bytes of formatted mass storage, partitioned into one 4.7M-byte fixed disk and a 5440-type removable 4.7M-byte top-loading disk cartridge (Item 520)
- Single-bay, double-bay desk, 1.8-m (70-in.) or 762-mm (30-in.) cabinet.
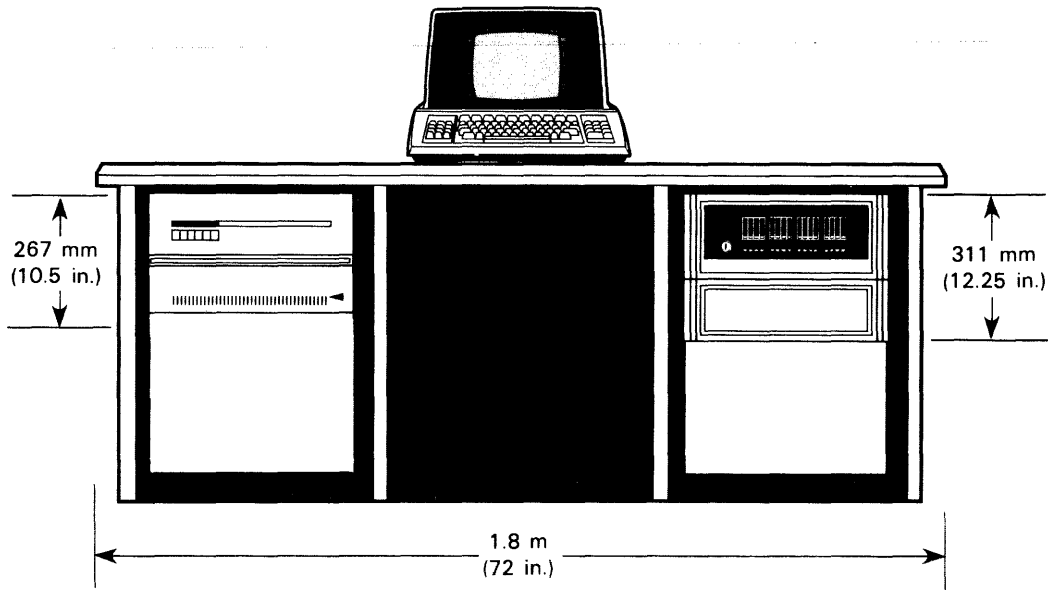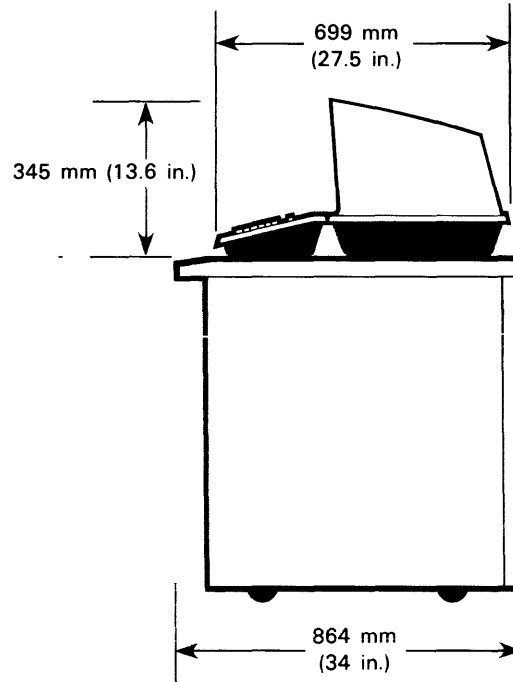
DS990 Model 4 Options

- DS990 options listed above
- Model 743 KSR Data Terminal (Item 620)
- One additional DS10 disk drive with 9.4M bytes of formatted mass storage, in deskmount, rackmount, or quietized pedestal version (Item 521 or 523).

Item	Description	Comments
6160	DS990 Model 4 in single-bay desk	Includes licensed DX10 Operating System software and installation
6161	DS990 Model 4 in dual-bay desk	Includes licensed DX10 Operating System software and installation
6162	DS990 Model 4 in 1.8-m (70-in.) cabinet	Includes licensed DX10 Operating System software and installation
6163	DS990 Model 4 in 762-mm (30-in.) cabinet	Includes licensed DX10 Operating System software and installation
6165	DS990 Model 4 in single-bay desk, without software	
6166	DS990 Model 4 in dual-bay desk, without software	
6167	DS990 Model 4 in 1.8-m (70-in.) cabinet, without software	
6168	DS990 Model 4 in 762-mm (30-in.) cabinet, without software	

13

DS990 Model 6 Standard Configuration

- Model 990/10 Minicomputer with mapping, 128K bytes of error-correcting memory (16K RAM) in a 13-slot chassis with programmer panel and disk loader ROM
- Model 911 Video Display Terminal (1920-character) with dual-port controller
- Licensed copy of DX10 Operating System on compatible disk media, with one-year software subscription service
- Dual DS25 disk drives for a total of 44.7M bytes of formatted mass storage on two removable disk packs (Items 530 and 532)
- Single-bay desk or 1.8-m (70-in.) cabinet and individual pedestals for the two top-loading disk drives.

DS990 Model 6 Options

- DS990 options listed above
- Model 743 KSR Data Terminal (Item 620)
- Additional DS25 disk drives (Item 532) up to a total of four

Item	Description	Comments
6170	DS990 Model 6 in single-bay desk	Includes licensed DX10 Operating System software and installation
6171	DS990 Model 6 in 1.8-m (70-in.) cabinet	Includes licensed DX10 Operating System software and installation
6172	DS990 Model 6 in single-bay desk, without software	
6173	DS990 Model 6 in 1.8-m (70-in.) cabinet, without software	
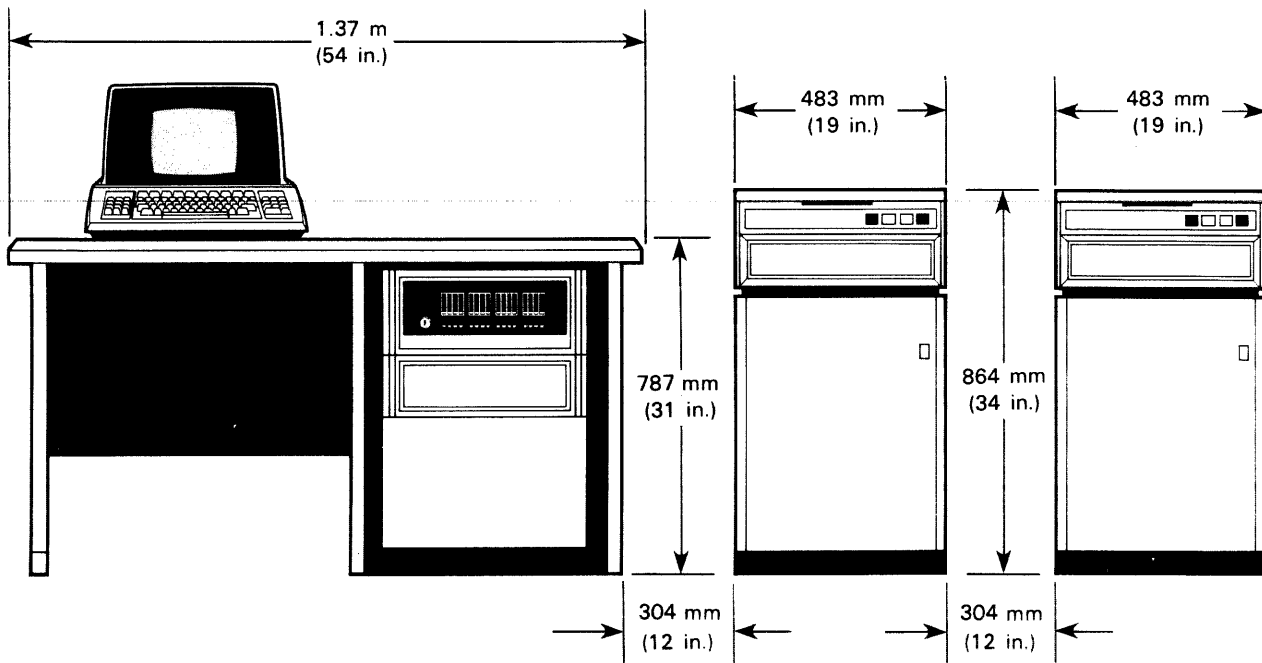
DS990 Model 6 and 8 Dimensions

14

DS990 Model 8 Standard Configuration

- Model 990/10 Minicomputer with mapping, 128K bytes of error-correcting memory (16K RAM) in a 13-slot chassis with programmer panel and disk loader ROM
- Model 911 Video Display Terminal (1920-character) with dual-port controller
- Licensed copy of DX10 Operating System on compatible disk media, with one-year software subscription service

- Dual DS50 disk drives for a total of 89.2M bytes of formatted mass storage on two removable disk packs (Items 534 and 536)
- Single-bay desk or 1.8-m (70-in.) cabinet and individual pedestals for the two top-loading disk drives
- Physical appearance similar to DS990 Model 6.

DS990 Model 8 Options

- DS990 options listed above
- Additional DS50 disk drives (Item 536) up to a total of four
- Model 743 KSR Data Terminal (Item 620).

Item	Description	Comments
6175	DS990 Model 8 in single-bay desk	Includes licensed DX10 Operating System software and installation
6176	DS990 Model 8 in 1.8-m (70-in.) cabinet	Includes licensed DX10 Operating System software and installation
6177	DS990 Model 8 in single-bay desk without software	
6178	DS990 Model 8 in 1.8-m (70-in.) cabinet without software	

DS990 Model 20 Standard Configuration

- Model 990/12 Minicomputer with cache controller, mapping, 256K bytes of error-correcting memory (16K RAM) in a 17-slot chassis with programmer panel and disk loader ROM.
- Dual 911 Video Display Terminals (1920-character) with dual-port controller.
- Licensed copy of DX10 Operating System on compatible disk media with one-year software subscription service.
- DS50 disk drive featuring 44.6M bytes of formatted mass storage.
- 979A magnetic tape drive (800 or 1600 BPI) or secondary DS50 disk drive
- 1.8-m (70 in.) cabinet enclosure, which may house selected combinations of the following items: the processor in a 17-slot chassis with a programmer panel, 979A magnetic tape drive, and a diskette drive if purchased as an option.
- Applicable hardware and software manuals.

DS990 Model 20 Options

- DS990 options listed above
- DS10, DS25, DS50, or DS200 disk drives with quietized pedestal enclosures (4 disk drives maximum each)
- All 990 communication kits
- FD1000 diskette drives.

Item	Description
6210	DS990 Model 20 w/ 800-bpi magnetic tape
6212	DS990 Model 20 w/1600-bpi magnetic tape
6214	DS990 Model 20 w/ DS50 secondary disk
6211	DS990 Model 20 w/ 800-bpi magnetic tape, without software
6213	DS990 Model 20 w/ 1600-bpi magnetic tape, without software
6215	DS990 Model 20 w/ DS50 secondary disk, without software

Note: Standard Model 20 requires 208 Vac. Refer to site preparation manual for details.

864 mm
(34 in.)

667
(26.

667 m
(26.25

16
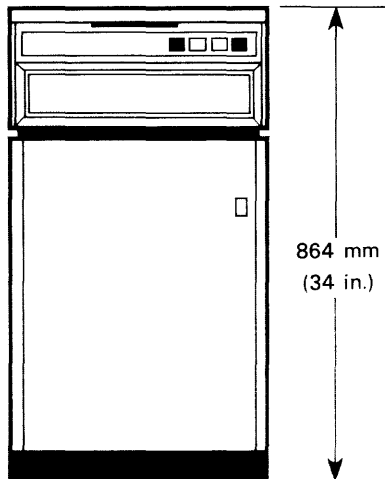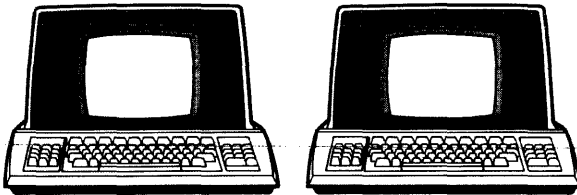
DS990 Model 30 Standard Configuration

- Model 990/12 Minicomputer with cache controller, mapping, 256K bytes of error-correcting memory (16K RAM) in a 17-slot chassis with programmer panel and disk loader ROM
- Dual 911 video display terminals (1920-character) with dual port controller
- Licensed copy of DX10 Operating System on compatible disk media, with one-year software subscription service (for magnetic tape system only)
- DS200 disk drive featuring 169.47M bytes of formatted mass storage
- 979A magnetic tape drive (800 or 1600 bpi) or secondary DS200 disk drive
- 1.8-m (70-in.) cabinet enclosure, which may house selected combinations of the following items: the processor in a 17-slot chassis with a programmer panel, 979A magnetic tape drive and a diskette drive if purchased as an option
- Applicable hardware and software manuals.

DS990 Model 30 Options

- DS990 options listed above
- DS10, DS25, DS50 or DS200 disk drives with quietized pedestal enclosures (4 disk drives maximum each)
- All 990 communication kits
- FD1000 diskette drives.

Item	Description
6220	DS990 Model 30 w/800 bpi magnetic tape
6222	DS990 Model 30 w/1600 bpi magnetic tape
6221	DS990 Model 30 w/800 bpi magnetic tape without software
6223	DS990 Model 30 w/1600 bpi magnetic tape, without software
6224	DS990 Model 30 w/DS200 secondary disk, without software

Note: Standard Model 30 requires 208 Vac. Refer to site preparation manual.

864 mm (34 in.)

667 mm (26.25 in.)

667 mm (26.25 in.)
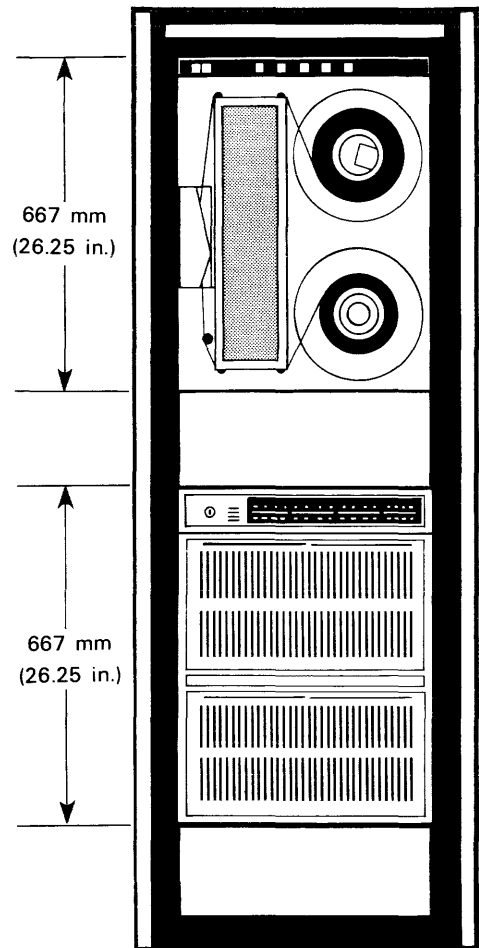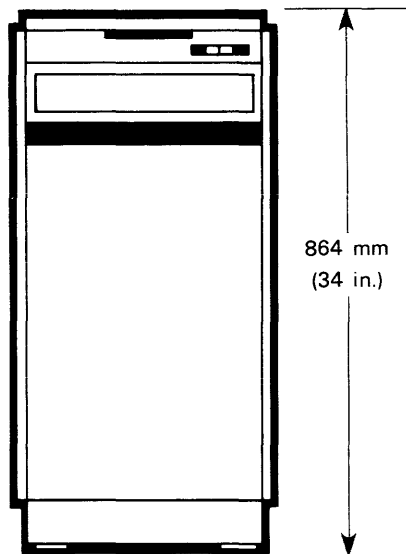
DS990 Commercial Systems

DS990 Model 4 Commercial System

- DS990 Model 4 with 128K bytes of error-correcting memory (16K RAM)
- Two 911 VDTs (1920-character)
- 810 Printer
- Licensed copy of DX10 Operating System, Sort/ Merge, and either RPG II or COBOL
- Choice of single-bay desk, dual-bay desk, 1.8-m (70-in.) cabinet, or 762-mm (30-in.) cabinet
- Installation included.

Item	Description	Comments
6180	Model 4 in single-bay desk	Includes COBOL
6181	Model 4 in dual-bay desk	Includes COBOL
6182	Model 4 in 1.8-m (70-in.) cabinet	Includes COBOL
6183	Model 4 in 762-mm (30-in.) cabinet	Includes COBOL
6185	Model 4 in single-bay desk	Includes RPG II
6186	Model 4 in dual-bay desk	Includes RPG II
6187	Model 4 in 1.8-m (70-in.) cabinet	Includes RPG II
6188	Model 4 in 762-mm (30-in.) cabinet	Includes RPG II

DS990 Model 6 DBM System

- DS990 Model 6 with 160K bytes of error-correcting memory (16K RAM)
- Four 911 VDTs (1920-character)
- Model 2230 Line Printer (300 lpm)
- Licensed copy of DX10 Operating System, COBOL, Sert/Merge and Data-base Management
- Choice of single-bay desk or 1.8-m (70-in.) cabinet
- Installation included.

Item	Description	Comments
6190	Model 6 DBM System	Single-bay desk
6191	Model 6 DBM System	1.8-m (70-in.) cabinet

DS990 Model 8 DBM System

- DS990 Model 8 with 160K bytes of error-correcting memory (16K RAM)
- Four 911 VDTs (1920-character)
- Model 2230 Line Printer (300 lpm)
- Licensed copy of DX10 Operating System, COBOL, Sort/Merge, and Data-base Management
- Choice of single-bay desk or 1.8-m (70-in.) cabinet
- Installation included

Item	Description	Comments
6195	Model 8 DBM System	Single-bay desk
6196	Model 8 DBM System	1.8-m (70-in.) cabinet

Central Processors

Model 990/4 Microcomputer

The Model 990/4 Microcomputer is a complete, low-cost computer packaged on a single circuit board. When supplied with a front panel, chassis (including power supply), add-on memory modules, the 990/4 is a flexible, powerful, and inexpensive solution to a wide range of processing and control problems. The 990/4 CPU board includes on-board real-time clock, hardware multiply/divide, power-fail auto-restart logic, eight vectored interrupts, and a command-drive CRU bus for up to 4096 input and 4096 output lines. The CPU board contains 8K bytes of dynamic RAM with parity. On-board sockets accommodate up to 2K bytes of PROM (SN74S287), ROM, or static RAM (TMS4043). The 990/4 CPU can address expansion memory boards to a total of 56K bytes.

The basic function of the 990/4 loader is to initialize the computer from a "cold start" (power turned on with memory empty). The data to be loaded must be resident in a suitable peripheral connected to the 990/4. The standard loader provides (1) diskette load from FD800 drive, (2) cassette load from 733 ASR, (3) CPU self-test, and (4) programmer panel management utility. The CPU self-test function is automatically initiated during the load procedure and executes a series of short software test routines (such as MULT/DIV) to determine the operational status of the CPU. Should the self-test function detect a malfunction, the fault indicator on the front panel remains lighted and the CPU is prevented from executing all other software. All loader functions are contained in 1K byte of preprogrammed PROM memory.

This subsection contains the information required to select the desired chassis, front panel, standby power supply, mounting, and expansion memory options. The computer is shipped in assembled form. A hardware reference manual is included with all Model 990/4 Microcomputers.
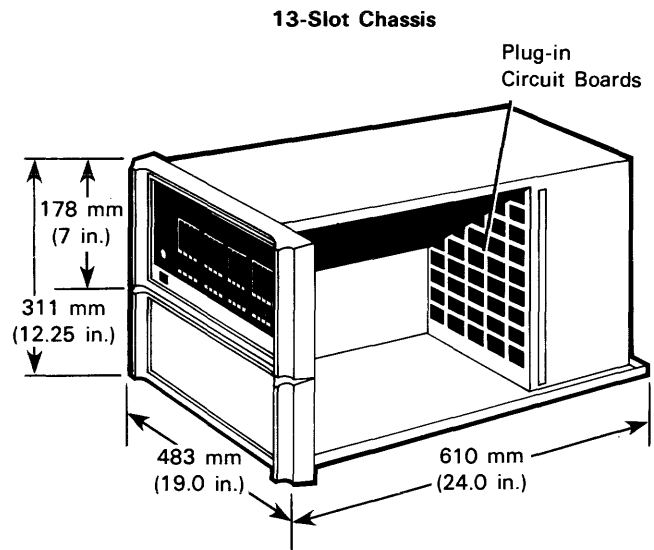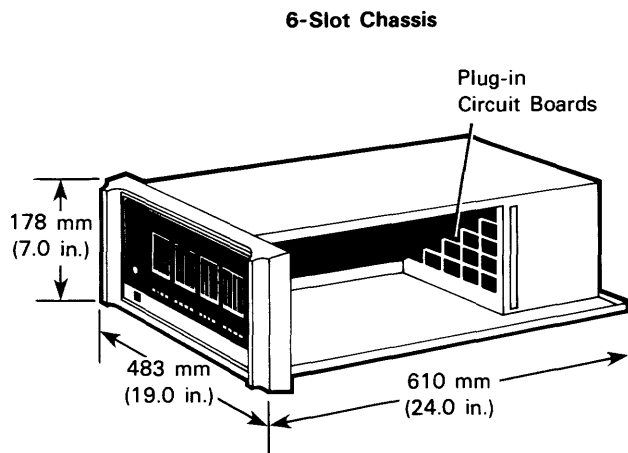
6-Slot Chassis

13-Slot Chassis

Chassis Options

- 6-Slot—Furnishes all power, cooling air, and backplane wiring for 990/4 CPU (uses one slot) and five additional full-size standard interface circuit boards. Maximum operating temperature is 50°C.

- 13-Slot—Furnishes all power, cooling air, and backplane wiring for 990/4 CPU (uses one slot) and 12 additional full-size standard interface circuit boards. Maximum operating temperature is 40°C.

Front Panel Options

- Operator Panel—Provides key-lock OFF/ON/LOAD switch and POWER and FAULT indicators

- Programmer Panel—Provides key-lock OFF/ON/ENABLE switch and POWER and FAULT indicators plus additional indicators and switches for manual control of CPU from front panel. The switches provide capability to load and read memory. Manual control can be disabled by key-lock switch.

Panel control is implemented by firmware in PROM loader. Programmer panel should be used where operation requires loading or examining memory content such as during software debug or debugging of custom interface designs.
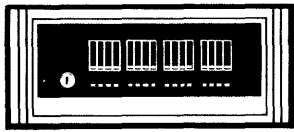
Programmer Panel   Operator Panel

990 Front Panel Options

Power Option

• Standby Power Supply—When computer operation is interrupted by power failure, dynamic RAM memory content is preserved for one hour at 25°C (for 56K bytes installed). This option furnishes battery, charger, and regulated memory standby power. This option does not require additional slots within chassis.

• No Standby—Power loss results in loss of all data in RAM.

NOTE: Power-fail/auto-restart logic requires that the user implement a coherent shutdown and restart, which is not automatically assured by standby power supply, 990/4 CPU board 2K-byte static memory content (if installed by user) is not maintained by standby power supply; however, the 8K-byte dynamic RAM content is maintained.

Model 990/4 Configuration Table

Item	Option	Chassis	Panel
300	No Standby	6-Slot Chassis	Operator Panel
301	Standby Power Supply	6-Slot Chassis	Operator Panel
302	No Standby	13-Slot Chassis	Operator Panel
303	Standby Power Supply	13-Slot Chassis	Operator Panel
304	No Standby	6-Slot Chassis	Programmer Panel
305	Standby Power Supply	6-Slot Chassis	Programmer Panel
306	No Standby	13-Slot Chassis	Programmer Panel
307	Standby Power Supply	13-Slot Chassis	Programmer Panel

Mounting Options

A pair of slides for mounting one chassis, either 6-slot or 13-slot, in standard 483-mm (19-in.) equipment cabinets is available to allow convenient extension of the chassis from cabinetry for service.

Dustcovers for tabletop operation are also available.

Item   Description
310   990 Computer Chassis Rackmount Slide Set
311   6-Slot Chassis Tabletop Dustcover
312   13-Slot Chassis Tabletop Dustcover

NOTE: TI maintenance rates apply only to units ordered with the above listed dustcovers or mounted with slide rails in cabinetry.

Memory Options

Two types of expansion semiconductor memory modules are offered for Model 990/4 Microcomputers: a dynamic RAM module with parity with 8K to 40K bytes and an EPROM module with 2K to 16K bytes.

Dynamic RAM modules consist of a single full-size circuit board with 8K to 40K bytes of read/write storage. These modules include write-protect feature and parity with provisions to light on-board LED and interrupt CPU in case of fault. On-board switches set memory address on 8K boundaries. Memory cycle time is 667 nanoseconds.

Item   Description
320   990/4 Parity Memory Module, 8K bytes
321   990/4 Parity Memory Module, 16K bytes
322   990/4 Parity Memory Module, 24K bytes
323   990/4 Parity Memory Module, 32K bytes
324   990/4 Parity Memory Module, 40K bytes

EPROM memory module consists of a single full-size circuit board with 2K bytes of TMS 2708 EPROM memory and sockets for an additional 14K bytes. On-board switches set memory address on 2K boundaries. Content may be erased and reprogrammed via the PROM Programming Kit (Item 130) with the EPROM Programming Adaptor (Item 132) and EPROM Erase Kit (Item 133). Cycle time is 667 nanoseconds. Maintenance is for controller only; TI cannot be responsible for EPROM content.

Item   Description
325   EPROM Memory Module

SHIPPING NOTE: Memory modules ordered on the same purchase order with a Model 990/4 Microcomputer will be installed in the computer chassis for shipment.

20

Model 990/5 Microcomputer

The Model 990/5 Microcomputer is a complete, low-cost computer packaged on a single circuit board.

The 990/5 CPU board includes on-board, real-time clock, hardware multiply/divide, power-fail auto-restart logic, 16 vectored interrupts, two EIA terminal interface ports, 32K or 64K bytes of dynamic RAM with parity, and 2K bytes of PROM or EPROM. The 990/5 CPU with 32K bytes on-board can address up to 32K bytes of TILINE-expansion memory. 990/5 on-board memory is accessible from TILINE. The 990/5 provides standard 990 TILINE and CRU interfaces.

The 990/5 on-board ROM provides the loader function.

The basic function of the 990/5 loader is to initialize the computer from a "cold start" (power turned on with memory empty). The data to be loaded must be resident in a suitable peripheral connected to the 990/5. The standard loader provides (1) disk loader, (2) double- or single-density diskette loader, (3) mag tape loader, (4) cassette loader via 733 ASR, (5) CPU self-test, and (6) programmer panel management utility. Default loading is from (a) mag tape or (b) disk ("Disk" includes TILINE diskette). The CPU self-test function is automatically initiated during the load procedure and executes a series of short software test routines (such as MULT/DIV) to determine the operational status of the CPU. Should the self-test function detect a malfunction, the fault indicator on the front panel remains lighted, and the CPU is prevented from executing all other software. All loader functions are contained in 2K bytes of preprogrammed PROM memory.

This subsection contains the information required to select the desired chassis, front panel, standby power supply, mounting, and expansion memory options. The computer is shipped in assembled form. A hardware reference manual is included with all Model 990/5 Microcomputers.
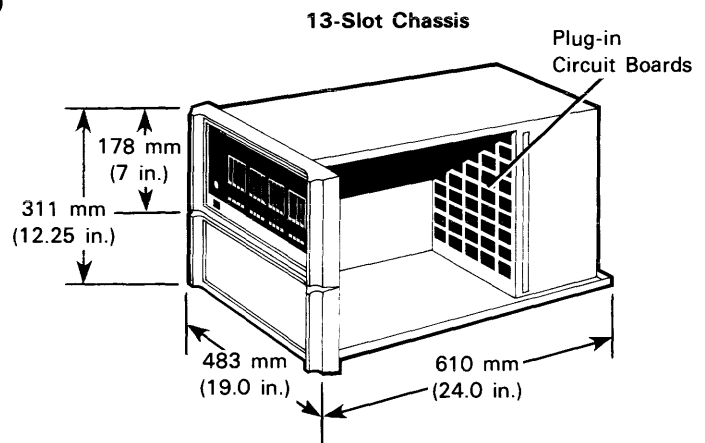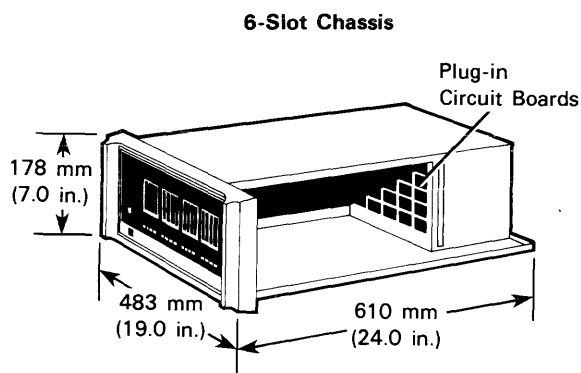
6-Slot Chassis

Plug-in Circuit Boards
178 mm (7.0 in.)
483 mm (19.0 in.)
610 mm (24.0 in.)

13-Slot Chassis

Plug-in Circuit Boards
178 mm (7 in.)
311 mm (12.25 in.)
483 mm (19.0 in.)
610 mm (24.0 in.)

Chassis Options

- 6-Slot—Furnishes all power, cooling air, and backplane wiring for 990/5 CPU (uses one slot) and five additional full-size standard interface circuit boards. Maximum operation temperature is 50°C.

- 13-Slot—Furnishes all power, cooling air, and backplane wiring for 990/5 CPU (uses one slot) and 12 additional full-size standard interface circuit boards. Maximum operating temperature is 40°C.
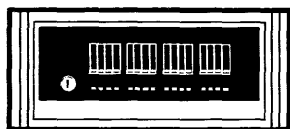
Programmer Panel   Operator Panel
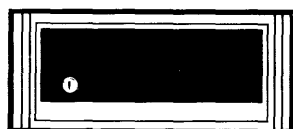
990 Front Panel Options

Front Panel Options

- Operator Panel—Provides key-lock OFF/ON/LOAD switch and POWER and FAULT indicators. If operator panel is chosen, boot loading may only be accomplished from default media as described above. If booting is desired from CRU diskette or ASR, or from more than one tape or disk controller, the programmer's panel should be chosen.

- Programmer Panel—Provides key-lock OFF/ON/ENABLE switch and POWER and FAULT indicators plus additional indicators and switches for manual control of CPU from front panel. The switches provide capability to load and read memory and registers. Manual control can be disabled by key-lock switch. Panel control is implemented by firmware in PROM loader. Programmer panel should be used where operation requires loading or examining memory content such as during software debug or debugging of custom interface designs.

Mounting Options

A pair of slides for mounting one chassis, either 6-slot or 13-slot, in standard 483-mm (19-in.) equipment cabinets is available to allow convenient extension of the chassis from cabinetry for service.

Dustcovers for tabletop operation are also available.

Item Description
310   990 Computer Chassis Rackmount Slide Set
311   6-Slot Chassis Tabletop Dustcover
312   13-Slot Chassis Tabletop Dustcover

NOTE: TI maintenance rates apply only to units ordered with the above listed dustcovers or mounted with slide rails in cabinetry.

Memory Options

The 990/5 CPU with 32K bytes on-board memory can address up to 32K bytes of TILINE expansion memory modules. These modules are described in the 990/10 CPU section.

SHIPPING NOTE: Memory modules ordered on the same purchase order with a Model 990/5 Microcomputer will be installed in the computer chassis for shipment.

Power Options

- Standby Power Supply—When computer operation is interrupted by power failure, dynamic RAM memory content is preserved for one hour at 25°C (for 64K bytes). This option furnishes battery, charger, and regulated memory standby power. This option does not require additional slots within chassis.
- No Standby—Power loss results in loss of all data in RAM.

NOTE: Power-fail/auto-restart logic requires that the user implement a coherent shutdown and restart, which is not automatically assured by standby power supply.

Model 990/5 Configuration Table

Item	Option	Chassis	Panel	On-Board Memory
370	No Standby	6-Slot Chassis	Operator Panel	32K bytes
371	Standby Power Supply	6-Slot Chassis	Operator Panel	32K bytes
372	No Standby	13-Slot Chassis	Operator Panel	32K bytes
373	Standby Power Supply	13-Slot Chassis	Operator Panel	32K bytes
374	No Standby	6-Slot Chassis	Programmer Panel	32K bytes
375	Standby Power Supply	6-Slot Chassis	Programmer Panel	32K bytes
376	No Standby	13-Slot Chassis	Programmer Panel	32K bytes
377	Standby Power Supply	13-Slot Chassis	Programmer Panel	32K bytes
380	No Standby	6-Slot Chassis	Operator Panel	64K bytes
381	Standby Power Supply	6-Slot Chassis	Operator Panel	64K bytes
382	No Standby	13-Slot Chassis	Operator Panel	64K bytes
383	Standby Power Supply	13-Slot Chassis	Operator Panel	64K bytes
384	No Standby	6-Slot Chassis	Programmer Panel	64K bytes
385	Standby Power Supply	6-Slot Chassis	Programmer Panel	64K bytes
386	No Standby	13-Slot Chassis	Programmer Panel	64K bytes
387	Standby Power Supply	13-Slot Chassis	Programmer Panel	64K bytes

Model 990/10 Minicomputer

The Model 990/10 Minicomputer is a high-performance minicomputer with an instruction set that is fully upward compatible with the Model 990/4, Model 990/5 Microcomputers, and TMS 9900 Microprocessor. The 990/10 is implemented with TTL MSI circuits on two full-size (279 mm x 356 mm; 11 in. x 14 in.) circuit boards. One board contains the AU and the other board contains the memory interface circuits. The two boards are interconnected across the top edge by two short cables and must be adjacent on the CPU chassis. The two CPU boards are located in the top two slots of the chassis. There are two versions of the memory interface board: one offering slightly higher speed with 64K bytes total memory capacity, and the other implementing a mapping scheme that increases total memory capacity to 2048K bytes. Both versions feature a high-speed multiuser bus structure, the TILINE, that supports high-speed peripherals such as disks and magnetic tapes.

Both versions of the 990/10 provide 1K byte of PROM program loader on the memory interface board; but loaders are not interchangeable between the unmapped and mapped versions. The standard loader included with 990/10 without mapping provides diskette load from FD800 drive, cassette load from 733 ASR, CPU self-test, and programmer panel management utility. The standard loader included with 990/10 with mapping provides load from disk or diskette, cassette load from 733 ASR, card reader load, magnetic tape load, and programmer panel management utility.

The Model 990/10 Minicomputer features include on-board real-time clock, integer hardware multiply/divide, power fail/auto restart logic, 16 vectored interrupts, 16 extended operations (XOPs), high-speed TILINE multiuser bus, CRU bus for decoding up to 4096 input lines and 4096 output lines, and interface for operator/programmer panel.

The chassis is the 13-slot chassis (CPU uses top two slots) with self-contained power supply for CPU and standard interface cards. Chassis dimensions are 311 mm H × 495 mm W × 762 mm D (12.25 in. × 19.50 in. × 30.00 in.). There are multiple options in front panels and power supplies. The maximum operation temperature is 40°C.
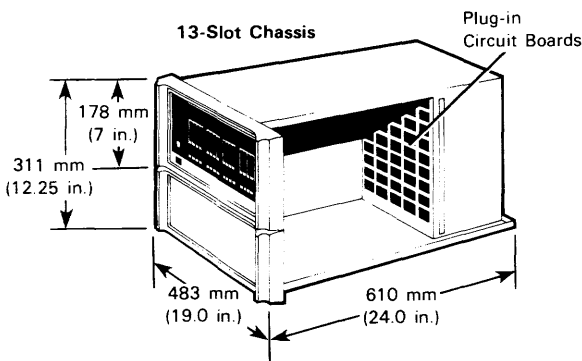
13-Slot Chassis
Plug-in Circuit Boards
178 mm (7 in.)
311 mm (12.25 in.)
483 mm (19.0 in.)
610 mm (24.0 in.)

990 Front Panel Options

- Operator Panel—Provides key-lock OFF/ON/LOAD switch and POWER and FAULT indicators.
- Programmer Panel—Provides operator panel functions plus switchboard indicator lights for full manual control of 990/10 from front panel. This includes ability to load and read registers and memory. Panel control is implemented by firmware in ROM loader. Programmer Panel should be used where operation requires loading or examining memory content, debugging custom designs, etc.

Programmer Panel   Operator Panel

Power Options

- Standby Power Supply—When computer operation is interrupted by power failure, up to 64K bytes of RAM memory content is preserved for one hour at 25°C. This option furnishes battery, charger, and regulated memory standby power. This option does not require additional slots within chassis.
- No Standby—RAM memory content is lost in the event of power failure.

NOTE: Power-fail, auto-restart logic requires that the user implement a coherent shutdown and restart, which is not automatically assured by standby power supply.

Mounting Options

A pair of extending slides is available for mounting one chassis in an equipment cabinet. A dustcover suitable for office environments is an option for tabletop mounting.

Item	Description
310	990 Computer Chassis Rackmount Slide Set
311	6-Slot Chassis Tabletop Dustcover
312	13-Slot Chassis Tabletop Dustcover

NOTE: TI maintenance rates apply only to units ordered with the above listed dustcovers or mounted with slide rails in cabinetry.

Model 990/10 Configuration Table

Item	Option	Panel	Description
404	No Standby	Operator Panel	990/10 with mapping (2048K Memory Space)
405	Standby Power Supply		
406	No Standby	Programmer Panel	
407	Standby Power Supply		

Model 990/12 High-Performance Minicomputer

The 990/12 is a high performance minicomputer that is fully upward compatible with the 990/10 and smaller 990 computers. The 990/12 is implemented with Schottky MSI circuits on two full-size (279 mm x 356 mm; 11 in. x 14 in.) circuit boards. The two boards are interconnected access the top edge by two short cables and must be adjacent in slots 1 and 2 of the CPU chassis. There is an unusual degree of compatibility between the 990/10 and 990/12 in that both machines use identical interfaces to the chassis. However, board level upgrades are not feasible because the 990/12 requires greater power than the smaller chassis used for 990/10 can provide.

The 990/12 interfaces the TILINE high-speed multi-user lines to support memory and high-speed peripherals and the CRU lines for low speed peripherals. The 990/12 CPU generates a 16-bit address for 64K bytes of direct-address capability. The 990/12 implements a mapping scheme that increases total memory capacity to 2048K bytes; 990/12 mapping is a superset of 990/10 mapping with all 990/10 features plus the capability to specify read-only and execute only access protection. Applications must be partitioned into tasks which use 64K bytes or less memory per task.

The 990/12 implements a total of 143 instructions. Seventy-two of the instructions are the identical set used by the 990/10, and any software implemented with these instructions will execute on either the 990/10 or 990/12; 71 of the instructions are new to the 990 family. These extensions increase the performance of the 990/12 in most applications. The new instructions include: floating points, byte strings, extended precision binary, conversions, stack operations, and bit and field manipulation.

The 990/12 loader is included, and provides disk load from moving-head disk or diskettes, magnetic tape load, programmer panel, management utility, and CPU self-test.

The Model 990/12 computer features include on-board real-time clock, signed multiply and divide, power fail/auto-restart logic, 16 restored interrupts, 16 extended operations (XOPs), workspace cache, error-trace memory, high-speed TILINE multiuser lines, and interface for the programmer panel.

The 990/12 chassis provides 17 full slots (CPU uses slots one and two) with self-contained power supply for CPU and peripheral interface cards. Chassis dimensions are 622 mm H x 495 mm W x 724 D (24½ in. h x 19 in. w x 28½ in.). The chassis is rigidly mounted in equipment enclosures and does not require slides. Service access is through the front and rear panels. Power provided is 80 A at +5 V, 6 A at + 12 V, and 2 A at - 12 V. Driving power required is 16 A at 115 V or 8 A at 208 V ac. Maximum ambient temperature is 50° C.

The 990/12 includes a programmer panel which provides key-lock off and panel enable/disable, power and fault indicators, plus switches and indicator lights for full manual control of 990/12 from front panel. This includes the ability to load and read registers and memory.

Item	Description
408	990/12 high-performance minicomputer with 17-slot chassis and programmer panel

Note: Upgrade from 990/10 to 990/12 requires special knowledge on cabinetry, power plugs, memory, etc. Please contact the local sales office for assistance.

483 mm (19 in.)

622 mm (24.5 in)

724 mm (28.5 in.)
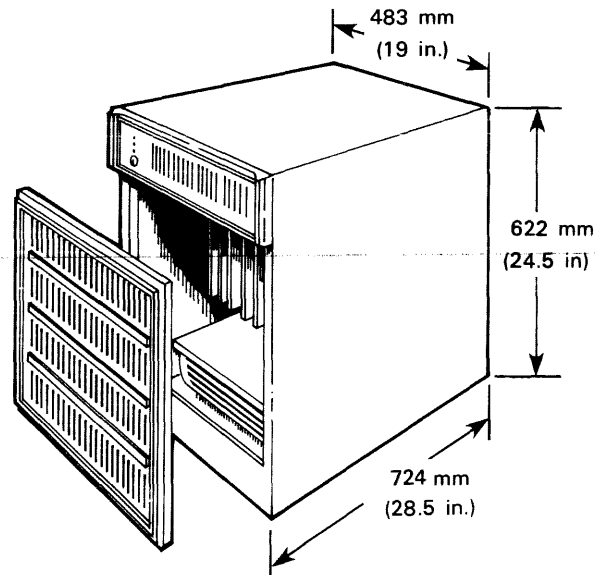
TILINE Memory Modules

TI offers four types of semiconductor memory modules that interface to the TILINE bus of the 990/10 and 990/12 computers. The different types may be intermixed on a single TILINE bus so long as the address limits of the CPU and the power limits of the chassis are not exceeded. The four types are as follows:

- EPROM Memory Module (Item 325)
- Parity Memory Module including controller with 32K bytes per module
- Error-correcting Memory
- Error-correcting Memory with cache.

EPROM memory module consists of a single, full-size circuit board with 2K bytes of TMS 2708 EPROM memory and sockets for an additional 14K bytes. On-board switches set memory address on 2K boundaries. Content may be erased and reprogrammed via the PROM Programming Kit (Item 130) with the EPROM Programming Adaptor (Item 132) and EPROM Erase Kit (Item 133). Cycle time is 667 nanoseconds. Maintenance is for controller only; TI cannot be responsible for EPROM content.

Item	Description
325	EPROM Memory Module

Parity Memory

The parity memory modules are single, full-size boards containing 16K to 40K bytes of MOS dynamic RAM with parity. They include parity features with provision to light on-board LEDs and interrupt the CPU in case of fault. On-board switches map memory address anywhere in TILINE address space on 8K boundaries. Memory cycle time is 725 nanoseconds without mapping, 825 nanoseconds with mapping.

Power: 16K = +5 V (0.75 A), +12 V (0.05 A)
      24K = +5 V (0.82 A), +12 V (0.06 A)
      32K = +5 V (0.89 A), +12 V (0.07 A)
      40K = +5 V (0.96 A), +12 V (0.08 A)
Space: Full-slot

Item	Description	Comments
410	Parity Memory Module, 16K bytes	
411	Parity Memory Module, 24K bytes	
412	Parity Memory Module, 32K bytes	Requires Item 410
413	Parity Memory Module, 40K bytes	Requires Item 410

Error-Correcting Memory

TILINE error-correcting memory modules store a 6-bit Hamming code with each 16-bit data word. The characteristic of the Hamming code is that it identifies a single-bit error in the data word or the code itself, which permits the single-bit in error to be corrected. Two-bit errors are caught, but not corrected (like 1-bit errors in parity systems). Error correction dramatically reduces the number of system failures in large memory systems, and the larger the memory, the greater the improvement. The cost of ownership for error-correction is lower over a multiyear period.

The basic element in TILINE error-correcting memory systems is the controller board which contains a TILINE interface, the error-correcting circuits, refresh circuits, and MOS dynamic RAM storage devices. The storage capacity can be expanded by adding from one to four array boards, which contain only storage devices and depend on the controller board for interface, error-correction, and refresh. Array boards connect to the controller by two cables on the top edge and must be adjacent to the controller in the chassis. The controller board has two LEDs which indicate that (1) a correctable (1-bit) error has occurred or (2) an uncorrectable (2-bit) error has occurred. Uncorrectable errors also interrupt the CPU. There are 11 LEDs on the controller that identify the chip which caused the failure.

The error-correcting modules are grouped as follows:
(1) EC Memory Subsystems—for initial purchase of memory
(2) EC Memory Expansion—for adding to an existing memory

EC Memory Subsystems. EC memory subsystems are complete memories with controller plus any required array boards and interconnecting cables. Simply choose the item that provides the required memory size.

Item	Description	Chassis slots required
430	64K-byte EC Memory Subsystem	1
431	96K-byte EC Memory Subsystem	1
432	128K-byte EC Memory Subsystem	2
433	160K-byte EC Memory Subsystem	2
434	192K-byte EC Memory Subsystem	2
435	256K-byte EC Memory Subsystem	2
436	320K-byte EC Memory Subsystem	2
437	384K-byte EC Memory Subsystem	3
438	512K-byte EC Memory Subsystem	3
439	768K-byte EC Memory Subsystem	4
440	1024K-byte EC Memory Subsystem	5

EC Memory Expansion. Memory expansion adds one or more array boards to an existing EC memory to increase the total memory size. Two parts are required: the array board and the cables that interconnect the controller and array boards. The new cables replace the old cables. The new cables must connect the controller to any existing arrays plus the arrays added by the expansion. The total number of arrays cannot exceed four. Array boards listed take one slot.

Item	Description
443	64K-byte EC Array Module
444	128K-byte EC Array Module
445	192K-byte EC Array Module
446	256K-byte EC Array Module
447	Interconnecting Cable, Controller & 1 Array (2 req)
448	Interconnecting Cable, Controller & 2 Arrays (2 req)
449	Interconnecting Cable, Controller & 3 Arrays (2 req)
450	Interconnecting Cable, Controller & 4 Arrays (2 req)
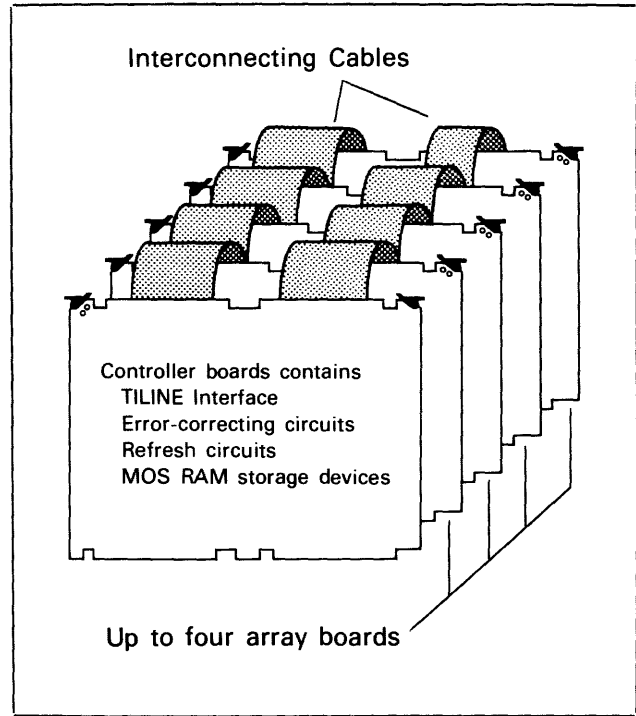
EC Memory Subsystems

TILINE Cache Memory Subsystems

TILINE Cache Memory Subsystems include all the features of TILINE EC memory: TILINE interface, error-correcting circuits, refresh circuits, and MOS dynamic RAM storage devices. the TILINE Cache Memory adds a 2K-byte high-speed TTL memory on the controller board which functions as a buffer for the MOS memory to improve access and cycle times. With the 990/12, CPU cycle time is 350 nanoseconds for a cache cycle and 740 nanoseconds for a MOS cycle. System performance improvement averages 30 percent for most 990/12 applications. Improvement is less with the 990/10 CPU. Cache operation is automatic and invisible to the programmer.

Cache memory is implemented with a controller board which contains the TILINE interface, error-correcting, refresh and standby circuits, 64Kbytes of RAM, and the 2K-byte cache. This controller drives up to four array modules. The arrays and interconnecting cables are identical to error-correcting memory without cache.

Item	Description
451	64K-byte Cache Memory Subsystem
452	128K-byte Cache Memory Subsystem
453	192K-byte Cache Memory Subsystem
454	256K-byte Cache Memory Subsystem
455	320K-byte Cache Memory Subsystem
456	384K-byte Cache Memory Subsystem
457	512K-byte Cache Memory Subsystem
458	768K-byte Cache Memory Subsystem
459	1024K-byte Cache Memory Subsystem

Mass Storage

FD800 Flexible Disk

FD800 flexible disks feature 77 tracks, 26 sectors, and 128 bytes per sector with a capacity of 256K bytes per diskette. Adjacent track seek time is 10 milliseconds and average rotational latency is 83 milliseconds. The FD800 interface is a full-size card that plugs into 990 chassis (to CRU bus) and interfaces up to four flexible-disk drives. Controller-to-disk transfer rate is 31K bytes per second, with double-sector buffering for both read and write operations. In most applications, controller-to-host transfer rate will average 5K bytes per second. This transfer rate is determined by the CRU I/O activity and the application software. The chassis unit consists of a chassis with power supply that accommodates up to two drives. Chassis dimensions are 178 mm H x 483 mm W x 622 mm D (7.0 in. x 19.0 in. x 24.5 in.). Interconnecting cables consist of a 3-m (10-ft.) status cable and a 3-m (10-ft.) daisy-chain cable.

Kit Configurations

FD800 Single-Drive Master Kit includes FD800 interface, one FD800 drive mounted in a dual-drive chassis, a blank diskette, interconnecting cable, and an installation and operation manual.

FD800 Dual-Drive Master Kit includes FD800 interface, two FD800 drives mounted in a dual-drive chassis, two blank diskettes, interconnecting cable, and an installation and operation manual.

FD800 Single-Drive Secondary Kit includes required daisy-chain and control cables plus one FD800 drive mounted in a dual-drive chassis, a blank diskette, and an installation and operation manual.

FD800 Dual-Drive Secondary Kit includes required daisy-chain and control cables plus two FD800 drives mounted in a dual-drive chassis, two blank diskettes, and an installation and operation manual.

A pair of slides and accessory hardware are available for mounting one FD800 chassis in a standard 483-mm (19-in.) equipment cabinet or desk. A dust cover is available as a packaging option for tabletop use.

SERVICE NOTE: TI maintenance rates apply to units operated with a suitable dust cover or mounted with extending slides in an equipment cabinet.

Item	Description	Comments
500	FD800 Single Drive Master Kit	
501	FD800 Dual Drive Master Kit	
502	FD800 Single Drive Secondary Kit	Requires Item 501
503	FD800 Dual Drive Secondary Kit	Requires Item 501
504	FD800 Diskette Expansion Drive	
505	FD800 Rackmounting Slide Set	
506	FD800 Tabletop Dust Cover	

178 mm (7 in.)

483 mm (19.0 in.)

622 mm (24.5 in.)
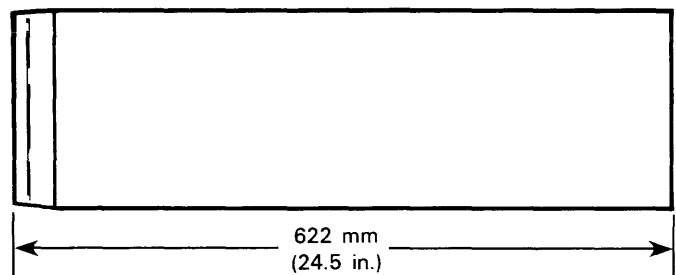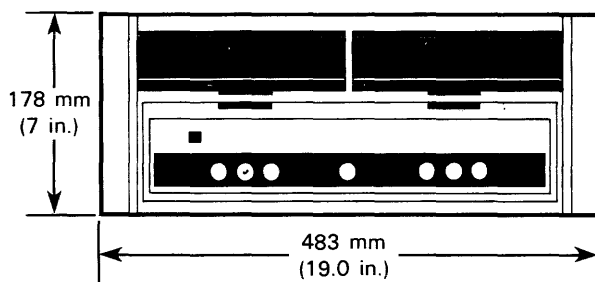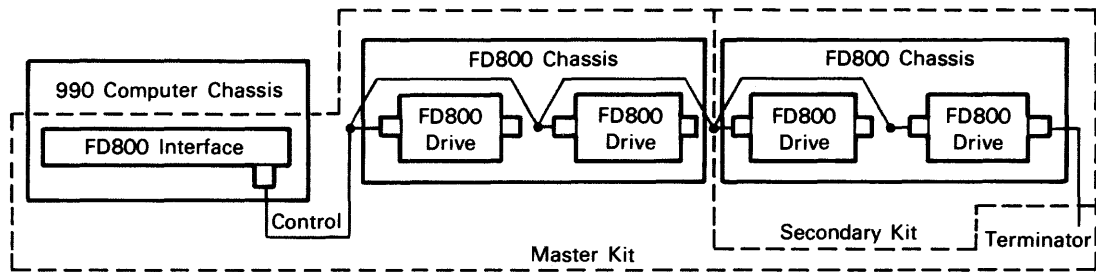
The chassis diagram for the FD1000 is identical. The FD1000 controller interfaces to the TILINE.

FD1000 Flexible Disk

FD1000 flexible disks operate with either double-sided, double-density diskettes or with IBM compatible, single-sided, single-density diskettes. The FD1000 features automatic sensing of diskette type. The single-sided, single-density diskette stores 256K bytes of data formatted in 128-byte sectors, 26 sectors per track, and 77 tracks per diskette. Single-sided diskettes are directly interchangeable between the FD1000 and the FD800. The double-sided, double-density diskette stores 1.1 megabytes data formatted in 288-byte sectors, 26 sectors per track, 77 tracks per diskette, and 2 tracks per cylinder. Burst data transfer rate with the double density diskette is 500K bits per second. With either diskette type, adjacent track seek time is 3 milliseconds, average seek time is 91 milliseconds, and average rotational latency is 83 milliseconds.

Kit Configurations

FD1000 Single-Drive Master Kit includes an FD1000 controller, one FD1000 drive mounted in a dual-drive chassis, a blank double-sided, double-density diskette, interconnecting cables, and an installation and operation manual.

FD1000 Dual Drive Master Kit includes all the items in the single drive master kit plus a second drive mounted in the chassis and a second blank diskette.

FD1000 Single-Drive Secondary Kit includes required daisy-chain and control cables plus one FD1000 drive mounted in a dual-drive chassis, a blank double-density diskette, and an installation and operation manual.

FD1000 Dual Drive Secondary Kit includes all the items in the single drive secondary kit plus a second drive mounted in the chassis and a second blank diskette.

NOTE: All FD1000 kits include slide kits required for rackmounting the chassis.

SERVICE NOTE: TI maintenance rates apply to units operated with a suitable dust cover or mounted with extending slides in an equipment cabinet.

Item	Description	Comments
507	FD1000 Single Drive Master Kit	
508	FD1000 Dual Drive Master Kit	
509	FD1000 Single Drive Secondary Kit	Requires Item 507
510	FD1000 Dual Drive Secondary Kit	Requires Item 508
511	FD1000 Diskette Expansion Drive	

178 mm (7 in.)   483 mm (19.0 in.)   622 mm (24.5 in.)
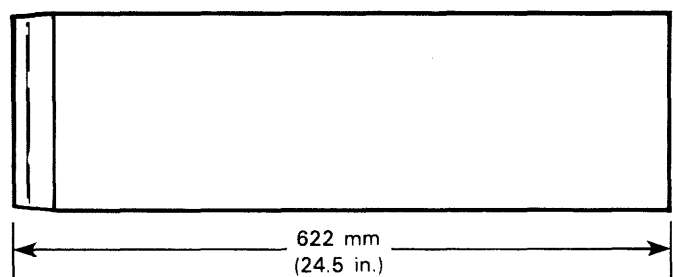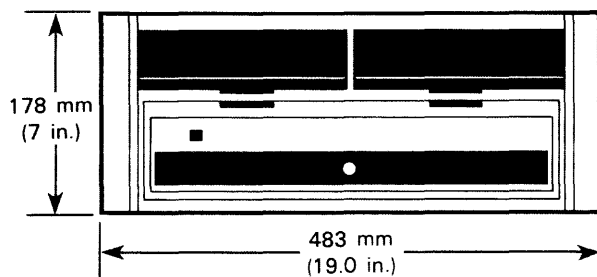
Model DS10 Disk

The Model DS10 Disk is a dual-platter, single-access, moving-arm disk drive. A total of 9.4 megabytes of formatted storage is provided by a 4.7-megabyte nonremovable platter and a 4.7-megabyte 5440-type disk cartridge. The disk format is 288 bytes per sector, 20 sectors per track, and 816 tracks per platter. Single track seek time is 7.5 milliseconds with an average seek time of 35 milliseconds. The transfer rate is 312K bytes per second.

The DS10 controller requires one full slot in the 990 chassis and communicates with the CPU via the TILINE data bus. The DS10 controller can service two DS10 drives for a total of 18.8 megabytes. DS10 disks may serve as system disks for the DX10 or TX5 Operating Systems.

Installation or removal of a 5440-type cartridge requires clear access to the top of the drive. Texas Instruments recommends the pedestal cabinet for those users who interchange disk cartridges frequently.

Kit Configurations

The DS10 Master Kit (rackmount) includes one DS10 disk controller, DS10 drive, disk cartridge, terminator, and the 6.1-m (20-ft.) cable set. Rackmounting slide set for the drive and an installation and operation manual are also included.

The DS10 Secondary Kit (rackmount) includes the 6.1-m (20-ft.) cable set, DS10 drive, disk cartridge, and rackmounting slide set. The drive signal terminators are part of the drive.

The DS10 Master Kit (with quietized pedestal cabinet) includes the same components as Item 520. The disk drive is separately mounted in a specially engineered pedestal cabinet to allow installation in a low-noise (office-type) environment.

The DS10 Secondary Kit (with quietized cabinet) includes the same components as the rackmount secondary kit with the addition of the quietized pedestal cabinet, and 2-m (7-ft.) cable instead of a 6.1-m (20-ft.) cable.

Item	Description	Comments
520	Model DS10 Master Kit (Rackmount)	267 mm H × 483 mm W × 762 mm D (10.5 in. × 19 in. × 30 in.)
521	Model DS10 Secondary Kit (Rackmount)	Requires Item 520
522	Model DS10 Master Kit (Quietized Pedestal Cabinet)	864 mm H × 470 mm W × 762 mm D (34 in. × 18.5 in. × 30 in.)
523	Model DS10 Secondary Kit (Quietized Pedestal Cabinet)	Requires Item 520 or 522
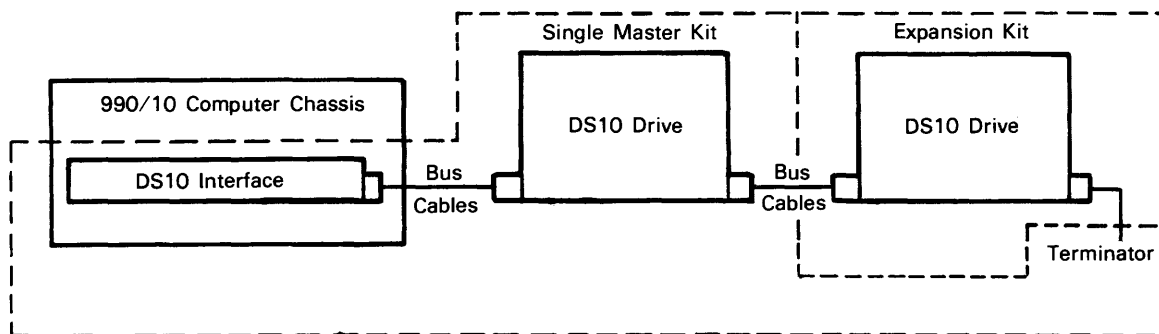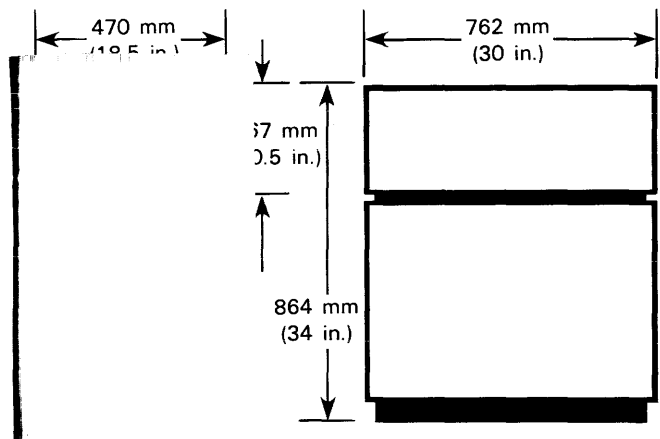
Models DS25 and DS50 Disks

The Models DS25 and DS50 disks are physically similar moving-head disks that use the same five-platter removable-disk pack. The DS25 provides 22.33M bytes of storage, and the DS50 provides 44.60M bytes. The DS25 provides 2040 tracks organized into 408 cylinders. The DS50 provides 4075 tracks on 815 cylinders. For either unit, each track contains 38 logically interlaced sectors with 288 bytes per sector. Single track seek time is 6 milliseconds, maximum seek time is 55 milliseconds, and the average is 30 milliseconds. Average rotational latency time is 8.3 milliseconds. The burst data transfer rate is 806,000 bytes per second, with an average transfer rate of 403,000 bytes per second.

The disk pack included with each drive is an error-mapped pack containing a maximum of 30 bad tracks per pack.

The DS25 and DS50 controllers each occupy a full slot in the chassis and communicate with the 990/5, 990/10, or 990/12 over the TILINE. Each controller supports up to four drives, but DS25 and DS50 drives may not be intermixed on the same controller. DS25 and DS50 drives are supported by the DX10 and TX5 Operating Systems.

Both the DS25 and DS50 ar[...] mounting pedestal. Pedestal moun[...] top of this drive is clear for easy a[...] packs.

Kit Configurations

DS25 Master Kit consists of DS25[...] drive, one disk pack, 4.6-m (15-ft.)[...] ft.) radial cable, and terminator. T[...] one full slot in a 990 chassis and i[...] to up to four DS25 disk-pack[...] installation and operation manual[...]

DS25 Secondary Kit consists of one DS25 drive, one disk pack, 2.4-m (8-ft.) daisy-chain bus cable (disk to disk), and 6.1-m (20-ft.) radial cable (controller to secondary disk).

DS50 kits have same content as corresponding DS25 kits, except substitute DS50 controllers and drives.

Item	Description	Comments
530	Model DS25 Master Kit	
532	Model DS25 Secondary Kit	Requires Item 530
534	Model DS50 Master Kit	
536	Model DS50 Secondary Kit	Requires Item 532
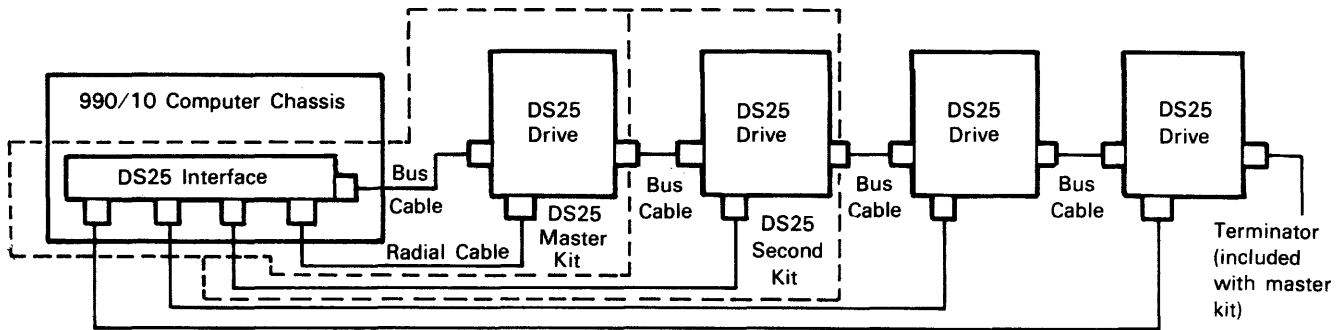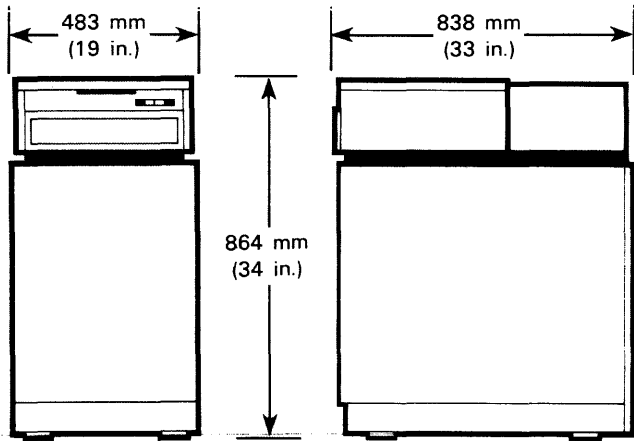
DS50 Configuration is identical with interchangeable cables, but
DS25 and DS50 Controllers and Drives may not be mixed.

30

Model DS200 Disk

The Model DS200 disk is a moving-head disk that utilizes a ten-platter (19 surfaces) removable-disk pack. The DS200 provides 169.47K bytes of formatted data storage. The DS200 provides 15,485 tracks organized into 815 cylinders and 19 heads. Each track contains 38 logical interplaced sectors with 288 bytes per sector. Single track seek time is 7.5 milliseconds, maximum seek time is 55 milliseconds, and average is 30 milliseconds. Average rotational latency is 8.3 milliseconds. The burst data transfer rate is 806,000 bytes per second, with an average transfer rate of 403,000 bytes per second.

The DS200 controller occupies one full slot in the chassis and communicates with the 990/10 or 990/12 CPU via the TILINE. The DS200 drives are supported by the DX10 Operating System, but DX10 software is not supplied on DS200.

The DS200 is a stand-alone, cabinet-mounted disk drive that requires access to the top of the drive to change the disk pack. DS200 disks require 208 V power.

Kit Configurations

DS200 Disk Master Kit con[...]
one DS200 disk drive, one e[...]
(15-ft.) bus cable, 6.1-m ([...]
terminator. The controller req[...]
chassis and interfaces the TIL[...]
disk-pack drives. DS200 ins[...]
manual is included.

DS200 Disk Secondary Kit consists of one DS200 disk drive, one DS200 error-free disk pack, 2.4-m (8-ft.) daisy-chain bus cable (disk to disk), and 6.1-m (20-ft.) radial cable (controller to disk).

Item	Description	Comments
540	Model DS200 Disk Master Kit	
541	Model DS200 Disk Secondary Kit	Requires Item 540

483 mm (19 in.)

838 mm (33 in.)

864 mm (34 in.)

DS200 Master Kit | Secondary Kit

990/10 Computer Chassis

DS200 Controller

DS200 Drive

DS200 Drive

DS200 Drive

DS200 Drive

Bus Cable

Bus Cable

Bus Cable

Bus Cable

Radial Cable

Terminator (included with master kit)

Model 979A Magnetic Tape Transport

The Model 979A Magnetic Tape Transport is provided in two versions: a 9-track, 800-bpi, NRZI version and a 9-track, 1600-bpi PE version. Tape formats are industry compatible. Model 979A transport features vacuum columns, 37.5 ips and 266-mm (10.5-in.) reels with quick release hubs. Transport must be rackmounted. Dimensions are 667 mm H × 483 mm W × 368 mm D (26.25 in. × 19 in. × 14.5 in.).

Two master kits are offered. One supports 800-bpi transports; the other supports both 800-bpi and 1600-bpi transports, which may be intermixed on the same controller. Both controllers interface the TILINE bus to up to four transports and require one chassis slot.

Model 979A transports may be used for support of sequential files under the DX10, TX990, and TX5 Operating Systems.

Kit Configurations

Model 979A Master Kit (800 bpi) includes 800-bpi controller, 4.6-m (15-ft.) primary cable, one 979A (800-bpi) transport with terminator, 51-m (200-ft.) tape, 266-mm (10.5-in.) take-up reel, and installation and operation manual. Controller will interface to one Model 979A Secondary Kit, Item 551.

Model 979A Secondary Kit (800 bpi) includes 800-bpi transport, 4.6m (15-ft.) daisy-chain cable, 51-m (200-ft.) tape, and 266-mm (10.5-in.) take-up reel.

Model 979A Master Kit (1600 bpi) includes 800/1600-bpi controller, 4/6-m (15-ft.) primary cable, one 979A (1600 bpi) transport with terminator, 51-m (200-ft.) tape, 266-mm (10.5-in.) take-up reel, and an installation and operation manual. Controller will interface to one Model 979A Secondary Kit, either 800 bpi or 1600 bpi.

Model 979A Secondary Kit (1600 bpi) includes 1600-bpi transport, 4.6-m (15-ft.) daisy-chain cable, 51-m (200-ft.) tape, and 266-mm (10.5-in.) take-up reel.

Item	Description	Comments
550	Model 979A Master Kit, 800 bpi	
551	Model 979A Secondary Kit, 800 bpi	Requires Item 550 or 552
552	Model 979A Master Kit, 1600 bpi	
553	Model 979A Secondary Kit, 1600 bpi	Requires Item 552
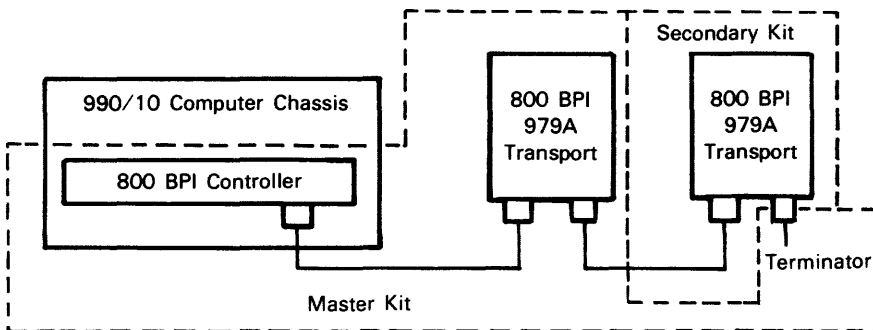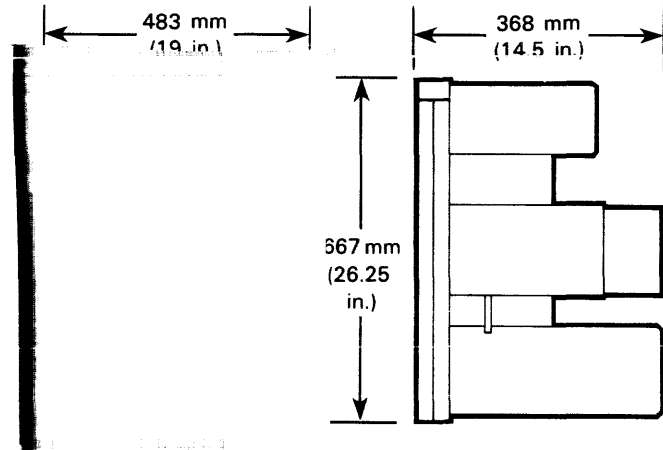
Configuration is identical for 800/1600 BPI

Peripherals

Model 911 Video Display Terminal

The Model 911 Video Display Terminal is a fast, convenient, and economical terminal for operator interaction with a 990 computer system. Data is displayed on a large, easy-to-read display screen, and a keyboard is provided for operator entries. The 911 controller occupies one full slot in the 990 chassis, and interfaces to the CRU input/output bus. Options are available to support one or two terminals on the same controller. The format consists of 1920 characters displayed 24 lines by 80 characters using 96-character ASCII with uppercase and lowercase alphabet. The screen size is 305 mm (12 in.) diagonal. The 911 includes full cursor control, programmable cursor positioning, three programmable levels of intensity (dark, light, and bright), ten programmable function keys, and repeat key (10 cps).

Kit Configurations

Kits include controller, display(s), keyboard(s), 4.8-m (16-ft.) controller to display cable(s), 1.5-m (5-ft.) display to keyboard cable(s), and installation and operation manual.

Item	Description	Comments
610	Model 911 Video Display Terminal Kit, Single 1920-Character Controller, 1 Display and Keyboard	
611	Model 911 Video Display Terminal Kit, Dual 1920-Character Controller, 1 Display and Keyboard	May be expanded by addition of Item 615
612	Model 911 Video Display Terminal Kit, Dual 1920-Character Controller, 2 Displays and Keyboard	
613	911 Controller to Display Extension Cable 15.2 m (50 ft.)	Maximum 610 m (2000 ft.) of cable between controller and display
614	911 Controller to Display Extension Cable, 30.5 m (100 ft.)	
615	Model 911 Video Display Terminal Expansion Display and Keyboard	

345 mm (13.6 in.)

508 mm (20.0 in.)

699 mm (27.5 in.)

911 Keyboard
990 Computer Chassis
911 Single Controller
911 Display
Model 911 VDT Kit (Single Controller)

911 Keyboard
990 Computer Chassis
911 Dual Controller
911 Display
911 Display
911 Keyboard
Model 911 VDT Kit (Dual Controller)
911 Expansion Display and Keyboard
911 VDT Kit Dual Controller, 2 Displays and Keyboards

Model 743 KSR Data Terminal

Model 743 KSR is a *Silent 700** full-duplex, 30-character-per-second, 80-column silent thermal printer/keyboard EIA terminal with ASCII 64-character and limited ASCII keyboard. The interface card requires one-half slot in the 990 chassis and interfaces to the CRU bus. The 990/5 kit uses CPU on-board interface connector.

Kit Components

Master kit includes terminal, interface card, 9.14-m (30-ft.) interconnecting cable, one roll of paper, and installation and operation manual.

990 Computer Chassis
◄— Half-Slot —►
743 Interface
743 Data Terminal
743 Master Kit
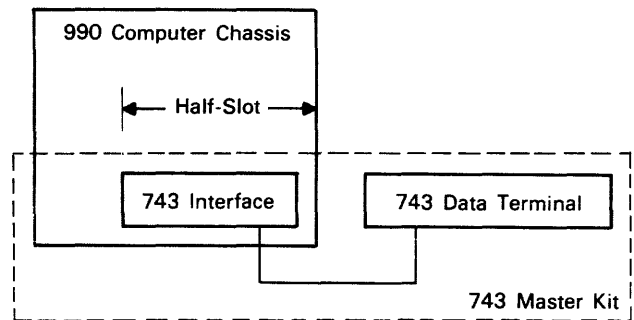
Item	Description
620	Model 743 KSR Master Kit
620A	Model 743 KSR Master Kit, 990/5
622	743 Data Terminal Cable

117 mm (4.6 in.)
391 mm (15.4 in.)
406 mm (16.0 in.)

*Trademark of Texas Instruments

34
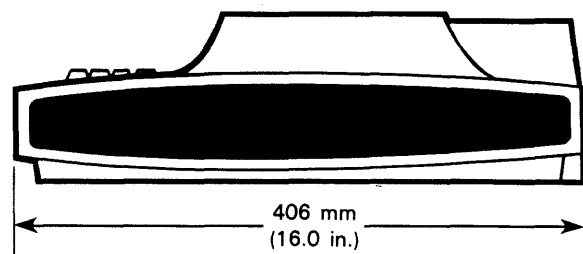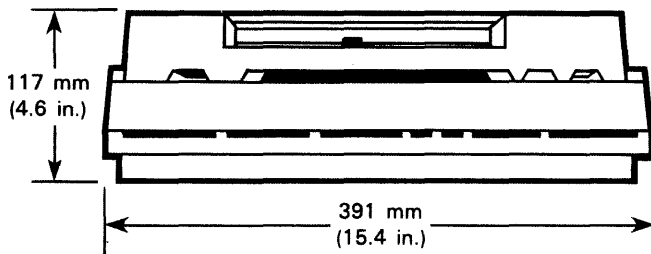
Model 733 ASR Data Terminal

Model 733 ASR is a *Silent 700** automatic send/receive 1200-baud, full-duplex 30-cps, 80-column silent thermal printer/keyboard with twin cassette unit providing buffered data transmit/receive, cassette read/write copy, and off-line edit. This terminal is configured for specific use with 990 minicomputers. The interface card requires one-half slot in the 990 chassis and interfaces to the CRU bus. The 990/5 kit uses CPU on-board interface connector.

Kit Components

Master kit includes terminal with twin cassette units, interface card, 9.1-m (30-ft.) interconnecting cable, installation and operation manual, two blank cassettes, and one roll of paper.

Item	Description
621	Model 733 ASR Master Kit
621A	Model 733 ASR Master Kit, 990/5
625	733 ASR Stand

Stand may be used for any *Silent 700* data terminal.

*Trademark of Texas Instruments

990 Computer Chassis · Half-Slot · 733 Interface · 733 Data Terminal · 733 ASR Master Kit

660 mm (26 in.) · 610 mm (24 in.) · 762 mm (30 in.)

371 mm (14.6 in.) · 538 mm (21.2 in.) · 495 mm (19.5 in.)
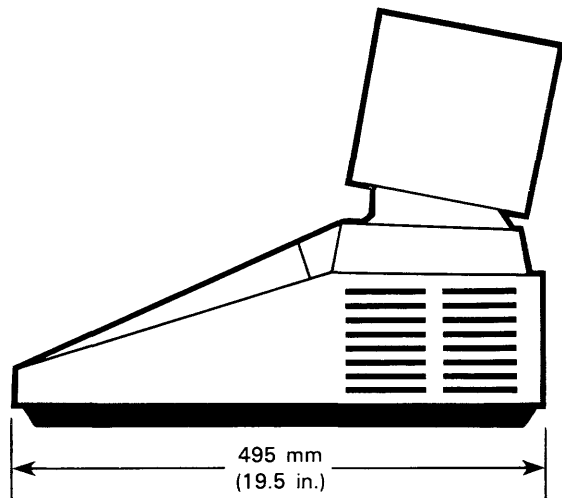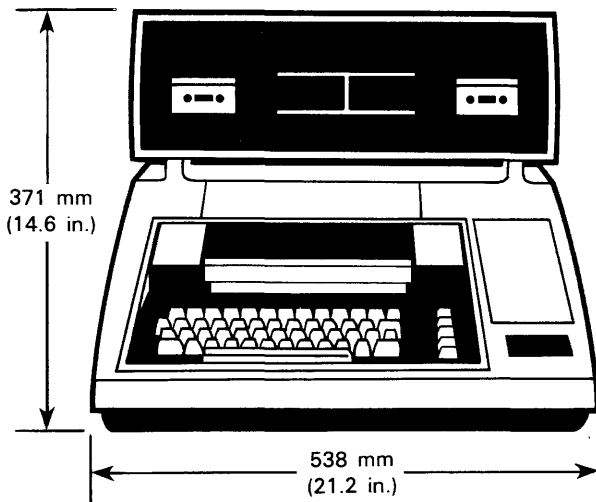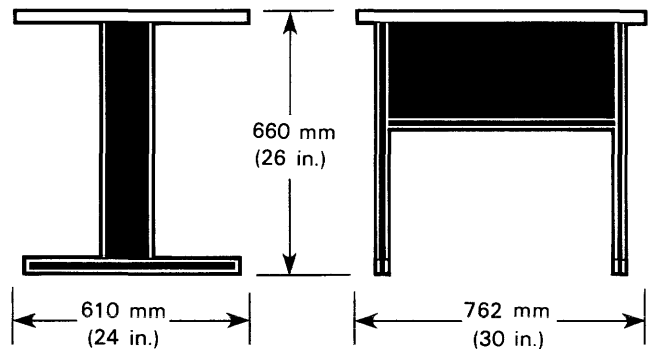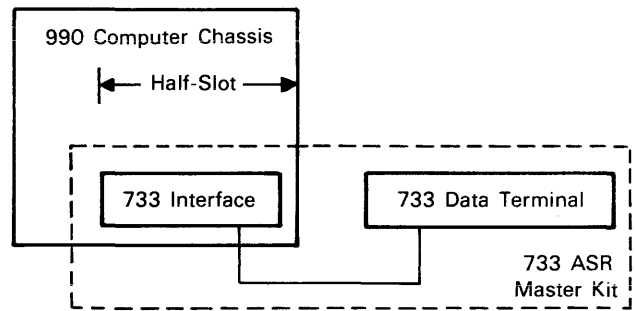
Model 810 Printer

The Model 810 Printer is a medium-duty, tabletop, 132-column, 150-character-per-second impact printer with 9 x 7 dot matrix character structure for 96-character full ASCII print set. The 810 uses sprocket-type paper, 76 mm to 381 mm (3 to 15 in.) wide, and will accommodate six-part multicopy forms. The print cycle provides bidirectional printing, buffered reception during line feed, vertical forms control, and horizontal tab control. The interface card occupies a half-slot in the 990 computer chassis and interfaces to CRU bus. The 990/5 kit uses CPU on-board interface connector.

Kit Components

Master kit consists of printer with features described above, interface card, 9.14-m (30-ft.) cable, printer-mounted paper tray, and installation and operation manual.

Item	Description	Comments
630	Model 810 Printer Master Kit	
630A	Model 810 Printer Master Kit, 990/5	
1614	Model 810 Printer to Interface Extension Cable, 15.2 m (50 ft.)	Maximum 304.8 m (1000 ft.) of cable between interface
1616	Model 810 Printer to Interface Extension Cable, 30.5 m (100 ft.)	and printer
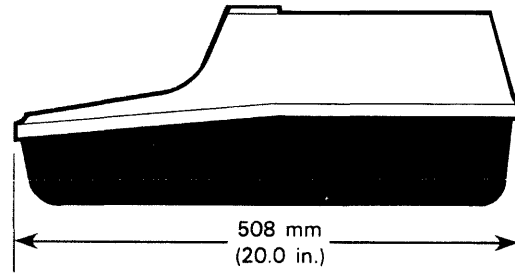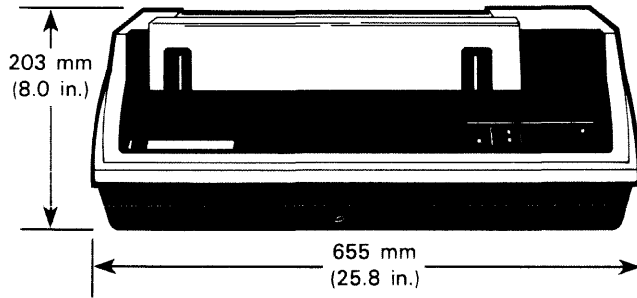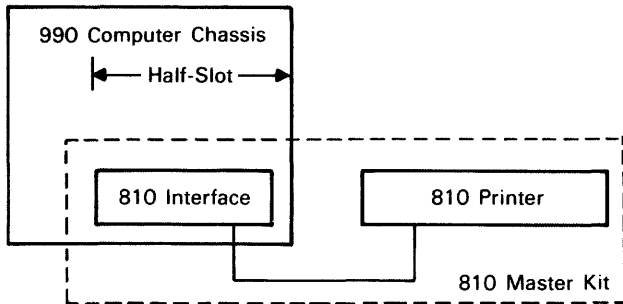
Model 820 KSR Terminal

The Model 820 is a 150-character-per-second keyboard send/receive data terminal that provides bidirectional printing and buffered reception during line feed. The Model 820 prints up to 132 columns and uses a 9 x 7 dot matrix structure to create the 96-character full ASCII print set. The terminal uses sprocket-type paper, 76 mm to 381 mm (3 to 15 in.) wide, and will accommodate six-part multicopy forms. The 820 includes a full ASCII typewriter keyboard with separate numeric key pad cluster, device forms control, and compressed print capability. The interface card occupies a half-slot in the 990 computer chassis and interfaces to the CRU bus. The 990/5 kit uses CPU on-board interface connector.

Kit Components

Master kit consists of terminal with features described above, interface card, 9.14-m (30-ft.) cable, terminal-mounted paper tray, and installation and operation manual.

Item Description
640 Model 820 KSR Master Kit
640A Model 820 KSR Master Kit, 990/5

990 Computer Chassis
|←— Half Slot —→|
820 Interface
820 Printer
820 Master Kit

209 mm
(8 in.)

660 mm
(26 in.)

533 mm
(21 in.)

37
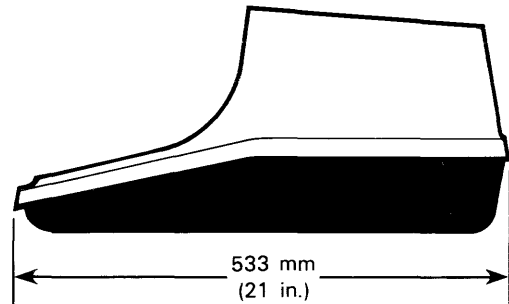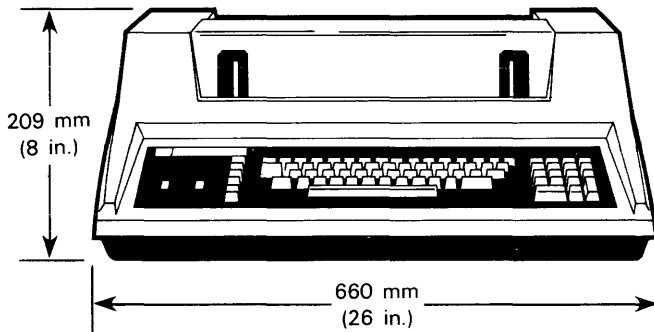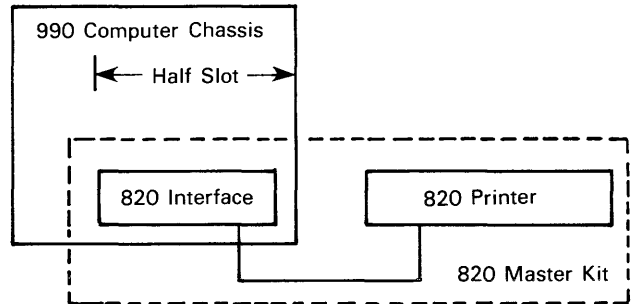
Model 2230/2260 Line Printer

The Models 2230 and 2260 are freestanding, heavy-duty, drum line printers offering, respectively, 300-lines-per-minute and 500-lines-per-minute printing speeds. Print features common to both printers are fully-formed characters (64-character ASCII set), 132-column, adjustable width 127 mm to 486 mm (5 to 16 in.), sprocket-type multicopy forms print capability (five parts), static eliminator, and tape-controlled 12-channel vertical format unit. The printer provides full-line buffering and high-speed data transfer handshake between the CPU and printer. The interface card occupies a half-slot in the 990 computer chassis and interfaces to CRU bus.

Kit Components

Master kit consists of printer with paper tray, interface card, 9.14-m (30-ft.) cable, and installation and operation manual.

Item	Description
650	Model 2230 Line Printer Master Kit
651	Model 2260 Line Printer Master Kit
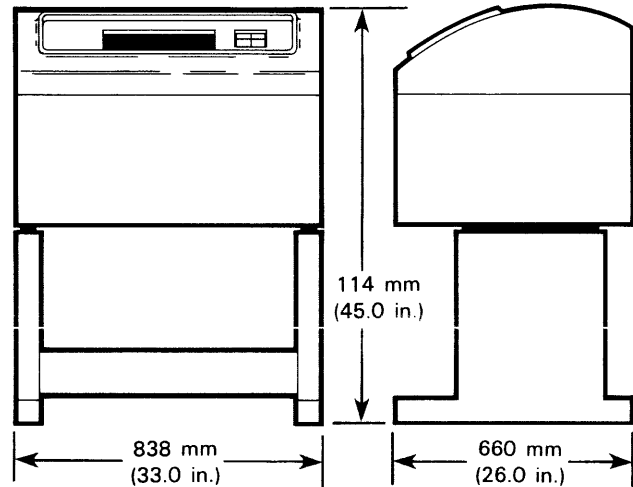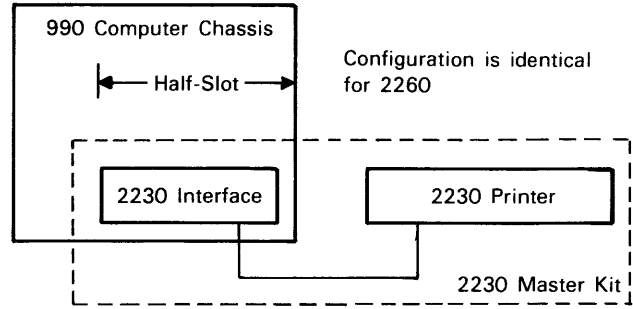
Model 804 Card Reader

The Model 804 is a tabletop, medium-duty, 400-card-per-minute card reader, which will accommodate standard-size 80-column cards (1000 in input hopper and 500 in output hopper). A fiber optic read station, which is cleaned automatically by each incoming card, provides excellent accuracy and reliability. The card reader interface occupies a half-slot in the 990 computer chassis and interfaces to the CRU bus.

Kit Components

Master kit consists of card reader, interface card, 8.5-m (28-ft.) cable, and installation and operation manual.

Item	Description
660	Model 804 Card Reader Master Kit

38
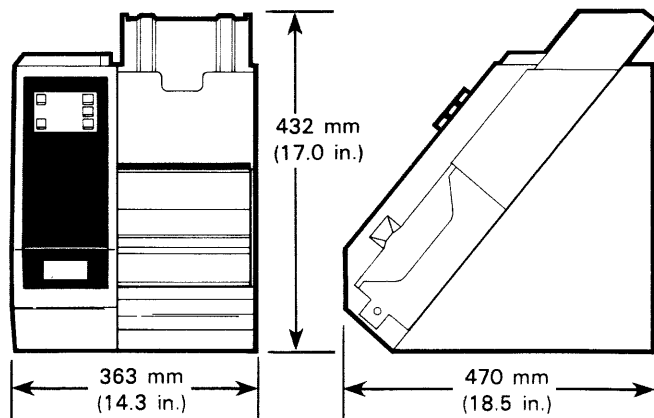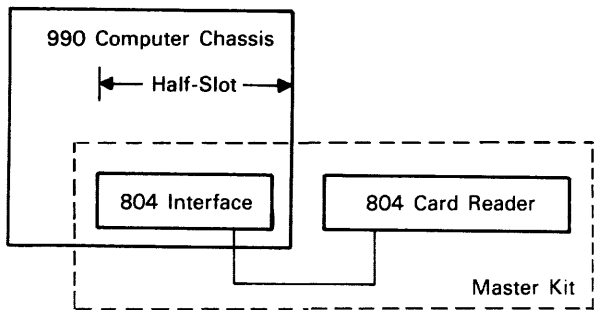
Interfaces

SOFTWARE NOTE: Software support for the following interface modules is intended to be customized according to the application requirement by the user.

TTY/EIA Interface

The TTY/EIA Terminal Interface Module interfaces 990 computers to terminal devices, such as displays and printers, that use EIA standard RS-232C or 20-milliampere TTY current-loop interfaces. (Modems should be interfaced via the Communications Interface Module, Item 710, because several data set control signals are omitted from the TTY/EIA module.) The TTY/EIA module occupies a half-slot in the 990 chassis and interfaces to the CRU bus. The following baud rates are selectable by jumper wires on the card: 110, 300, 1200, 4800, and 9600. The installation and operation manual is included.

Item   Description
700   TTY/EIA Terminal Interface Module

Cable, 9.14 m (30 ft.), assembly mating with the TTY/EIA terminal interface module connector.

TTY/EIA Remote Terminal Interface

The TTY/EIA Remote Terminal Interface Kit interfaces 990 computers to asynchronous modems (Bell 103, 212, or equivalent) to support operation of remote terminals equipped with an EIA-standard RS232C interface over the DDD network or private lines. Kit includes TTY/EIA module, TTY/EIA to modem cable, and installation and operation manual.

Item   Description
702   TTY/EIA Remote Terminal Interface Kit, 300 bps
703   TTY/EIA Remote Terminal Interface Kit, 1200 bps

990 Communications Modules

The 990 Communications Interface Module provides an RS-232C interface with full modem control signals for synchronous and asynchronous modems.[1] Selectable baud rates of 75, 110, 150, 200, 300, 1200, 2400, 4800, and 9600 meet almost any communication requirement.

Built-in Modems and Autocall
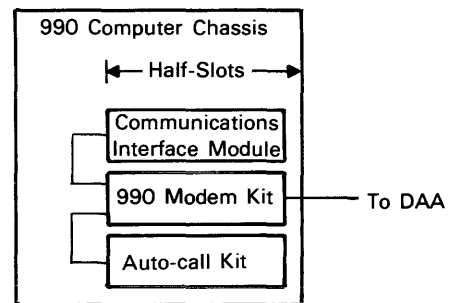
Character size is selectable from 5 to 9 bits with programmable parity (odd, even, or none). Other features include line-break detection/generation, 250-millisecond timer, programmable SYN, DLE stripping, false-start bit detection, selection of 1-, 1 1/2-, or 2-stop bits, and programmable self-test.

Bell Data Set Interface Kit

---

[1]Asynchronous operation of the communications module requires systems-level software which TI does not provide.

39
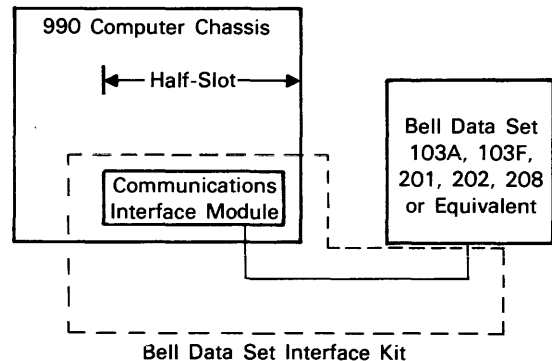
The 990 Communication Interface Module requires a half-slot in the 990 chassis, and interfaces to the CRU bus. The installation and operation manual supplied with this module also covers the 990 Asynchronous Modem and the 990 Synchronous Modem, below.

Bell Data Set Interface Kit includes 990 Communications Interface Module, installation and operation manual, and a 9.1-m (30-ft.) cable that interfaces to the following Bell Data Sets (or equivalent):

Asynchronous	Synchronous
Bell 103A or F (300 baud)	Bell 201 (2400 baud)
Bell 202 (1200 baud)	Bell 208 (4800 baud)

990 Asynchronous Modem Kit provides Bell 202 equivalent (1200-baud) modem with auto answer, capable of full-duplex operation over 4-wire private line or half-duplex over DDD network. Modem provides loop-back for test. The module requires a half-slot in 990 chassis and interfaces to a 990 Communications Interface Module (not included) via top-edge connector and cable. The modem must be adjacent to the 990 Communications Interface Module in the chassis. Kit includes asynchronous modem, modem to 990 communications module cable, and 9.1-m (30-ft.) modem to DAA cable. Manual furnished with communication module covers this kit also.

990 Synchronous Modem Kit is similar to Asynchronous Modem Kit except modem is Bell 201C equivalent (2400 baud) for synchronous communication. Modem provides internal clock and loop-back for self-test.

Auto-call Kit provides for CPU calling via dial pulse or tone signals to telephone switching circuitry. The module plugs into a half-slot in 990 chassis and interfaces to modem (synchronous or asynchronous) by a top-edge cable. Auto-call module must be adjacent to modem in the chassis. Kit includes auto-call module, auto-call to modem cable, and installation and operation manual.

Item	Description	Comments
710	990 Communications Interface Module	
711	Bell Data Set Interface Kit	
712	990 Asynchronous Modem Kit	Requires Item 710
713	990 Synchronous Modem Kit	Requires Item 710
714	Auto-call Kit	Requires Item 710 and Item 712 or 713

EIA Data Modules

EIA data modules provide a general-purpose 16-bit parallel input-output interface between 990 computer and any external device or devices that require EIA signal levels. Jumper wire option card provides options of 16 inputs and 16 outputs or 15 inputs, 14 outputs, and one maskable interrupt.

Interrupt request may be polled regardless of the state of the interrupt mask. Module requires a half slot in the 990 chassis and interfaces to CRU bus. Top edge mates to connectors listed with hardware accessories. Manual is included.

Inputs	Outputs	Maskable Interrupt	Signal Transition Trigger Internal
16	16	No	N/A
15	14	Yes	Hi/Lo
15	14	Yes	Lo/Hi

Item	Description
720	16 I/O EIA Data Module
721	16 I/O EIA Data Module with Hi/Lo Interrupt
722	16 I/O EIA Data Module with Lo/Hi Interrupt

TTL Data Modules

TTL data modules provide two-way parallel interface between 990 computer and devices that require TTL interface signals. Jumper wire option on card provides options for 16 inputs and 16 outputs or 15 inputs, 14 outputs, and one maskable interrupt. Interrupt request may be polled regardless of the state of the interrupt mask. Module requires a half slot in 990 chassis and interfaces to CRU bus. Top edge mates to ribbon-cable connector. Kit includes module and 3.7-m (12-ft.) ribbon cable with connectors installed and manual.

Item	Description
730	16 I/O TTL Data Module
731	16 I/O TTL Data Module with Hi/Lo Interrupt
732	16 I/O TTL Data Module with Lo/Hi Interrupt
733	16 I/O TTL Data Module with Pull-Up

Inputs	Outputs	Maskable Interrupt	Signal Transition Trigger Internal
16	16	No	N/A
15	14	Yes	Hi/Lo
15	14	Yes	Lo/Hi
16	16	3K Pull-Up	Resistor on Input

D/A Converter Kits

The D/A Converter Modules generate one to four analog output signals. Output voltage (or current) of each channel is independently commanded via CRU to any value in output range within 12-bit resolution. For the voltage option, the output stage regulates voltage into 2K or larger resistance for the current option, the output stage regulates current into 500-ohm or smaller resistance. Switch-selectable output ranges are as follows:

Voltage	Current Range
±10.24	±20.48 MA
±5.12	±10.24 MA
0 to 10.24 V	0 to 20.48 MA
0 to 5.12 V	0 to 10.24 MA

Settling time to 1/2 LSB is 10 microseconds maximum for voltage output. Slew rate is 10 volts per microsecond. Module requires a half slot in 990 chassis and interfaces via CRU bus. Top edge connects to connectors listed with hardware accessories. Installation and operation manual and appropriate converter module are included in each kit.

Item	Description
740	D/A Converter Kit, 1 Channel
741	D/A Converter Kit, 2 Channel
742	D/A Converter Kit, 3 Channel
743	D/A Converter Kit, 4 Channel

A/D Converter Kits

The A/D Converter Module provides 16 to 64 analog input lines. When commanded by CPU, the module reads a channel and represents the voltage as a 12-bit binary number. Use one input line for single-ended or a pair of input lines for differential channels. Maximum throughput rate is 27,500 (single-ended) channels per second. On-board switches select ±10.24, ±5.12, 0 to 10.24, or 0 to 5.12-volt range. Module requires a half slot in 990 chassis and interfaces to CRU bus. Top edge mates to connectors listed with hardware accessories. Use small or large metal hood connector for 16-channel module and use only large metal hood for all other A/D modules. Installation and operation manual and appropriate module are included in each kit.

Item	Description	Number of Channels Single Ended	Differential
745	A/D Converter Kit, 16 Channels	16	8
746	A/D Converter Kit, 32 Channels	32	16
747	A/D Converter Kit, 48 Channels	48	24
748	A/D Converter Kit, 64 Channels	64	32

32-Bit Input and Output Modules

32-Bit Input/Transition Detection Module Kit monitors up to 32 TTL input lines. Any or all of the lines (16 at a time) may be read by the 990 CPU. The module can generate an interrupt when a transition occurs on any line and supply address and current state of the interrupting line. A programmable mask determines which lines generate an interrupt on transition, or the entire board may be masked.

The module requires a full slot in the 990 chassis, although it physically occupies only a half slot. The module uses all 32 CRU channels dedicated to a full slot. The top edge mates to two ribbon cable connectors on the termination panel cables described below. The kit includes the module and installation and operation manual.

32-Bit Output Data Module Kit provides 32 buffered output lines, each of which may be addressed as a single line or as a member of a group of two to sixteen lines. Open collector transistors on the output are capable of sinking 200 milliamperes and holding off up to 50 volts dc. This half-size module requires a full slot in the 990 chassis, because it utilizes all 32 CRU channels dedicated to the slot. The module interfaces to two ribbon cable connectors on the termination panel cables described below. Kit includes module and installation and operation manual.

Digital I/O Termination Panel Kit provides the necessary space for terminating 16 digital input or output channels. The panel consists of 16 "cells", one per channel. Each cell provides pads for installing resistors, capacitors, diodes, jumper wires, and optical isolators. Connection to digital input or digital output cards is by means of ribbon cable. Connection to external devices is by means of terminal strips, one per cell. Kit contains panel, schematic for panel, rackmount kit, assembly drawing for rackmount kit, and cable. When used with the 32-bit input module or the 32-bit output module, two kits per module are required to terminate all available channels. This kit is not compatible with the 16 I/O TTL Data Module.

Item	Description
750	32-Bit Input/Transition Detection Kit
751	32-Bit Output Data Kit
752	Digital I/O Termination Panel Kit, 3-m (10-ft.) Cable
753	Digital I/O Termination Panel Kit, 4.6-m (15-ft.) Cable
754	Digital I/O Termination Panel Kit, 6.1-m (20-ft.) Cable

41

990 5MT/6MT
Serial Interface

990 5MT/6MT Serial Interface Module Kits. The 990 5MT/6MT interface module and the associated 990 computer can provide the monitor and control functions normally provided by the 5TI Programmable Sequencer and the 5TI Programmer in a 5TI Programmable Control System. The module is capable of controlling up to 256 output points and monitoring 256 input points as provided by the 5TI I/O System.

The module is implemented as a half-size 990 CRU board. The module requires 32 CRU address locations and must always be used in the P2 side half-slot. The corresponding P1 connector must always be empty.

Kit consists of the 5MT/6MT interface module, one installation and operation manual, and the appropriate cable for interconnecting the module to I/O expanders.

The cable used to connect the 5MT/6MT interface module to the 5TI I/O system splits into two serial lines, each line consisting of up to 128 input and/or 128 output points. Each line must connect directly to a 5TI I/O expander. The 5MT/6MT modules, are then connected to the expander.

The following components of the 5TI I/O system are available from TI, Attleboro, Massachusetts:

5TI	I/O Expander
5MT	Input Modules
5MT	Output Modules
5MT	Mounting Base
5TI	Logic Interface Module
6MT	Input Modules
6MT	Output Modules
6MT	Mounting Base
6MT	Logic Interface Modules
5TI	I/O Cable

Item	Description
760	990 5MT/6MT Serial Interface Kit, 3.1-m (10-ft.) Cable
761	990 5MT/6MT Serial Interface Kit, 4.6-m (15-ft.) Cable
762	990 5MT/6MT Serial Interface Kit, 6.1-m (20-ft.) Cable

Mass Storage

Model FD800 Interface Kit
Includes CRU controller module and a 3.66-m (12-ft.) cable assembly to interface up to two drives.

Model FD1000 Interface Kit
Includes FD1000 TILINE controller module and a 3.05-m (10-ft.) cable assembly to interface to up two drives.

Model DS10 Disk Interface Kit
Includes TILINE disk controller which can control up to two disk drives and cables to interface up to one DS10 disk drive.

Model DS25 Disk Interface Kit
Includes TILINE disk controller with 4.57-m (15-ft.) bus cable and 6.1-m (20-ft.) radial cable to interface up to four DS25 drives.

Model DS50 Disk Interface Kit
Includes TILINE disk controller with 4.57-m (15-ft.) bus cable and 6.1-m (20-ft.) radial cable to interface up to four DS50 drives.

Model DS200 Disk Interface Kit
Includes TILINE disk controller with 4.57-m (15-ft.) bus cable and 6.1-m (20-ft.) radial cable to interface up to four DS200 disk drives.

Model 979A Magnetic Tape Transport Interface Kit, 800 bpi
Includes TILINE tape controller and 4.57-m (15-ft.) primary cable to interface up to four Model 979A, 9-track, 800-bpi NRZI tape transports.

Model 979A Magnetic Tape Transport Interface Kit, 1600 bpi
Includes TILINE tape controller and 4.57-m (15-ft.) primary cable to interface up to four Model 979A, 9-track, 1600-bpi PE tape transports.

Item	Description
770	Model FD800 Interface Kit
771	Model FD1000 Interface Kit
773	Model DS10 Disk Interface Kit
776	Model DS25 Disk Interface Kit
777	Model DS50 Disk Interface Kit
778	Model DS200 Disk Interface Kit
779	Model 979A Magnetic Tape Transport Kit, 800 bpi
780	Model 979A Magnetic Tape Transport Kit, 1600 bpi

Peripheral Interfaces

Model 743 KSR Interface Kit
Includes CRU interface card and 9.14-m (30-ft.) cable to interface a 743 KSR terminal.

Model 733 ASR Interface Kit
Includes CRU interface card and 9.14-m (30-ft.) cable to interface a 733 ASR terminal.

Model 810 Printer Interface Kit
Includes CRU card and 9.14-m (30-ft.) cable to interface a Model 810 Printer.

Model 820 KSR Interface Kit
Includes CRU interface card and 9.14-m (30-ft.) cable to interface a Model 820 KSR Terminal.

Model 2230/2260 Line Printer Interface Kit
Includes CRU card and cable to interface 2230 or 2260 line printers.

Model 804 Card Reader Interface Kit
Includes CRU card and 8.53-m (28-ft.) cable to interface a Model 804 Card Reader.

Item	Description
790	Model 743 KSR Interface Kit
791	Model 733 ASR Interface Kit
792	Model 810 Printer Interface Kit
793	Model 820 KSR Interface Kit
794	Model 2230/2260 Line Printer Interface Kit
795	Model 804 Card Reader Interface Kit

Cabinetry and Accessories

Equipment Enclosures

Texas Instruments offers a coordinated line of enclosures that blend with modern office decor. This line includes a single-bay pedestal, a single-bay desk, and a double-bay desk. Each of these units has a rugged, neutral-white work surface with a simulated walnut-grain comfort edge. The frames are textured charcoal color, and the removable rear and side panels are light gray. Any blank panels are textured white. All the enclosures feature standard 483-mm (19-in.) EIA rackmount space for easy installation of equipment.
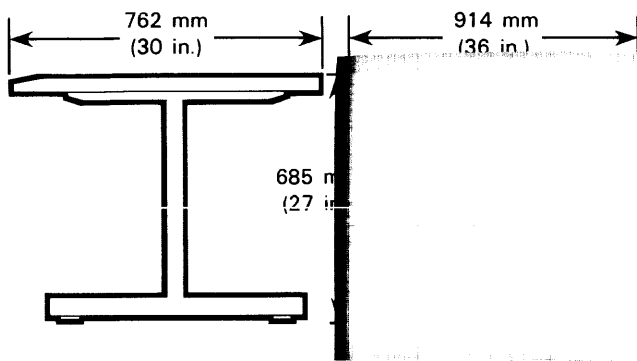
Item	Description
800	Single-bay Equipment Desk
801	Double-bay Equipment Desk
802	Single-bay Pedestal
803	Rackmount Cabinet
809	System Console Table

Blank Front Panels

These standard EIA panels may be used to cover vacant equipment mounting space in 483-mm (19-in.) cabinets. These are not required for standard TI packaged systems. Blank panel requirements may be determined on the configuration worksheets in the Configuration Guide.

Item	Description
804	45-mm (1.75-in.) Blank Front Panel
805	89-mm (3.50-in.) Blank Front Panel
806	178-mm (7.00-in.) Blank Front Panel
807	222-mm (8.75-in.) Blank Front Panel
808	227-mm (10.50-in.) Blank Front Panel

762 mm (30 in.)   914 mm (36 in.)   685 mm (27 in.)

Single-bay Pedestal

The single-bay pedestal is the basic element of all the office enclosures. The pedestal has 622 mm (24.5 in.) of EIA rackmount space. A cable slot at the rear of the work surface provides an unobtrusive cable route from desktop equipment, such as a display terminal, to the rackmounted equipment. A cable plug fills the slot if desktop to bay cabling is unnecessary.

The side and rear panels are slotted to allow sufficient movement of cooling air through the equipment bay. A minimum of 305 mm (12 in.) of side clearance and 153 mm (6 in.) of rear clearance are required for convection cooling of the equipment bay. Two pedestals can be placed side-by-side if the intervening side panels are removed to allow unrestricted air flow.

483 mm (19 in.)
784 mm (31 in.)
622.3 mm (24.5 in.)

- 115 Vac Power Strip
- 15 A Circuit Breaker
- Removable Air Filter
- Office-Environment Decor

610 mm (24 in.)
NEMA 5-15P 3-Prong 15 A 115 Vac Plug
787 mm (30 in.)
Service Access
584 mm (23 in.)
762 mm (30 in.)

44
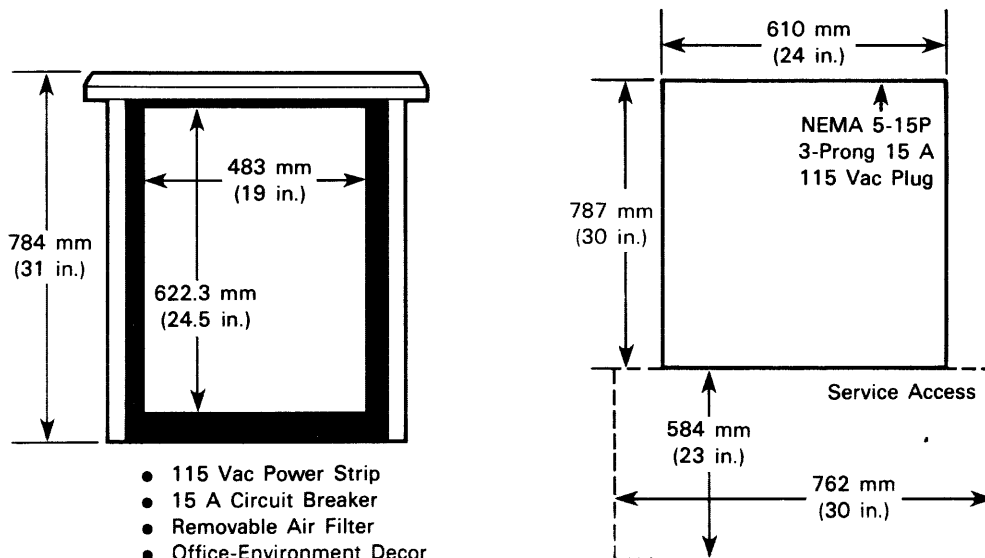
Single-bay Desk

The single-bay desk has a 622-mm (24.5-in.) mounting space enclosure at the right side. The work surface is 1.37 m (54 in.) long with a cable access slot above the equipment bay. The power and cable entry panel is identical to the single-bay pedestal power entry. A 15-ampere circuit breaker, with a protective guard, is located on a power panel in the rear. Right side and rear clearance requirements are identical to the single-bay pedestal clearances.

- 115 Vac Power Strip
- 15 A Circuit Breaker
- Removable Air Filter
- Office-Environment Decor
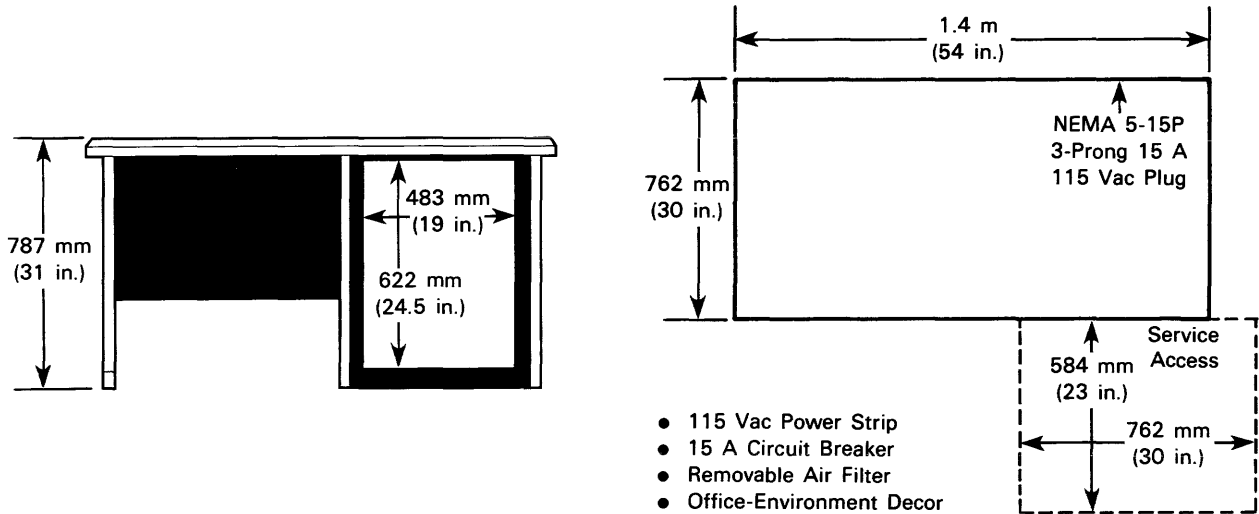
Double-bay Desk

The double-bay desk features a 1.8-m (71.6-in.) work surface and two bays, each with 622.3 mm (24.5 in.) of EIA rackmount space. Cable cutouts are provided above each equipment bay, and a cable path between the bays is concealed behind the kneehole. The desk is composed of two equipment bays and the center kneehole and power entry module. A protected 15-ampere circuit breaker in the rear provides control of ac power. A minimum of 305 mm (12 in.) of side clearance (left and right) and 127 mm (5 in.) of rear clearance is required for convection cooling of the cabinet.

- 115 Vac Power Strip
- 15 A Circuit Breaker
- Removable Air Filter
- Office-Environment Decor

45
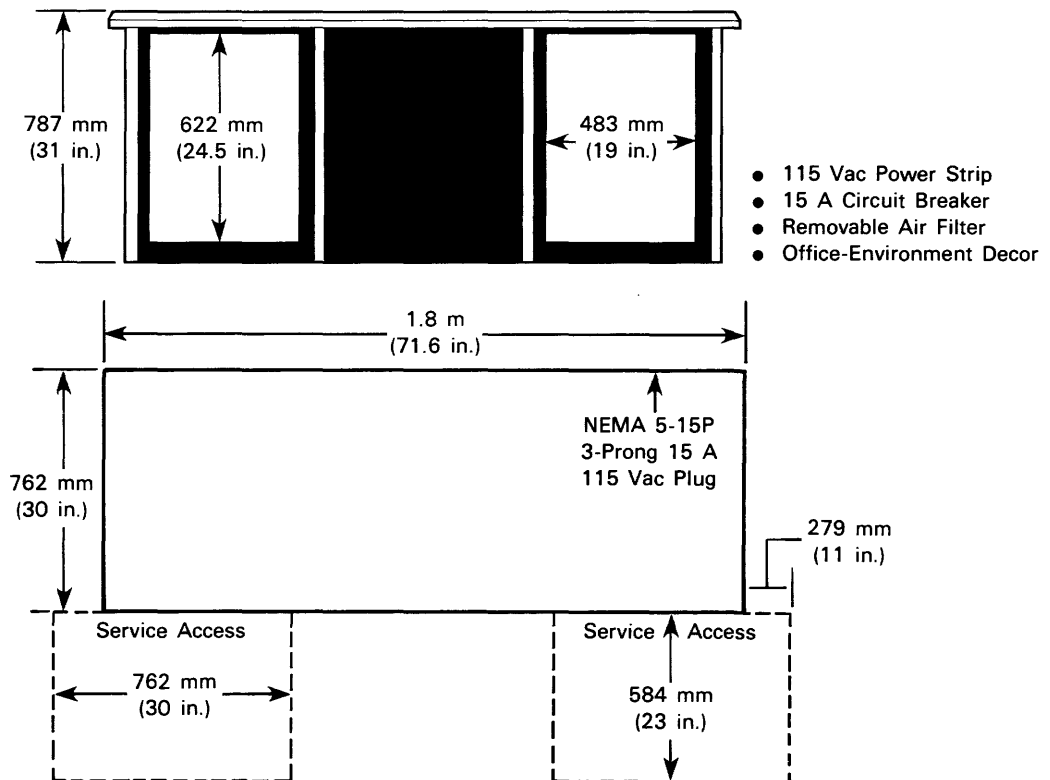
Rackmount Cabinet

For computer-room environments, Texas Instruments offers a functional rackmount cabinet with 1.6 m (63 in.) of standard 483-mm (19-in.) EIA rack space. The removable door panels are light gray and the frame is charcoal gray.

Cooling air is drawn into the cabinet through a large, washable aluminum filter on the rear door and exhausted by an enclosed 600-cfm fan at the top of the cabinet. A minimum 153 mm (6 in.) of rear clearance is required for proper air flow, and a clearance of 153 mm (6 in.) above the exhaust fan is also required.

The cabinet is capable of exhausting approximately 2000 watts or 6826 Btu/hour of heat with a clean air filter. When configuring cabinet layout, consider obstructions that create dead air space, start-up power for equipment such as DS10, and maximum heat load within the enclosure.

Cables and ac power enter the cabinet through a panel on the rear of the cabinet. The signal cable entry has a built-in adjustable strain-relief clamp. Ac power enters the cabinet via a recessed twist-lock connector and a 3-m (10-ft.) heavy duty 3-wire power cable, requiring a NEMA 5-20 power outlet. Power is controlled by a 20-ampere circuit breaker on the power input panel. An ac power distribution strip is mounted in the cabinet. The circuit breaker allows a 200 percent overload for 2.5 seconds.

A 610-mm (24-in.) arc of clear area behind the cabinet is required to open the rear door. The bottom of the door is 133 mm (5.25 in.) above floor level (with casters installed). If the rear door is not to be opened, a smaller clearance may be provided. Standard front to rear mounting dimension for rails is 610 mm (24 in.).

If installation is purchased on an order for 990 equipment and a rackmount cabinet (Item 803 only), appropriate blank panels are installed without additional charge to cover vacant spaces in the cabinet.
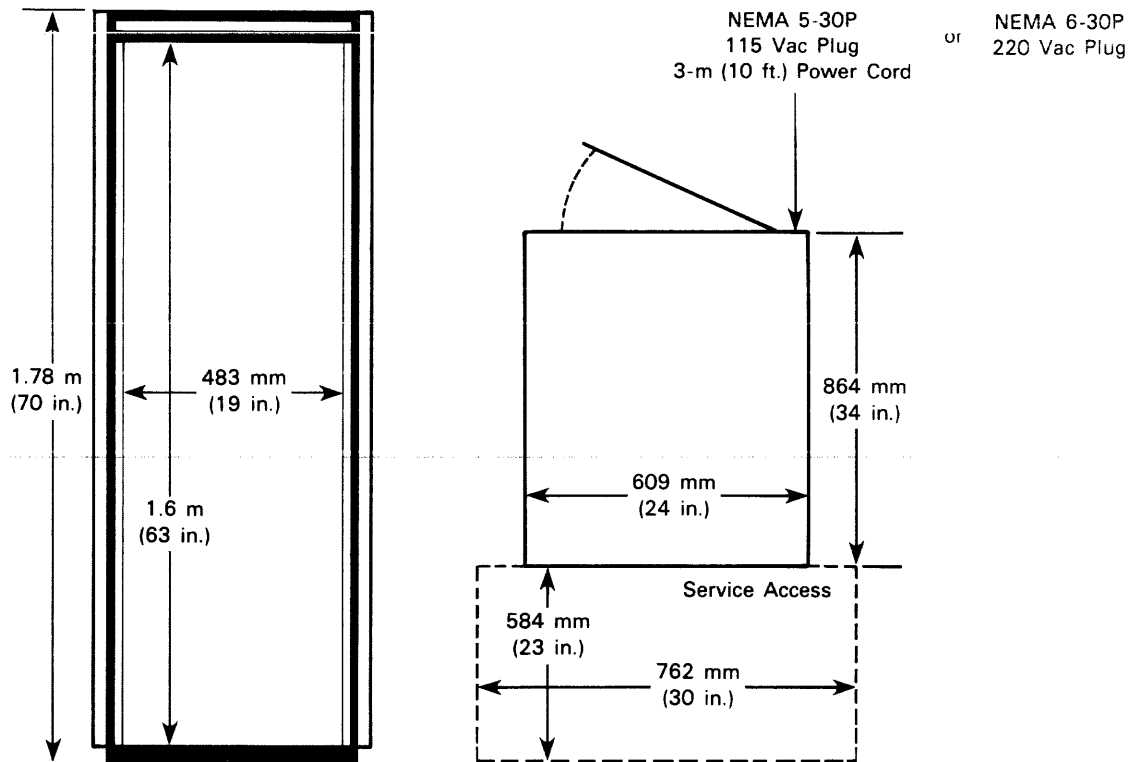
- 115 Vac Power Strip
- 20 A Circuit Breaker
- Removable Air Filter
- 600-cpm Blower
- Casters and Levelers

Note: The top two inches of a full-size cabinet are unuseable unless a mag tape drive occupies the upper section of the cabinet.

46

Hardware Accessories

CRU Expansion Chassis

CRU expansion kits extend the CRU bus from the 990/12, 990/10, 990/5, or 990/4 chassis into an expansion chassis. The expansion chassis supplies power, cooling, and interconnect wiring for standard CRU modules. The expansion chassis, which measures 311 mm H x 483 mm W x 610 mm D (12.25 in. x 19 in. x 24 in.), is identical to the 13-slot 990 chassis with operator panel. The CRU buffer module occupies one full slot, leaving 12 full slots available for CRU interface modules. Center card guides (Item 840) allow subdivision of full slots into half slots, up to a maximum of 24 half-slots.

CRU bus expansion requires a full-slot CRU expander in the 990/12, 990/10, 990/5, or 990/4 chassis. A single expander can service up to seven expansion chassis. CRU data transfer rate in the expansion chassis is 250K bytes per second. Contact your TI field sales representative regarding configuration constraints when using two or more expansion chassis.

Master kit provides one expansion chassis, CRU expansion card, CRU buffer card, and a 3.6-m (12-ft.) expansion/buffer interconnecting cable. System hardware reference manuals furnished with 990/4, 990/5, 990/10, and 990/12 CPUs cover installation and operation of the CRU expansion kits.

CRU secondary kit is identical to master kit except CRU expander card is not included.

CRU Expansion Kit

Kit includes CRU Expansion PCB, one CRU Buffer PCB, and one 3.6-m (12-ft.) CRU expansion ribbon cable. CRU Expansion PCB has one additional cable connector to allow expansion up to a total of two expansion chassis by utilizing one Item 883 and 884 for each expansion required. Power: CRU Expansion +5 V (0.9 A), CRU Buffer +5 V (0.5 A). Space: full slot/chassis.

CRU Expansion PCB

CRU Expansion PCB plugs into the 990 CPU chassis and provides interface for CRU expansion. One CRU Expansion PCB has connectors for up to two expansion chassis. Cables not included. Power: +5 V (0.9 A). Space: full slot.

CRU Buffer PCB

CRU Buffer PCB plugs into CRU expansion chassis and interfaces that chassis to CRU Expansion PCB in CPU chassis. Cables not included, see Item 884. Jumper options include vectored or direct interrupts, module select, internal or external clock. Power: +5 V (0.05 A). Space: full slot.

CRU Expansion Cable Kit

Kit consists of one 3.6-m (12-ft.) CRU expansion ribbon cable with connectors. Connects one Item 882 to Item 883.

Item	Description	Comments
810	CRU Expansion Master Kit	First CRU expansion kit
811	CRU Expansion Secondary Kit	Second CRU expansion kit
880	CRU Expansion Kit	
882	CRU Expansion PCB	
883	CRU Buffer PCB	
884	CRU Expansion Cable Kit	
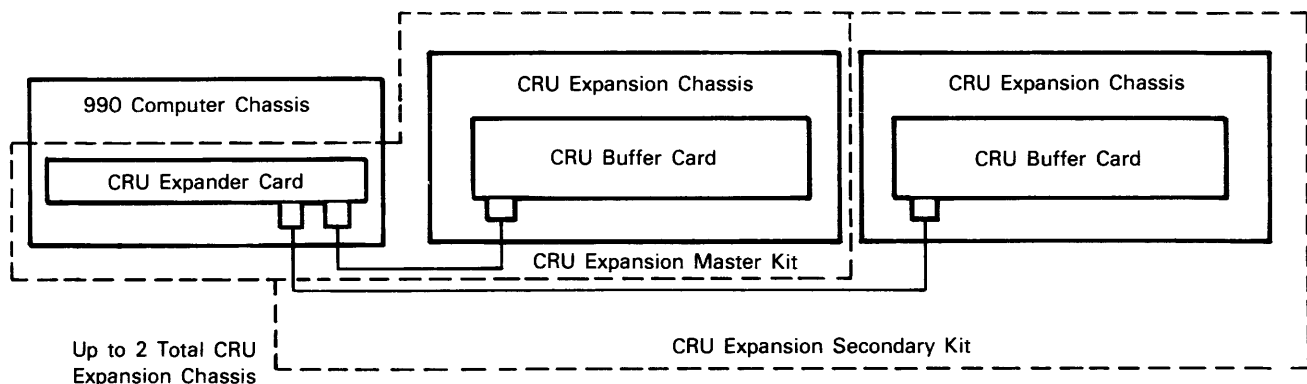
TILINE Expansion Chassis

TILINE kits link TILINE bus between 990/10 or 990/12 chassis. TILINE Expansion Kit provides expansion chassis with power, cooling, and wiring to support standard TILINE modules such as memory and magnetic tape controllers. Expansion chassis measures 311 mm H x 483 mm W x 610 mm D (12.25 in. x 19 in. x 24 in.) and is identical to a CPU chassis with operator panel. Chassis provides 12 full slots for TILINE modules. Data transfers to module in expansion chassis require 0.5 microseconds longer than same cycle in CPU chassis. Expansion kit supplies one expansion chassis, two TILINE coupler modules requiring one full slot in computer chassis and one full slot in TILINE expansion

chassis, and 3.6-m (12-ft.) interconnecting cable. Manual furnished with 990/10 or 990/12 CPU covers installation and operation of TILINE expansion.

TILINE Interface kit provides two TILINE coupler modules and 3.6-m (12-ft.) interconnecting cable and is used to connect TILINE bus between CPU chassis or second CPU to TILINE expansion chassis. The TILINE interface kit may be used with either of the CRU expansion kits to provide an expansion chassis with both CRU and TILINE buses.

Item	Description	Comments
820	TILINE Expansion Kit	Includes Item 821
821	TILINE Interface Kit	
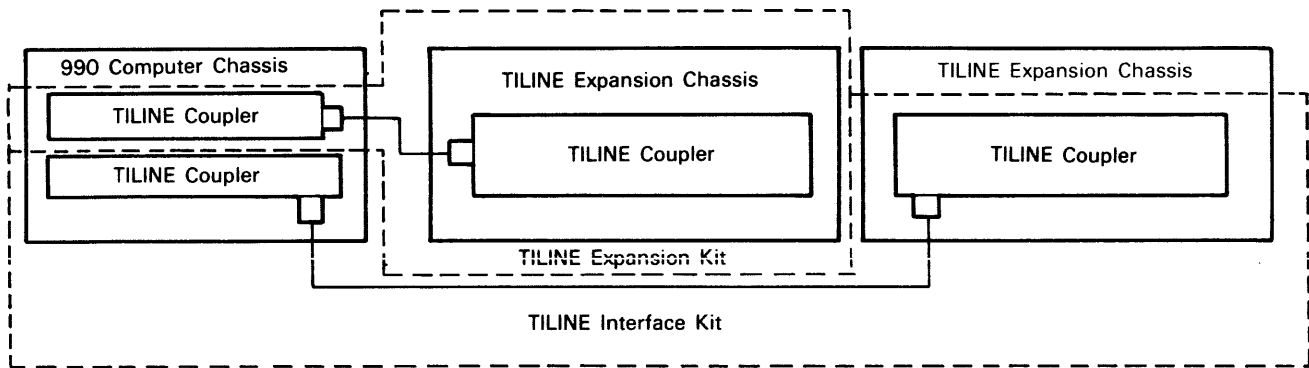
Chassis Center Card Guide Kit (6-, 13-Slot Chassis)

Includes one center card guide and all necessary hardware to allow subdivision of a single slot into two half-size board positions. Used on 6-slot chassis starting with serial number 0291001556 and 13-slot chassis starting with 0294001075 (all current shipments).

Chassis Center Card Guide kit (3-Slot Chassis)

Same as Item 840, but for use on any 3-slot chassis or 6- or 13-slot chassis prior to the serial numbers shown above.

Universal Wire-Wrap Board, Full Size

Board is full-size, 362 mm × 260 mm (14.25 in. × 10.25 in.), development card that conforms to the circuit board specifications for a double-connector board. Board contains 13 rows of 15 locations for mounting either 14- or 16-pin ICs, two rows of locations for mounting 20-, 24-, 28-, or 40-pin ICs, and ample space for associated discrete components. Wire-wrap pins on the reverse side of the circuit board allow interconnection in any required configuration.

Universal Wire-Wrap Board, Half Size

Board is half-size, 260 mm × 178 mm (10.25 in. × 7 in.)

development card. Ample space is provided for associated discrete components. Wire-wrap pins on the reverse side of the circuit board allow interconnection of the circuits in any required configuration. Board contains 20 rows of 80 pins that allow 50 locations for 14/16 pin ICs. Larger ICs and discrete components may also be mounted with 200-mil spacing.

Free Matrix Universal Wire-Wrap Board, Full Size

This board is a full-size, 362 mm × 272 mm (14.25 in. × 10.7 in.) double-ended development card that conforms to the circuit board specifications for a double connector board. Board contains a free matrix row-column pattern. There are 22 pairs of columns containing 80 pins each, suitable for ICs with 7.6-mm (0.3-in.) pin spacing. An additional column of 80 pins is located on each side of the board for ICs with 10.2-mm (0.4-in.) pin spacing. The middle of the board contains four additional columns of 78 pins for ICs with staggered pin patterns such as the SN74S481. The top edge of the card will accept either ribbon connector cables or EIA-compatible connectors. Wire-wrap pins on the reverse side of the circuit board allow interconnection in any required configuration.

Free Matrix Universal Wire-Wrap Board, Half Size

Board is half-size, 260 mm × 178 mm (10.25 in. × 7 in.) double-ended development card. Board contains a free matrix row-column pattern. There are ten pairs of columns containing 80 pins each, suitable for ICs with 7.6-mm (0.3-in.) pin spacing. An additional column of 80 pins is located on each side of the board for ICs with 10.2-mm (0.4-in.) pin spacing. The middle of the board contains four additional columns of 78 pins for ICs with staggered pin patterns such as the SN74S481. The top edge of the card will accept either ribbon connector cable or EIA-compatible connectors. Wire-wrap pins on the reverse side of the circuit board allow interconnection in any required configuration.

Full-Size Extender Card

This full-slot extender board facilitates in-house maintenance and allows operation of any full-slot card external to the chassis. Extending 990/4 CPU also requires front panel extender cable. 990/10 CPU requires 990/10 CPU extender cables and front panel extender cable.

Half-Size Extender Card

The half-slot extender card is a board that facilitates in-house maintenance, and allows operation of any half-slot card external to the chassis.

990/10 CPU Extender Cables

This item includes one 50-pin and one 34-pin extender cable for extending 990/10 AU interconnect cables when extending one AU board.

Front Panel Extender Cable

This cable extends front panel cable when CPU is mounted on extender card.

Tabletop Programmer Panel

Tabletop programmer panel facilitates in-house maintenance on systems with operator panels.

6-Slot Chassis with Operator Panel, 20 A

178-mm (7-in.) rackmounting chassis and fans with 5-volt, 20-ampere power supply (115 Vac). Contains room for six full-size logic boards. Each board position may be subdivided for two half cards within addition of Item 840. Operator Panel is a key lock switch with power off-on-load functions only. Chassis can be used for either CPU chassis or for I/O expansion chassis. Power Available: +5 V (20.0 A), +12 V (2.0 A), -12 V (1.0 A). Space: 178 mm × 622 mm (7 in. × 24.5 in.).

6-Slot Chassis with Programmer Panel, 20 A

178-mm (7-in.) rackmounting chassis and fans with 5-volt, 20-ampere power supply (115 Vac). Contains room

for six full-size logic boards. Each board position may be subdivided for two half cards with addition of Item 840. Programmer panel gives user full control of the CPU and enables user to modify and examine memory from the front panel. Requires a ROM loader kit to provide front panel firmware utility. Power Available: +5 V (19.7 A), +12 V (2.0 A), -12 V (1.0 A). Space: 118 mm × 622 mm (7 in. × 24.5 in.).

13-Slot CPU Chassis with Operator Panel, 40 A, 40°C

311-mm (12.25-in.) rackmounting chassis with power supply (115 Vac) and cooling fans for ambient temperatures up to 40°C. Contains room for 13 full-size logic boards. Twelve positions may be subdivided for two half cards with the addition of Item 840. Operator panel is a key lock switch with power off-on-load function only. Chassis can be used for either CPU chassis or as an expansion chassis. Power Available: +5 V (40.0 A), +12 V (4.0 A), -12 V (2.0 A). Space: 311 mm × 622 mm (12.25 in. × 24.5 in.).

13-Slot Chassis with Programmer Panel 40 A, 40° C

311-mm (12.25-in.) rackmounting chassis with power supply (115 Vac) and cooling fans for ambient environment temperatures up to 40° C. Contains room for 13 full-size logic boards. Twelve positions may be subdivided for two half cards with the addition of Item 840. Programmer panel is firmware controlled with addition of the appropriate CPU and PROM loader kit. Power available: +5 V (40.0A), +12 V (4.0 A), -12 V (2.0 A). Space: 311 mm x 622 mm (12.25 in. x 24.5 in.)

Item	Description
840	Chassis Center Card Guide Kit (6-, 13-slot Chassis)
842	Universal Wire-Wrap Board, Full Size
843	Universal Wire-Wrap Board, Half Size
844	Free Matrix Universal Wire-Wrap Board, Full Size
845	Free Matrix Universal Wire-Wrap Board, Half Size
846	Extender Card, Full Size
847	Extender Card, Half Size
848	990/10 CPU Extender Cables
849	Front Panel Extender Cable
850	Tabletop Programmer Panel
851	6-Slot Chassis with Operator Panel, 20 A
852	6-Slot Chassis with Programmer Panel, 20 A
855	13-Slot CPU Chassis with Operator Panel
856	13-Slot Chassis with Programmer Panel
864	Extended capacity standby power supply, 13-slot chassis

Connector Kits

The 72-pin connector kits are required by 16 I/O EIA, D/A and A/D modules (top-edge interface). Kit includes connector, cover, hood, and hardware. The plastic hood is preferred and should be used where the required wires can be packed into a 19-mm (0.75-in.) diameter tubing sheath. The small metal hood accommodates a 13-mm (0.5-in.) diameter tubing sheath.

Item	Description	Comments
860	Connector Kit, Small Plastic Hood	For D/A converter
861	Connector Kit, Small Metal Hood	For A/D or D/A converter
862	Connector Kit, Large Metal Hood	For A/D converter with 32 or more channels

Software

This section provides a product description for each of the standard software products available for the 990 computer family and Series 700 Distributed Processing Systems. Information is provided under the following headings:

Description—A product description summary for each product listing key features

Applications—Intended applications environment

Components—Software components included

Prerequisites—Minimum hardware and software configuration required to use the software

Expansion—Maximum system expansion configuration.

More detailed information about software products is located in software data sheets available upon request from your local TI field sales representative.

For pricing and ordering information including part number, price, format, and distribution media, refer to the appropriate item number in the Computer Family Price List. Each software product is available only on the media specifically listed for that product.

Software License

All software products offered in this price list are licensed. Reproduction or installation and use on CPUs of licensed software products, including the programs and documentation, in whole or in part, is prohibited except as authorized by the software license contained in TI's applicable terms and conditions or quantity purchase agreement.

Software Support

Subscription/Support Service—The licensed software includes a subscription/support service providing software updates for one year following purchase. Annual subscription/support service is available after the initial one-year term by payment of the subscription/support fee listed for each software product in the price list. The subscription/support fee provides a one-year renewal of subscription/support service for a software product. The service is initiated with the initial copy purchase of that product.

Subscription support service provides customers with the benefit of additional features or improvements made available through new releases of the software product for a one-year period. Subscribers are also entitled to assistance from the TI Support Line. For further details, consult the software section of the price list.

Training—Regularly scheduled programming courses on the 990 computer family are offered by the TI Education and Development Center. Self-study courses are also available. Consult the education subsection under Customer Service.

Software Installation—The software license of 990 system software, where so specified in the price list, will include installation support. This support will consist of verifying TI software operation in accordance with the TI-supplied installation procedure.

Hardware installation by a TI customer engineer is a prerequisite for software installation support.

Travel expense for software installation will be subject to the same terms and conditions applying to hardware installation described under Customer Services.

Delivered Software

Software is provided on the media specifically listed for that product in the price list. A complete set of user manuals is provided.

In addition to object format named in the price list, source packages for most software are available for developing custom functions. A source package requires assembly and linking on the appropriate program development system prior to execution. Unless indicated otherwise for a particular package, a DS990 Model 4 or larger system is required. Some source packages also require Pascal for development. Pricing and information concerning source software can be obtained from local TI sales representatives.

Source is protected by license and is nontransferable in source format.

Item 211 TX990 Operating System

TX990 is a memory-resident, multitasking executive constructed of linkable object modules (many of which are optional) that allow the system to be tailored to support only the features desired. Features include four levels of priority task scheduling, interrupt handling, I/O processing, supervisor call processing, operator communications, and diskette file management for sequential and relative record files.

TX990 provides a memory-resident target system for dedicated assembly-language or FORTRAN IV application programs developed with TXDS or DX10 software systems, and Pascal applications developed on DX10 only. Multiple application tasks can be linked with TX990, and a single task can be installed dynamically.

Item 220 TXDS Diskette System

TXDS software is a diskette system including the TX990 multi-tasking executive with diskette file management for sequential and relative record files, a complete set of assembly-language software development utilities, plus copy/concatenate, PROM programmer, BNPF/high-low dump, and IBM diskette conversion utilities. The TXDS control program provides prompts and interactive program control.

TXDS provides single-user program development capabilities in assembly language or FORTRAN IV and provides a target system for diskette-based OEM applications. Pascal applications may be developed on DX10 to operate under TXDS. TX990 can be separated from TXDS to provide a memory-resident executive system for programs developed under TXDS or DX10. Firmware development is provided if the optional PROM Programmer hardware is selected.

Item 221-222 TX990 3780/2780 Emulator

The TX990 3780/2780 Emulator Communications package provides remote job entry binary synchronous communications capability with an IBM 360/370 host computer using 3780/2780 at a compatible baud rate or another 3780/2780 Emulator-equipped 990 computer. Communications consist of exchanging data files between master and slave stations over leased point-to-point or switched telephone lines. Data transmission is in EBCDIC (conversion to ASCII is transparent to user) in half-duplex mode at line speeds up to 9600 bps. It provides for unattended operation over switched lines and may be operated as a host or slave station.

The TX990 3780/2780 Emulator operates under the TXDS operating system and is sold on a single-density flexible diskette. It provides IBM 3780 and IBM 2780 communications emulation between an FS990 system and an IBM 360/370 host or to another FS990 system or DS990 system equipped with a 3780/2780 Emulator Communications package.

Components	Prerequisites	Expansion	Comment
A minimum TX990 requires a task scheduler, interrupt handler, and supervisor call interface. Optional modules include additional supervisor calls, logical I/O, operator communications, and diskette file management.	A minimum TX990 system requires a 990/4, 990/5, 990/10, or 990/12 computer with at least 8K-byte memory. Development requires the use of a DX10 or TXDS development system.	64K bytes maximum memory on 990/5 and 990/10 and 56K bytes maximum memory on 990/4; 911 video display terminal; 733 ASR/743 KSR data terminal; 810, 2230, or 2260 printer; FD800 diskette; 804 card reader.	TX990 is also included as part of the TXDS system software, Item 220.
TXDS software includes the TX990 Operating System, two-pass assembler, text editor, linker, debug package, sysgen program, and diskette file management. Additional utilities include the IBM diskette format conversion, PROM programmer, BNPF/high-low dump, and cross-reference utilities.	990/4, or 990/10, computer with 48K-byte memory; or 990/5 computer with 64K bytes; 911 video display terminal, dual FD800 flexible-disk drives and PROM loader.	56K-byte maximum memory on 990/4 or 64K-byte maximum memory on 990/5, 990/10 or 990/12; 911 video display terminals (single user only for development); four FD900 flexible-disk drives; 810, 2230, or 2260 printer; 733 ASR/743 KSR terminal; 804 card reader; PROM programmer; TXDS FORTRAN IV, Pascal run-time, TX 3780/2780 Communications.	TXDS software is included as part of the FS990/4 and FS990/10 systems (Item 110 and 112).
TX990 3780/2780 Emulator Communications package consists of two loadable tasks containing the device service routine, emulator functions, and operator interface software for a 3780 emulator and a 2780 emulator.	FS990 system with 48K bytes of memory (minimum). TI Communications Interface module P/N 945105-0001) and TI Synchronous Modem (P/N 945094-0003) or Bell Data Set Interface (P/N 945104-0002) for use with non-TI modems (i.e., Bell 201B, C, or 208A compatible).	810 printer, additional 911 video display terminals.	

TX5 Operating System

The TX5 Operating System is a memory-resident, multitasking executive with double-density flexible-disk and disk file management for sequential and relative record, DX10-compatible files. TX5 includes task scheduling, interrupt handling, I/O processing, supervisor call processing, and utility support compatible with the TXDS system. A TXDS to TX5 conversion utility is also included.

The TX5 Operating System is designed to support small system applications based on the DS990 Models 1 and 2, 990/5, or 990/10 computer, with TILINE, and dual-density flexible disk. TX5 supports development in assembly language, BASIC, and FORTRAN IV. Pascal run-time support is also available.

Components	Prerequisites	Expansion	Comment
The TX5 Operating System includes all of the components of the TX990 operating system plus DX10 compatible, sequential and relative record file management, and a screen-oriented text editor.	DS990 Model 1, Model 2, 990/5, or 990/10 computer with 64K bytes memory; 911 video display terminal or other supported I/O terminal; double-density flexible disk or DS10 disk.	64K-byte maximum memory, 911 video display terminals, four FD800 flexible-disk drives, 820 KSR printer, 733 ASR and 743 KSR terminals, 810, 2230, and 2260 line printers, 804 card reader; TX5 BASIC, TX5 FORTRAN, Pascal run-time, TX5 3780/2780 communications.	TX5 software is included as part of the DS990 Model 1 and 2 systems.

Also included are the following presysgened, ready-to-run configurations:
(Item 226 DS10 media)
990/5 CPU, 64K bytes, 911 VDT, 810 printer, and DS10 disk drive;
(Item 226 DSDD media)
990/5 CPU, 64K bytes, 911 VDT, 810 printer, and FD1000 diskette drive;
990/5 CPU, 64K bytes, 820 KSR, FD1000 DSDD diskette drive;
990/10 CPU, 64K bytes, 911 VDT, 810 printer, FD1000 DSDD diskette drive;
(Item 227 DS10 media)
990/10 CPU, 64K bytes, 911 VDT, 810 printer, and DS10 disk drive
(Item 226 DSDD media)
DS990 Model 1 with 810 printer and dual FD1000 diskette drives
DS990 Model 2 with 810 printer, two 911 VDTs, and dual FD1000 diskette drives
DS990 Model 2 with two 820 KSR terminals and dual FD1000 diskette drives
(Item 226 DS10 media)
DS990 Model 2, 810 printer, two 911 VDTs, and DS10 disk drive

Item 230

DX10 Disk System

DX10 is designed for a wide range of commercial and industrial applications on the 990/10 or 990/12 minicomputer, FORTRAN, COBOL, BASIC, and Pascal languages are available for application programming. A Sort/Merge package, Data-Base Management System, Query, and a forms programming language are also available. Programs can also be developed using assembly language or FORTRAN to execute on the smaller diskette-based or memory-resident members of the 990 family for OEM applications. Both interactive (3780) and batch (3780/2780) communications are available options.

DX10 is designed for a wide range of commercial and industrial applications on the 990/10 minicomputer. FORTRAN, COBOL, BASIC and Pascal languages are available for application programming. A Sort/Merge package is also available. Programs can also be developed using assembly language or FORTRAN to execute on the smaller diskette-based or memory-resident members of the 990 family for OEM applications.

Item 231-232

DX10 3780/2780 Emulator

The DX10 3780/2780 Emulator Communications package provides remote job entry binary synchronous communications capability with IBM 360/370 host computer using 3780/2780 at a compatible baud rate or another 990 computer equipped with 3780/2780 emulator. Communications consist of exchanging data files between master and slave stations over leased point-to-point or switched telephone lines. Data transmission is in EBCDIC (conversion to ASCII is transparent to the user) in half-duplex mode at line speeds up to 9600 bps. It provides for unattended operation over switched lines and may be operated as a host or slave station.

The DX10 3780/2780 emulator operates under the DX10 operating system and is sold on a variety of disk media or mag tape. It provides IBM 3780 and IBM 2780 communication emulation between a DS990 Model 4 (or higher) and an IBM 360/370 host, another DS990 system or FS990 system equipped with a 3780/2780 Emulator Communication package.

Item 233

DX10 3270 Interactive Communications Software

The DX10 3270 Interactive Communications Software provides the DS990 family of packaged minicomputer systems with interactive remote communications to an IBM host by emulating a subset of the IBM 3270 Communications System.

The DX10 3270 ICS operates under the DX10 multitasking disk operating system and supports any combination of eight emulated display stations and printers using Model 911 Video Display Terminals and DX10-supported printers. User-supplied tasks may also assume the identity of an emulated display or print station. DX10 3270 ICS provides emulation of an IBM 3271 Control Unit (Model 2), IBM 3277 Display Station/keyboards (Model 2), and IBM 3284 Printers (Model 2).

Components	Prerequisites	Expansion	Comment
DX10 system executive; logical I/O including extended 911 VDT support, interpreter for interactive and batch operation; program development utilities including interactive text editor, macro assembler, link editor, and debug package; system log; and file management including sequential, relative record, and multi-key-indexed files.	990/10 or 990/12 with mapping; 128K bytes of memory; 911 video display terminal; DS10 disk or dual DS25 or DS50 disks; selectable system disk PROM loader.	2M bytes maximum memory; 911 video display terminals; 810, 2230, 260 printers; 733 ASR/743 KSR terminals; 979A mag tape drives; 800 or 1600 bpi; DS31, DS10, DS25, DS50 disk drives; FD800 flexible-disk drives (physical I/O only); FD1000; 804 card reader; FORTRAN IV; COBOL; BASIC: Sort/ Merge; Pascal; RPG II; DBMS 990; Query; TI-FORMS; 3270/2780; DX10 3270 ICS.	DX10 software is included as part of the DS990 systems (Items 140, 141, 144, and 146).
DX10 3780/2780 Emulator Communications package consisting of a system resident device service routine and loadable tasks that include emulator and operator interface functions.	DS990 Model 4 (or higher) with 128K bytes of memory, TI Communications Interface module (P/N 946104-0001) and TI Synchronous Modem (P/N 945094-0003), or Bell Data Set Interface (P/N 946104-0002) for use with non-TI modems (i.e., Bell 201B, C, or 208A compatible).		
990 Interactive Communications Software (ICS) package.	DS990 Models 4 and above, TI Communications Interface Module (P/N 946104-0001) and TI Synchronous Modem (P/N 945094-0003) or Bell Data Set Interface (P/N 946104-0002) for use with non-TI modems (i.e., Bell 201B, C, or 208A compatible).		

TX FORTRAN IV

TX FORTRAN is designed to allow development of FORTRAN programs on 990 TXDS software system. The TX FORTRAN IV compiler is an enhancement of ANSI standard X3.9-1966 including optimization, debug options, and program development features. Run-time support is included for TXDS.

TX FORTRAN compiler operates under the TXDS system software. Compiler can be linked to other 990 code for execution on 990 target systems under control of TXDS or TX990 system software or stand-alone with user-supplied I/O.

TX5 FORTRAN IV

TX5 FORTRAN provides the same features as TX FORTRAN above, with the exception that the TX5 operating system is required.

TX5 FORTRAN compiler operates under the TX5 system software.

Components	Prerequisites	Expansion	Comment
TXDS FORTRAN compiler and run-time library.	FS990 system; 990/4 with 48K-byte memory, 990/5, 990/10, or 990/12 with 48K byte memory; 911 video display terminal; dual FD800 flexible disks; TXDS system software.		DX10 FORTRAN IV also incorporates all the modules in TXDS FORTRAN IV.
TX FORTRAN compiler and run-time library.	990/5 or 990/10 with 64K-byte memory; 911 video display terminal; dual FD1000 flexible disks; TX5 system software; DS990 Models 1 and 2		

Description	Application

Item 241 DX10 FORTRAN IV

DX10 FORTRAN IV is an enhancement of ANSI FORTRAN IV (X3.9-1966) adding ISA-recommended extensions (ISA-S61.1-1975 and S61.2-1976) and other useful program development aids including direct access I/O and debug options. The DX10 FORTRAN optimizing compiler operates under the DX10 Disk System Software, which allows concurrent execution of many FORTRAN programs. Overlay capability is provided. A math and statistical package is also included.

DX10 FORTRAN compiler operates under the DX10 Disk System Software. Run-time library allows execution of compiled FORTRAN programs under DX10 and TX990 Operating Systems, limited stand-alone (no operating system), or with a user-written operating system.

Item 242 DX10 COBOL

The DX10 COBOL compiler/interpreter is a business-oriented, multiuser, high-level computer language that conforms to ANSI COBOL subset X3.23-1974 (level 1 nucleus, table handling, and sequential I/O) and adds useful higher level extensions including interactive video display terminal I/O, relative- and key-indexed I/O, library, segmentation, interprogram communications, and debug aids.

The DX10 COBOL multiterminal compiler interpreter operates under the DX10 Disk System Software and is structured to handle large data files and typical business records.

Item 243 DX10 990 BASIC

DX10 990 BASIC is an enhanced ANSI standard (X3.60-1978) business-oriented, interpretive, interactive computer language designed to run under the DX10 operating system. Extensions included are subprograms, image formats, virtual arrays, breakpoint command, file I/O, cursor addressing, lowercase letters, decimal type, trace, and multiline functions.

DX10 990 BASIC is an interactive language designed for multiuser development and execution under the DX10 Disk Operating System. DX10 990 BASIC applications can also be developed to execute on smaller DS990 systems.

Item 244 DX10 Sort/Merge Utility

The DX10 Sort/Merge utility provides full, address, key and summary sorts and full and summary merges on up to five input files. Sequence, record length, record selection, and reformatting are all user selectable. The replacement selection algorithm efficiently handles large volumes of data and nearly sorted data.

Sort/Merge operates under the DX10 Disk System Software and is accessible as a utility under DX10 in interactive and batch mode or called from COBOL, FORTRAN, BASIC, or assembly language programs.

Components	Prerequisites	Expansion	Comment
FORTRAN IV compiler and run-time library.	Compiler—DS990 system, 990/10 or 990/12 disk system with 128K-byte memory; 911 video display terminal; DX10 Disk System Software.		DX10 FORTRAN IV also incorporates all the modules in TXDS FORTRAN IV.
COBOL compiler and run-time interpreter.	DS990 system, 990/10, or 990/12 disk system with 128K bytes memory; 911 video display terminal; DX10 Disk System Software.		
Basic Interpreter, DX10 Disk Operating System.	DS990 System, Model 4 (or higher) with 128K bytes of memory.		
Control Statement Compiler Module, Record Selection and Reformatting Module, Sort Module, Merge Module, and Summary Module.	DS990 System, 990/10 or 990/12 disk system with 128K byte memory; 911 video display terminal; DX10 Disk System Software.		

Item 245   990 Diagnostic Kit

The 990 diagnostic package includes tests for the 990 computer family.

    Each diagnostic package contains all available central processor, memory, and standard peripheral tests in object code format with documentation.

The 990 diagnostic package supports 990 family 990/4, 990/5, and 990/10 users who desire to perform their own equipment maintenance.

Item 246   990 RPG II

The 990 RPG II is a business-oriented report generator which has been designed to be closely compatible with the popular IBM System/3 RPG II. Special features of 990 RPG II include an RPG II-oriented source editor for interactive program generator or modification, numerous extensions to the System/3 RPG II, and an IBM RPG II flexible-disk conversion utility.

The 990 RPG II is intended for existing users who have outgrown their current RPG II system or who desire the added capability of utilizing other languages as well as RPG II.

Item 247   TI 990 Pascal

TI 990 Pascal is a higher level language characterized by a high degree of readability, excellent bit-manipulation capabilities, and the ability to handle complex user-defined data structures. It is ideally suited for the development of systems software and scientific or engineering applications. Its block structure format facilitates program design using structured programming concepts.

The TI 990 Pascal compiler operates under the DX10 Disk Operating System. The run-time library allows execution of a compiled Pascal program to execute under DX10, TX990, or TX5 operating systems.

Components	Prerequisites	Expansion	Comment
Cassette Package—Each cassette of the kit contains multiple versions of a particular diagnostic. For example, the object code for different versions of the line printer diagnostic would reside on one cassette. *Card Package*—The kit includes a card deck for each diagnostic. *Diskette Package*—Each diskette contains multiple diagnostics and is labeled to show their contents. Each diskette also contains software to help the operator specify, load, and execute the resident diagnostics. *DS31, DS10, DS25, DS50 Disk Packages*—All diagnostics related to the 990 family are packaged on a single disk pack. A software package is provided to help the operator specify, load, and execute the resident diagnostics.	990/4, 990/5, 990/10, or 990/12 computer; I/O device compatible with selected input media; ROM loader for selected I/O device.		
990 RPG II compiler and run-time; IBM RPG II flexible disk conversion utility; RPG II text editor.	DS990 System; 990/10 or 990/12 disk system with 128K-byte memory; 911 video display terminal; DX10 Disk System Software.		
TI 990 Pascal Compiler and Run-time Library.	DS990 Model 4 (or higher) with 128K bytes of memory.		

Item
248

TI DBMS-990 Data-Base Management System

The TI DBMS-990 is designed to support commercial data-base applications where a need exists for a more organized and centralized control of a company's data assets. It facilitates data-base maintenance by eliminating redundant data storage. It allows greater usability of data by providing a structure which defines and provides access to the data in a format that can be directly equated to commonly used business documents and records. Application programs can access the data base without being constrained by physical storage requirements which are addressed when the data base is originally defined. This allows changes to the data base without affecting existing programs that access the data base.

The TI DBMS-990 operates in a DX10 operating system environment. It provides user interface by means of its Data Definition Language (DDL) and its Data Manipulation Language (DML). DDL is used to define the data base and its associated data elements. DML provides the application program with the means to access and manipulate data in the data base by imbedding the appropriate DML syntax in a COBOL, Pascal, or FORTRAN application.

Item
249

Query-990

Query-990 is an inquiry/report language which provides interactive access to data stored in the DBMS-990 data-base management system. Selection of desired data is provided via high-level Query-990 commands. Both guided and nonguided query are provided to suit the experience level of the user. Query-990 provides capabilities for both interactive viewing or printed reports.

The Query-990 language is intended for a wide range of applications, any of which require frequent access to data, based upon a variety of criteria. It is particularly useful for one-time accesses. Its ease of use reduces reliance upon programming staff resources to repetitively generate such information.

Item
250

TIFORM 990

The TIFORM 990 forms package is a generalized forms package that allows the interactive data entry application designer to separate the man/machine interface from the application's procedural logic. It provides the capability to define the video display terminal screen formats by means of the Form Description Language. The result is compiled to produce object code which is executed by the Form Executor which provides the interface between the application and the data terminal.

TIFORM operates in a DX10 operating system environment. It allows interactive or batch design of screen formats to produce source in the Form Description Language which specifies screen layouts (segments) and individual field specifications. The application program interfaces with the form by means of calls to the Form Executor from assembly language or a higher level language (i.e., COBOL, FORTRAN, Pascal).

Components	Prerequisites	Expansion	Comment
TI DBMS-990 software package.	DS990 Model 6 (or higher) with 128K bytes of memory.		
Query-990 language processor.	DS990, 990/10, or 990/12 disk system with 128K bytes of memory; 911 video display terminal; DX10 disk system software; DBMS-990 Data-Base Management System software.		.
TIFORM 990 package and run-time interface package.	DS990 Model 4 (or higher) with 128K bytes of memory.		

Item 260   TX BASIC

TX BASIC is a business-oriented interpretive, interactive computer language. The interpreter conforms to ANSI standard (X3.60-1978) and incorporates extensions to enhance its use in business applications. These extensions include subprograms, image formats, virtual arrays, breakpoint command, file I/O, cursor addressing, lowercase letters, decimal type, trace, multiline functions, local variables, time function, If-Then-Else, and assembly language subroutines.

TX BASIC is sold as a stand-alone package on a single flexible disk (single-sided, single-density) which includes the TX BASIC interpreter and a presysgened subset of TXDS to support a standard configuration. Several utilities such as disk copy, disk initialize, and map disk are included. It provides for single-user application development and multiuser execution.

Item 263   TX5 BASIC

TX5 BASIC provides the same features as TX BASIC.

TX5 BASIC is sold as a stand-alone package on either double-sided, double-density diskette or DS10 disk media.

Item 266-267   TX5 3780/2780 Emulator

The TX5 3780/2780 Emulator Communications package provides the DS990 Models 1 and 2 with remote job-entry binary synchronous communications capability with an IBM 360/370 host computer or using 3780/2780 at a compatible baud rate or another 990 computer equipped with 3780/2780 Emulator. Communication consists of exchanging data files between master and slave stations over leased or switched telephone lines. Data transmission is in EBCDIC (conversion to ASCII is transparent to the user) in half-duplex mode at line speeds up to 9600 bps. It provides for unattended operation over switched lines and may be operated as a host or slave station.

The TX5 3780/2780 Emulator operates under the TX5 operating system and is sold on a DSDD flexible disk. It provides IBM 3780 and IBM 2780 communications emulation between a DS990 Model 1 or Model 2 and an IBM 360/370 host or any other DS990 system equipped with a 3780/2780 Emulator communications package.

Components	Prerequisites	Expansion	Comment
BASIC interpreter and pre-sysgened TXDS subset. Also included are the following presysgened ready to run, configurations: (Item 260 Diskette media) 990/10 or 990/4 CPU 48K bytes or more, 810 printer 911 VDT, dual FD800 diskette drives 990/5 CPU, 810 printer, 911 VDT, dual FD800 diskette drives 771/1 with 810 printer 771/2 with 810 printer 774/1 with 810 printer and (4) 911 VDTs 774/2 with 810 printer and (4) 911 VDTs	FS990 system with 48K bytes or 56K bytes of memory, 771, or 774.	810 printer, additional 911 video display terminals.	
BASIC interpreter and pre-sysgened TX5 subset. (Item 263 DSDD media) DS990 Model 1 with 810 printer and dual FD1000 diskette drives DS990 Model 2 with 810 printer, two 911 VDTs, and dual FD1000 diskette drives DS990 Model 2 with two 820 KSR terminals, and dual FD1000 diskette drives. (Item 263 DS10 media) DS990 Model 2, 810 printer, two 911 VDTs, and DS10 disk drive.	DS990 Model 1 or 2 with 64K bytes of memory.	810 printer; additional 911 video display terminals.	
The TX5 3780/2780 Emulator communications package consists of two loadable tasks containing the device service routine, emulator functions, and operator interface software for an IBM 3780 emulator and an IBM 2780 emulator.	DS990 Model 1 and Model 2, TI communications interface module (P/N 946104-0001), and TI synchronous modem (P/N 945094-003) or Bell Data Set Interface (P/N 946104-0002) for use with non-TI modems (i.e., Bell 201 B, C, or 208A compatible)		

Item 5230, 5250 6038, 1700 Terminal Programming Language (TPL)

TPL is the application programming language developed specifically for VDT-oriented data entry and local preprocessing. It combines a powerful, fill-in-the-blanks, forms package for data-entry applications, with a high-level, English-like procedure language for data processing applications. The two modules may be used separately, or the resulting object programs can be merged or linked into a total system. Thus, the advantages of each module can be realized in any type of applications task.

TPL 700 Forms allows a non-computer-oriented operator to draw a form on the video display unit for subsequent data-entry transactions. TPL 700 Procedures offers the application programmer a high-level, English-like language for easy generation, compilation, and testing of processing programs and complex field-validation programs directly on the video display unit.

Item 5232, 5252, 6044, or 1744 TTY Emulator

The TTY Emulator packages enable a Model 770, 771, 774, or DS1 operating under TPL to communicate with time-sharing services and host computers that use TTY protocol half- or full-duplex up to 1200 bps.

The TTY Emulator allows the operator to communicate interactively using the keyboard and display or may cause data to be transmitted from or recorded onto user-specified files on the diskettes.

Item 5234, 5254, 6041, or 1709 IBM 3780/2780 Emulator

The IBM 3780/2780 Emulator packages enable the Model 770, 771, 774, or DS990 Model 1 user to communicate with a host computer by using a synchronous communications kit. This option kit enables the user to communicate with other DS990 systems, Series 700 systems, or other computers with corresponding emulators using IBM synchronous communications protocol.

This point-to-point communications package features support of transparency mode, destination device selection, and space compression/expansion.

Item 5236, 5256 or 6047 742 Emulator

The 742 Emulator packages enable the Model 770, 771, and DS990 Model 1 to communicate with the Terminal Polling System (TPS) offered by TI, using a synchronous block protocol. The TPS will automatically poll Model 1 systems, Models 770 and 771 Intelligent Terminals, and Model 742 Programmable Data Terminals via the switched telephone network, and record the received data on IBM-compatible magnetic tape.

This system allows the tasks of data collection and distribution to be removed from the host computer, resulting in a completely independent terminal network.

Components	Prerequisites	Expansion	Comment
A complete set of system support and program development utilities is provided with the TPL system.	Model 770, Model 771,774, or DS990 Model 1		
The TTY communications kit includes a user's manual and a diskette that contains both the TTY emulator and TTY parameter-selection utility program.	Model 770, Model 771, Model 774, or DS990 Model 1		
The IBM 3780/2780 communications kit includes a user's manuals and diskette with the emulator and parameter-selection utility programm.	Model 770, Model 771, Model 774, or DS990 Model 1		
The 742 communications kit includes a user's manual and diskette that contains both the 742 emulator and the 742 parameter-selection utility programs.	Terminal Polling System, DS990 Model 1, Model 770, or Model 771		

Documentation

Hardware Manuals

All 990 computer family hardware products are fully documented in one or more of three types of manuals: installation and operation, field maintenance, and depot maintenance.

Installation and Operation Manual

The purpose of an installation and operation manual is to present specific information regarding the correct procedures and site preparation required for the successful installation of the hardware peripheral. An overview of the physical, electrical, and operational characteristics of the peripheral, including both the hardware device and its associated computer interface, are included. In addition, the software requirements are detailed to assist the customer who intends to develop customized application software drivers as opposed to using the standard TI operating system(s) device service routine(s).

Field Maintenance Manual

The field maintenance manual outlines the preventive maintenance procedures required to maintain the computer and/or peripherals in good operating condition and presents equipment malfunction troubleshooting techniques. In general, the maintenance procedures are intended to resolve equipment problems at the assembly or boardswap level.

Depot Maintenance Manual

Depot maintenance manuals present detailed electrical and mechanical data to allow circuit-level diagnosis and resolution of equipment malfunctions.

			Item Number				
Install. and Oper.	Field Maint.	Depot Maint.	Description	Install. and Oper.	Field Maint.	Depot Maint.	Description
9030	9031	9032	990/4 Microcomputer	9020	1	9021	PROM Programmer
9035	—	—	990/5 Microcomputer	9015	—		FS990
9050	9051	9052	990/10 Microcomputer	9025	—	—	DS990
9055	9056	9057, 9058, 9059	990/12 Minicomputer	9140	—	9141	TTY/EIA
				9145	—	9146	990 Communications
				9150	—	9151	Autocall Unit
9070	1	9071	FD800 Flexible Disk	9160	—	9161	16 I/O EIA
9075	1	9076	FD1000 Flexible Disk	9162	—	9163	16 I/O TTL
9080	—	—	DS10 Disk	9170	—	9171	A/D, D/A
—	—	9081	DS10 Disk Controller	9175	—	—	32 I/O Module
9085	—	—	DS25/50 Disk	9180	—	—	990 5MT/6MT I/F
—	—	9086	DS25/50 Disk Controller				990 Family Drawings
9060	—	—	979A Tape System	—	—	9000	Volume I—Processors
9061	—	—	979A Tape Transport	—	—	9001	Volume II—Peripherals
—	—	9063	979A Tape Transport Subsystem	—	9002	—	900 Peripherals
				—	9003	—	990 Diagnostic Handbook
—	—	9062	979A Tape Controller	—	—	—	990 External ACU I/F
9100	—	9101	911 VDT				
9105	—	9106	743 KSR				
9110	1	9111	733 ASR				
9115	—	—	810 Printer				
9120	—	—	820 KSR Printer				
9125	—	—	2230/2260 Line Printer				
9130	1	—	804 Card Reader				
—	—	9131	Card Reader I/F				

[1]Included in *Model 990 Computer Peripheral Equipment Field Maintenance Manual*, Item 9002.

Software Manuals

All 990 computer family software is fully documented in one or more of the following types of manuals: system operation guides, user guides, programmer's guides, reference cards, and installation procedures.

System Operation Guides

A system operation guide is provided with each of the packaged systems for the 990 computer family. This manual links together the hardware components of the system with the software that accompanies it and describes the concepts required to effectively use the system. This information includes installation instructions, procedures for verifying that the system is operating effectively, plus operating instructions for using each of the software packages in conjunction with the hardware included with the system.

User Guides

User guides provide information about individual software packages that are not ordinarily used in conjunction with a specific system. Each guide contains a description of the functions and capabilities of the package as well as detailed instructions for effectively using the package.

Programmer's Guides

Programmer's guides provide complete, detailed coverage concerning an operating system or programming language. These guides provide all the information an experienced programmer requires to interface with the 990 computer family through the subject medium.

Reference Cards

These handy pocket-size cards condense the essential information necessary to program the computer. These cards list the instruction set and give formats for the different instructions, as well as summarizing other helpful concepts.

Installation Procedures

These procedures supply the information necessary to initially install a software package into a system.

See the price list for descriptions, part numbers, and pricing of all available software manuals. Note that at least one set of applicable manuals is supplied with each software package.

Configuration Guide

This section provides technical guidelines to ensure that desired hardware and software components can be integrated into an operational configuration. The section is subdivided into three parts:

- Configuration diagrams
- Chassis planning
- Cabinet planning

Configuration Diagrams

There are four configuration diagrams, one for each 990 CPU. These diagrams illustrate conceptual configuration requirements. Consider the example of the 990/10 CPU at the top center of the 990/10 diagram. The 990/10 CPU consists of two boards that are illustrated as two boxes: 990/10 AU and 990/10 memory interface. There are two optional memory interface boards, one with mapping and one without; hence the note. The memory interface board connects to the TILINE and CRU buses, and the 990/10 AU board connects only to the memory interface (via top edge) as shown. The programmer panel connects to the memory interface board and requires the ROM panel utility routine support; therefore, the diagram shows the programmer panel connected to the ROM that connects to the memory interface board.

These diagrams show limited detail and you must refer to the item descriptions in the Product Description section to determine all the relevant facts. For example: the connection between DX10 and the 979A tape transports simply means that DX10 software can be provided on magnetic tape. The DX10 item description lists the prerequisites for DX10 operation disk, operator's terminal, memory size, and others.

Custom System Generation

The TX990 and DX10 operating systems for a mass storage peripheral must be available on the medium and must be bootstrap loaded for immediate operation. The system must meet the minimum configuration requirements specified for that item. See the item description for minimum requirements. In addition to the linked, loadable, executable program, these packages also include linkable object modules and the software to link these modules into a custom-tailored operating system. Thus, for example, the prelinked operating system includes program development facilities such as an assembler, which a user might wish to

leave out of a target/production system to reduce memory and disk requirements. Also, some of the optional features are not in the prelinked operating system and will require a custom system generation to add these features to the operating system. The documentation included with the packages explains how to do this.

In cases where a custom sysgen is contemplated that results in a target system with lesser prerequisites than the standard prelinked operating system, you should consider the acquisition of one development system that meets the standard prerequisites. Otherwise, the problem of a substandard development system will continue for the life of the project. TI support services cannot support substandard configurations. For example, the subscription service included with all licensed software also assumes at least minimum standard prerequisites in the development system. A capability to use standard support services usually saves our customers both time and money.

Support Services

With the exception of packaged systems, the 990 computer family is "unbundled"; that is, the hardware, software, and services are priced separately, so that a customer pays only for what he needs. Most customers use some 990 support services (usually, where the cost is lower than available alternatives). When configuring 990 systems, you should consider what support services may be required and the impact of your configuration on the cost of these services. For example, TI standard maintenance rates assume that rackmounted 990 chassis will have chassis slides; otherwise, the chassis must be removed from the rack to change a circuit card, which increases the time to accomplish a repair and, consequently, increases repair charges. Our field sales offices will be happy to discuss your support requirements and the multiple support alternatives that we offer.

Add-On Options to Packaged Systems

There are a very large number of alternatives in adding options to the packaged 990 systems. In general, the addition of options should be treated as custom configurations in chassis and cabinet planning; that is, you should complete the chassis and cabinet planning forms for systems with options added. The forms specify the starting layout of the standard systems.

990/4 Configurator

Operator Panel

OR

ROM Utility Required

Programmer Panel

ROM

Static RAM

Dynamic RAM

990/4 Microcomputer

990 Chassis

DMA Bus

990/4 Memory Module

Standby Power

CRU Bus

FD800 Flexible-Disk Controller

733 ASR Interface

804 Interface

911 VDT Controller

743 or 820 Interface

2230/2260 Interface

810 Interface

PROM PROG Interface

TTY/EIA Module

Comm I/F Module

Auto-Dial Module

CRU Expander

990/5 Configurator

Operator
Panel

OR

Programmer
Panel

ROM

990/5 CPU
& Memory

Memory Size
64K bytes Total

TILINE Parity
Memory
Module

TILINE EC
Mem
Controller

TX BASIC Object

TX5 FORTRAN
Object

TX5 3780/2780
Emulator

TX5
Object

Diagnostics Object

FD1000
Flexible-disk
Chassis

FD1000
Flexible Disk
Drive

FD1000
Flexible Disk
Drive

Up to 2 Chassis
(4 Drives)

FD1000
Flexible-disk
Controller

1-2 DS10
Disk Drives

DS10
Controller

1-4 DS25
Disk Drives

DS25
Controller

1-4 DS50
Disk Drives

DS50
Controller

1-4 DS200
Disk Drives

DS200
Controller

1-4 979 Mag
Tape Transports
800 or 1600 bpi

800/1600 bpi
Mag Tape
Controller

1-4 979 Mag
Tape Transports
800 bpi only

800 bpi
Mag Tape
Controller

TILINE Coupler

TILINE Expansion Chassis

TILINE
Coupler

Standby
Power Supply

TILINE BUS

990 Chassis

CRU BUS

TXDS

FD800 Flexible-Disk Controller

Up to 2 Chassis (4 Drives)

FD800 Flexible-Disk Chassis

FD800 Flexible Disk Drive

FD800 Flexible-Disk Drive

TX990 Source

TX FORTRAN Object

TX 3780/2780 Emulator

733 ASR Interface

733 ASR Data Terminal

Diagnostics Object

TX BASIC Object

804 Interface

804 Card Reader

911 VDT Controller

911 Video Terminal

Keyboard

Second 911 Terminal with keyboard

743 or 820 Interface

743 or 820 Data Terminal

2230/2260 Interface

2230/2260 Printer

General Purpose Interface Modules connect to CRU

810 Interface

810 Printer

PROM Programmer Interface

PROM Programmer

Adapter

PROM/EPROM Device

TTY/EIA Module

RS232 I/F No Auto-Answer (Remote Terminals using DX10 DSR)

RS232 I/F Auto-Answer

Comm I/F Module

OR

Asynchronous Modem

TO DAA

Auto-Dial Module

OR

Synchronous Modem

To DAA

CRU Expander

Up to 2 Total CRU Expansion Chassis

CRU Buffer

CRU Bus

CRU Expansion Chassis

A/D Converter

16-64 in

D/A Converter

1-4 out

Analog

16 I/O EIA

16 in
16 out

EIA

16 I/O TTL

16 in
16 out

32 IN

32 in

32 OUT

32 out

TTL

5MT/6MT

5TI
5MT
6MT

Modules

990/10 Configurator

Operator
Panel

OR

Programmer
Panel

ROM

990/10
AU

990/10
Memory I/F

Memory Size:
64K bytes, No Map
2048K bytes, Mapped

TILINE BUS

TX BASIC Object

TX5 FORTRAN
Object

TX5 3780/2780
Emulator

TX5
Object

Diagnostics Object

FD1000
Flexible-disk
Chassis

FD1000
Flexible Disk
Drive

FD1000
Flexible Disk
Drive

TILINE Parity
Memory
Module

TILINE EC Mem
Array Module

TILINE *
Mem
Controller

Up to 2 Chassis
(4 Drives)

FD1000
Flexible-disk
Controller

TXDS Source

TX FORTRAN Source

DX FORTRAN Object or Source

COBOL Object or Source

BASIC Object or Source

Pascal Object or Source

SORT/MERGE Object or Source

RPG II Object or Source

3780/2780 Emulator

3270 Interactive Comm. Software

DX10 Source

Query-990

TIFORM 990

DBMS-990
Data-Base
Management
System

DX10 Object

1-2 DS10
Disk Drives

DS10
Controller

1-4 DS25
Disk Drives

DS25
Controller

1-4 DS50
Disk Drives

DS50
Controller

1-4 DS200
Disk Drives

DS200
Controller

1-4 979 Mag
Tape Transports
800 or 1600 bpi

800/1600 bpi
Mag Tape
Controller

1-4 979 Mag
Tape Transports
800 bpi only

800 bpi
Mag Tape
Controller

TILINE Coupler

TILINE Expansion Chassis

TILINE
Coupler

Standby
Power Supply

*TILINE EC or TILINE CACHE Memory Controller

78

990
Chassis

CRU BUS

TXDS

FD800 Flexible Disk Drive

FD800 Flexible-Disk Chassis

FD800 Flexible-Disk Drive

TX990 Source

TX FORTRAN Object

TX 3780/2780 Emulator

TX BASIC Object

FD800 Flexible-Disk Controller

Up to 2 Chassis (4 Drives)

733 ASR Interface

733 ASR Data Terminal

Diagnostics Object

804 Interface

804 Card Reader

911 VDT Controller

911 Video Terminal

Keyboard

Second 911 Terminal with keyboard

743 or 820 Interface

743 or 820 Data Terminal

2230/2260 Interface

2230/2260 Printer

A/D Converter — 16-64 in

D/A Converter → 1-4 out

Analog

16 I/O EIA — 16 in / 16 out

EIA

16 I/O TTL — 16 in / 16 out

32 IN — 32 in

32 OUT → 32 out

TTL

General Purpose Interface Modules connect to CRU

810 Interface

810 Printer

5MT/6MT — 5TI / 5MT / 6MT

Modules

PROM Programmer Interface

PROM Programmer

Adapter

PROM/EPROM Device

TTY/EIA Module

RS232 I/F No Auto-Answer (Remote Terminals using DX10 DSR)

RS232 I/F Auto-Answer

Comm I/F Module

OR

Asynchronous Modem

TO DAA

Auto-Dial Module

OR

Synchronous Modem

To DAA

CRU Expander

Up to 2 Total CRU Expansion Chassis

CRU Buffer

CRU Bus

CRU Expansion Chassis

990/12 Configurator

```
┌─────────────────┐        ┌──────────────┐
│  Programmer     │        │    ROM       │
│    Panel        │────────│              │
└─────────────────┘        └──────────────┘

┌─────────────────┐        ┌──────────────┐
│     990/12      │        │    990/12    │
│      AU         │────────│  Memory I/F  │
└─────────────────┘        └──────────────┘
```

Memory Size:
64K bytes, No Map
2048K bytes, Mapped

```
┌─────────────────────┐     ┌──────────────┐
│ TX BASIC Object     │     │TILINE Parity │
└─────────────────────┘     │   Memory     │
                            │   Module     │
┌──────────────┐            └──────────────┘
│ TX5 FORTRAN  │   ┌──────┐
│   Object     │───│      │  ┌──────────────┐   ┌──────────────┐
└──────────────┘   │ TX5  │  │ TILINE EC Mem│   │  TILINE *    │
┌──────────────┐   │Object│  │ Array Module │───│    Mem       │
│TX5 3780/2780 │───│      │  └──────────────┘   │ Controller   │
│  Emulator    │   └──────┘                     └──────────────┘
└──────────────┘
```

FD1000 Flexible-disk Chassis

FD1000 Flexible Disk Drive
FD1000 Flexible Disk Drive

```
┌──────────────────┐
│ Diagnostics Object│
└──────────────────┘
```

```
                              ┌──────────────┐
Up to 2 Chassis ──────────    │   FD1000     │
(4 Drives)                    │ Flexible-disk│
                              │  Controller  │
                              └──────────────┘

┌──────────────┐   ┌──────────────┐
│  1-2 DS10    │   │    DS10      │
│  Disk Drives │───│  Controller  │
└──────────────┘   └──────────────┘
```

```
┌─────────────────────┐
│   TXDS Source       │
└─────────────────────┘        ┌──────────────┐   ┌──────────────┐
                               │  1-4 DS25    │   │    DS25      │
┌─────────────────────┐        │ Disk Drives  │───│ Controller   │
│  TX FORTRAN Source  │        └──────────────┘   └──────────────┘
└─────────────────────┘

┌─────────────────────┐        ┌──────────────┐   ┌──────────────┐
│DX FORTRAN Object or │        │  1-4 DS50    │   │    DS50      │
│      Source         │        │ Disk Drives  │───│ Controller   │
└─────────────────────┘        └──────────────┘   └──────────────┘

┌─────────────────────┐
│ COBOL Object or Source│
└─────────────────────┘        ┌──────────────┐   ┌──────────────┐
                               │  1-4 DS200   │   │   DS200      │
┌─────────────────────┐        │ Disk Drives  │───│ Controller   │
│ BASIC Object or Source│       └──────────────┘   └──────────────┘
└─────────────────────┘

┌─────────────────────┐        ┌──────────────┐   ┌──────────────┐
│Pascal Object or Source│       │ 1-4 979 Mag  │   │ 800/1600 bpi │
└─────────────────────┘        │Tape Transports│──│  Mag Tape    │
                               │ 800 or 1600 bpi│  │ Controller   │
┌─────────────────────┐        └──────────────┘   └──────────────┘
│SORT/MERGE Object or │
│      Source         │
└─────────────────────┘        ┌──────────────┐   ┌──────────────┐
                               │ 1-4 979 Mag  │   │   800 bpi    │
┌─────────────────────┐        │Tape Transports│──│  Mag Tape    │
│ RPG II Object or Source│      │ 800 bpi only │   │ Controller   │
└─────────────────────┘        └──────────────┘   └──────────────┘

┌─────────────────────┐
│  3780/2780 Emulator │        ┌──────────────────────────┐   ┌──────────────┐
└─────────────────────┘        │  ┌────────────────────┐  │   │   TILINE     │
                               │  │  TILINE Coupler    │  │───│   Coupler    │
┌─────────────────────┐        │  └────────────────────┘  │   └──────────────┘
│3270 Interactive Comm.│       │ TILINE Expansion Chassis │
│      Software       │        └──────────────────────────┘
└─────────────────────┘

┌─────────────────────┐
│    DX10 Source      │
└─────────────────────┘

┌──────────┐   ┌──────────────┐
│Query-990 │───│  DBMS-990    │
└──────────┘   │  Data-Base   │
┌──────────┐   │  Management  │
│TIFORM 990│───│   System     │
└──────────┘   └──────────────┘
```

DX10 Object

TILINE BUS

*TILINE EC or TILINE CACHE Memory Controller

TXDS

17-Slot Chassis

CRU BUS

FD800 Flexible-Disk Controller — Up to 2 Chassis (4 Drives) — FD800 Flexible-Disk Chassis — FD800 Flexible Disk Drive / FD800 Flexible-Disk Drive

TX990 Source
TX FORTRAN Object
TX 3780/2780 Emulator
TX BASIC Object

733 ASR Interface — 733 ASR Data Terminal

Diagnostics Object

804 Interface — 804 Card Reader

911 VDT Controller — 911 Video Terminal — Keyboard
Second 911 Terminal with keyboard

743 or 820 Interface — 743 or 820 Data Terminal

2230/2260 Interface — 2230/2260 Printer

General Purpose Interface Modules connect to CRU

A/D Converter ← 16-64 in
D/A Converter → 1-4 out
} Analog

16 I/O EIA ← 16 in / → 16 out } EIA

16 I/O TTL ← 16 in / → 16 out
32 IN ← 32 in
32 OUT → 32 out
} TTL

5MT/6MT → 5TI 5MT 6MT } Modules

810 Interface — 810 Printer

PROM Programmer Interface — PROM Programmer — Adapter — PROM/EPROM Device

TTY/EIA Module — RS232 I/F No Auto-Answer (Remote Terminals using DX10 DSR)

RS232 I/F Auto-Answer

Comm I/F Module — OR — Asynchronous Modem — TO DAA

Auto-Dial Module — OR — Synchronous Modem — To DAA

CRU Expander — Up to 2 Total CRU Expansion Chassis
CRU Buffer — CRU Bus
CRU Expansion Chassis

Chassis Planning Form, Sheet 1

The purpose of this form is to determine whether a chassis power supply can support a particular configuration of CPU, memory, peripherals, and interfaces. This planning form is intended for rapid calculation and uses simplifications that are conservative and safe for the items listed. This form is inadequate for special circuit designs furnished by customers. Complete the following steps to find the power requirements necessary for your planned configuration. For more details, contact the local field sales office.

---

1. Use a separate copy of sheets 2 and 3 for each chassis.

2. Sheet 1 describes the chassis. Each item listed on this sheet includes a chassis. The slots and power listed on this sheet are available for peripherals and interfaces. The CPU, memory, peripherals, and interfaces furnished with the item have been subtracted from the total power and space available. The power numbers are available current in amperes. Identify the item and copy that line onto sheet 3, line C (Power Available).

3. On Sheet 3 identify the modules that may be plugged into this chassis. For each item, enter the number of modules of that type in the "quantity" column. Identify all modules and enter all quantities.

4. Working across the row for each item used, complete every box.
   Chassis Slots Required, Plan = Chassis slots per unit $\times$ quantity
   DC Power Plan, +5 V Main = DC Power per unit, +5 V Main $\times$ quantity
   +5 V Mem, +12 V Main and +12 V Mem are like +5 V Main: PLAN = UNIT $\times$ QTY.

5. Add the "PLAN" columns and enter the totals on line A, Sheet 3. Enter 5 columns: plan slots, +5 V Main, +5 V Mem, +12 V Main, and +12 V Mem.

6. Examine line C, +5 V Mem and +12 V Mem. If these columns are non-zero, then there is a standby power supply in the chassis. In this case, simply copy line A onto line B and go to step 7. If these columns are zero, then there is no standby power supply and the +5 V Mem will be connected to +5 V Main and +12 V Mem will be connected to +12 V Main. The +5 V Main power supply must support both +5 V Main and +5 V Mem and the +12 V Main must supply both +12 V Main and +12 V Mem. Add the +5 V Main and +5 V Mem figures on line A and enter the total on line B +5 V Main. Enter 0 in +5 V Mem line B. Add the +12 V Main and +12 V Mem on line A and enter the total on +12 V Main, line B. Enter 0 in +12 V Mem line B. Copy the slots required from line A to line B.

7. Compare the five entries on line B to the five entries on line C, entry by entry. If the slots and power available equal or exceed the slots and power required, then the plan is right. Otherwise, you must add one or more expansion chassis and divide the load between the chassis. Item 810 adds a CRU expansion chassis. Item 820 adds a TILINE expansion chassis. Items 810 and 821 combined add an expansion chassis with both CRU and TILINE. Use a separate copy of sheets 2 and 3 for each chassis to evaluate the power and slots for the new plan.

8. If multiple TILINE devices are to be located in the expansion chassis, a CRU expansion to that chassis is also required to support the interrupt handling of those TILINE controllers.

Chassis Planning Form, Sheet 1 (Continued)

	Item	Description			Vacant Chassis Slots Per Unit	+5 V Main	+5 V Mem**	+12 V Main	+12 V Mem**
Systems	110-113	FS990/4 System (13-Slot Chassis)			9	28.30	0	2.55	0
	114-115	FS990/10 System (13-Slot Chassis)			7	20.40	0	2.61	0
	6100-	DS990 Model 2 w/911			10	28.20	0	2.71	0
	6121	DS990 Model 2 w/820			11	32.40	0	2.95	0
	6160-6168	DS990 Model 4 (13-Slot Chassis)			7	18.03	0	2.85	0
	6170-6173	DS990 Model 6 (13-Slot Chassis)			7	16.03	0	2.85	0
	6175-6178	DS990 Model 8 (13-Slot Chassis)			7	16.03	0	2.85	0
	6210	DS990 Model 20 w/800-bpi tape			10	33.8	0	4.70	0
	6212	DS990 Model 20 w/1600-bpi tape			10	31.8	0	4.70	0
	6214	DS990 Model 20 w/dual disk			10	38.8	0	4.70	0
	6220	DS990 Model 30 w/800-bpi tape			10	33.8	0	4.70	0
	6222	DS990 Model 30 w/1600-bpi tape			10	31.8	0	4.70	0
	6224	DS990 Model 30 w/dual disk			10	38.8	0	4.70	0

	Item	*Panel*	*Chassis*	*Standby Power*	Vacant Chassis Slots Per Unit	+5 V Main	+5 V Mem**	+12 V Main	+12 V Mem**
990/4	300	Operator	6-Slot	Without	5	16.80	0	1.53	0
	301	Operator	6-Slot	With	5	17.12	1.08	1.89	0.84
	302	Operator	13-Slot	Without	12	36.80	0	3.53	0
	303	Operator	13-Slot	With	12	37.12	1.08	3.89	0.84
	304	Programmer	6-Slot	Without	5	16.53	0	1.53	0
	305	Programmer	6-Slot	With	5	16.85	1.08	1.89	0.84
	306	Programmer	13-Slot	Without	12	36.53	0	3.53	0
	307	Programmer	13-Slot	With	12	36.85	1.08	3.89	0.84

		Item	*Panel*	*Chassis*	*Standby Power*	Vacant Chassis Slots Per Unit	+5 V Main	+5 V Mem**	+12 V Main	+12 V Mem**
990/5	**32K bytes**	370	Operator	6-Slot	Without	5	17.42	0	1.47	0
		371	Operator	6-Slot	With	5	17.72	1.10	1.80	0.87
		372	Operator	13-Slot	Without	12	37.42	0	3.47	0
		373	Operator	13-Slot	With	12	37.72	1.10	3.80	0.87
		374	Programmer	6-Slot	Without	5	17.15	0	1.47	0
		375	Programmer	6-Slot	With	5	17.45	1.10	1.80	0.87
		376	Programmer	13-Slot	Without	12	37.15	0	3.47	0
		377	Programmer	13-Slot	With	12	37.45	1.10	3.80	0.87
	64K bytes	380	Operator	6-Slot	Without	5	17.17	0	1.15	0
		381	Operator	6-Slot	With	5	17.47	1.10	1.80	0.55
		382	Operator	13-Slot	Without	12	37.17	0	3.15	0
		383	Operator	13-Slot	With	12	37.47	1.10	3.80	0.55
		384	Programmer	6-Slot	Without	5	16.90	0	1.15	0
		385	Programmer	6-Slot	With	5	17.20	1.10	1.80	0.55
		386	Programmer	13-Slot	Without	12	36.90	0	3.15	0
		387	Programmer	13-Slot	With	12	37.20	1.10	3.80	0.55

	Item	*Mapping*	*Panel*	*Standby Power*	Vacant Chassis Slots Per Unit	+5 V Main	+5 V Mem**	+12 V Main	+12 V Mem**
990/10	404	With	Operator	Without	11	31.75	0	4.00	0
	405	With	Operator	With	11	31.75	2.50	4.00	4.00
	406	With	Programmer	Without	11	31.48	0	4.00	0
	407	With	Programmer	With	11	31.48	2.50	4.00	4.00
990/12	408	With	Programmer	Without	15	58.0	0	6.00	0

	Item	Description			Vacant Chassis Slots Per Unit	+5 V Main	+5 V Mem**	+12 V Main	+12 V Mem**
Expansion	810	CRU Expansion Kit			12	39.10	0	4.00	0
	820	TILINE Expansion Kit			12	38.80	0	4.00	0

Chassis Planning Form, Sheet 2

Item	Description	Qty	Chassis Slots Required Per Unit	Plan	Dc Power Per Unit Current Required in Amps +5 V Main	Mem	+12 V Main	Mem	Dc Power Plan +5 V Main	Mem	+12 V Main	Mem
320	990/4 Memory Module with 8K bytes[1]		1		0.55	0.20	0	0.50				
321	990/4 Memory Module with 16K bytes[1]		1		0.55	0.27	0	0.51				
322	990/4 Memory Module with 24K bytes[1]		1		0.55	0.34	0	0.52				
323	990/4 Memory Module with 32K bytes[1]		1		0.55	0.41	0	0.53				
324	990/4 Memory Module with 40K bytes[1]		1		0.55	0.48	0	0.54				
325	EPROM Memory Module with 2K bytes		1		0.40	0	0.10	0				
	Each additional 2K bytes EPROM		0		0.02	0	0.10	0				
410	990/10 Parity Memory, 16K bytes				0.50	0.32	0	0.71				
411	990/10 Parity Memory, 24K bytes				0.50	0.39	0	0.72				
412	990/10 Parity Memory, 32K bytes				0.50	0.46	0	0.73				
413	990/10 Parity Memory 40K bytes				0.50	0.53	0	0.74				

Chassis Planning Form, Sheet 2 (Continued)

| Item | Description | Qty | Chassis Slots Required | | Dc Power Per Unit Current Required in Amps | | | | Dc Power Plan | | | |
| | | | Per Unit | Plan | +5 V | | +12 V | | +5 V | | +12 V | |
					Main	Mem	Main	Mem	Main	Mem	Main	Mem
430	64K-byte EC Memory Subsystem		1		2.00	0.55	0	0.82				
431	96K-byte EC Memory Subsystem		1		2.01	0.55	0	0.87				
432	128K-byte EC Memory Subsystem		2		2.30	0.95	0	0.91				
433	160K-byte EC Memory Subsystem		2		2.31	0.95	0	0.96				
434	192K-byte EC Memory Subsystem		2		2.31	0.95	0	1.00				
435	256K-byte EC Memory Subsystem		2		2.32	0.95	0	1.09				
436	384K-byte EC Memory Subsystem		3		2.63	1.35	0	1.27				
437	512K-byte EC Memory Subsystem		3		2.65	1.35	0	1.45				
438	768K-byte EC Memory Subsystem		4		2.98	1.75	0	1.81				
439	1024K-byte EC Memory Subsystem		5		3.31	2.15	0	2.17				
451-459	For Cache Memory Subsystems add		1		5.00	0	0	0				
443	64K-byte EC Array Module		1		0.30	0.40	0	0.09				
444	128K-byte EC Array Module		1		0.31	0.40	0	0.18				
445	192K-byte EC Array Module		1		0.32	0.40	0	0.27				
446	256K-byte EC Array Module		1		0.33	0.40	0	0.36				
500-501	Single-Sided Single-Density Diskette Master Kits		1		3.00	0	0.20	0				
507-508	Double-Sided Double-Density Diskette Master Kits		1		4.50	0	0.20	0				
520-522	DS10 Master Kits[3]		1		6.00	0	0	0				
530	DS25 Master Kit[3]		1		8.00	0	0	0				
532	DS50 Master Kit[3]		1		8.00	0	0	0				
540	DS200 Master Kit[3]		1		8.00	0	0	0				
550	979A Master Kit, 800 bpi[3]		1		5.00	0	0	0				
552	979A Master Kit, 800/1600 bpi[3]		1		7.00	0	0	0				
610	911 VDT Kit, Single Display Controller		1		2.62	0	0.12	0				
611-612	911 VDT Kit, Dual Display Controller		1		4.20	0	0.24	0				

Chassis Planning Form, Sheet 3

Item	Description	Qty	Chassis Slots Required Per Unit	Plan	+5 V Main	+5 V Mem	+12 V Main	+12 V Mem	+5 V Main	+5 V Mem	+12 V Main	+12 V Mem
					Dc Power Per Unit Current Required in Amps				**Dc Power Plan**			
620	743 Master Kit		.5		0.38	0	0.02	0				
621	733 Master Kit		.5		0.38	0	0.02	0				
630	810 Printer Master Kit		.5		0.38	0	0.02	0				
640	820 KSR Master Kit		.5		0.38	0	0.02	0				
650-651	2230/2260 Printer Master Kit		.5		0.53	0	0.00	0				
660	804 Card Reader Master Kit		.5		0.60	0	0	0				
700	TTY/EIA Interface Module		.5		0.38	0	0.02	0				
710	990 Communication Interface Module		.5		1.50	0	0.10	0				
711	Bell Data Set Interface Kit		.5		1.50	0	0.10	0				
712	990 Asynchronous Modem Kit		.5		0.15	0	0.15	0				
713	990 Synchronous Modem Kit		.5		0.20	0	0.20	0				
720-722	16 I/O EIA Data Module		.5		0.34	0	0.08	0				
730-733	16 I/O TTL Data Module		.5		0.53	0	0	0				
740	D/A Converter Module, 1 Channel		.5		0.75	0	0	0				
741	D/A Converter Module, 2 Channels		.5		1.14	0	0	0				
742	D/A Converter Module, 3 Channels		.5		1.53	0	0	0				
743	D/A Converter Module, 4 Channels		.5		1.92	0	0	0				
745-748	A/D Converter Modules,16 to 64 Channels		.5		0.95	0	0	0				
750	32-In Transition Detection Module		1[4]		0.85	0	0	0				
751	32-Out Data Module		1[4]		1.50	0	0	0				
760	5MT/6MT Serial I/F		1[4]		1.50	0	5	0				
882	CRU Expander Card Coupler		1		0.90	0	0	0				
821	TILINE Expander Card		1		1.20	0	0	0				
A	Subtotal of Sheets 2 and 3											

If there is no standby power supply (see D), then add +5 V Main and +5 V Mem and enter total in +5 V Main on line B. Also add +12 V Main and +12 V Mem and enter total in +12 V Main, line A. Otherwise, copy each column directly to line B.

B	Power Required											
	Compare the columns as indicated											
C	Power Available											

D   Zero here means there is no standby power

[1] Memory size is per memory module. 990/4 CPU usually has 8K bytes on CPU module. Do not exceed 56K bytes total in Items 320-324 plus CPU memory.

[3] No power required for secondary kit.

[4] Items 750 and 751 occupy 1/2 slot physically, but require the full slot electrically.

Chassis Layout Forms

This section is intended to help you plan chassis layouts using the TI standard chassis, modules, and peripherals. For more detail see data sheet TI-517 *Model 990 Computer Family Chassis.* In general, any module may be plugged into any slot in the chassis. The exceptions are discussed in the following paragraphs.

Slot 1 uniquely wired to distribute interrupts and decoded CRU MODSEL signals. This slot is reserved for the modules which decode MODSEL and receive interrupts. The modules are 990/4 CPU, 990/5 CPU, 990/10 AU2, 990/12 SMI, and CRU buffer board.

Certain modules are interconnected by cables across the top edge and must be adjacent in the chassis:

- 990/12 AU and 990/12 SMI
- 990/10 AU1 and 990/10 AU2
- EC Memory Controller and array board or boards
- Communication interface module and modem
- Communication interface module and autodialer module
- 990/5 CPU (communication port) and modem
- 990/5 CPU (communication port) and autodialer module
- AMPL emulator and trace modules

There are further considerations that are not absolute requirements, but which may simplify procurement or impact system performance.

TILINE

TILINE data transfers inside a chassis are faster than TILINE transfers between chassis (via TILINE couplers). The CPU and memory should be in one chassis for maximum performance. Disk and mag tape controllers are buffered and may be located in expansion chassis without degrading performance. The DS31 disk controller is an exception and should be located in the same chassis as the CPU and memory. There is no benefit in locating part of the memory in an expansion chassis with disk or tape controllers.

TILINE Access Granted Signals, which are used by TILINE masters to gain access to the bus, originate at the high slot numbers and propagate toward the low slot numbers. In the 13-slot chassis, slots 2 through 13, this signal is jumpered by a shorting link across each connector in order to improve propagation time. In the 17-slot chassis, they are controlled by pencil switches. The shorting link may be removed (or switch set in 17-slot chassis) from any of the slots 2 through 13 in order to install a TILINE master in that slot. The higher the number of the slot, the higher the TILINE priority of the slot.

Interrupts

Most modules generate interrupt signals that must be routed to the CPU. Two interrupt wires originate at each slot, one per half-slot, and are routed to an interrupt crossover plug. The interrupt inputs to slot 1 are also routed to the plug. Generally, any interrupt signal may be routed to any interrupt level (exceptions noted below) by jumpers on the interrupt plug. Multiple signals may be routed to one interrupt level by simply connecting the wires, but only CRU devices may share interrupts.

Access to the interrupt levels from expansion chassis is limited. Two interrupt signals may be routed through a TILINE coupler. Two interrupt signals may be routed through a CRU buffer/expander. There is a special logic on the CRU buffer card which routes multiple signals to one interrupt level and also makes the ID number of the interrupting signal available through the CRU bus. This permits fast decoding without polling of both CRU and TILINE devices located in the expansion chassis.

Interrupts 0, 1, and 2 are normally reserved on all 990 CPUs for internal CPU functions: power-up, power-down, and error. The real-time clock is normally wired to interrupt level 5. The 990/5 CPU uses interrupts 6, 8, and 14 for the on-board communication ports.

Note that if more than two TILINE devices are to be located in an expansion chassis, a CRU Expansion Kit is required also to support the interrupt handling of those TILINE controllers.

CRU

Most CRU modules use the MODSEL signals which are uniquely decoded for each chassis slot, including expansion chassis slots. Modules that use the MODSEL signals have preassigned CRU addresses which are determined by the slot. The accompanying figure shows the fixed addresses of the MODSEL signals by slot. In the figure, CRU addresses are expressed as the base address, which is the four-digit hexadecimal number loaded into WR12 in order to address the module or function. The addresses are shown for the CPU chassis. Addresses for the CRU expansion chassis may be determined by adding 0400_{16} for the first CRU expansion, 0800_{16} for the second CRU expansion, and so forth.[1]

The 990/5 CPU has on-board communication ports. The figure shows the preassigned interrupts and CRU addresses for these on-board ports.

There are further preassignments of CRU addresses for internal functions such as front panel control. For further detail, see TI data sheet TI-517.

---

[1]Slots 3, 4, and 5 in a 17-slot chassis may not be used for CRU when the chassis is used as a primary CPU chassis or has TILINE devices in it.

Preassigned CRU Addresses

6-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	N/A	N/A	✕
2		0120	0100	
3		00E0	00C0	
4		00A0	0080	
5		0060	0040	
6		0020	0000	

990/5 Comm Ports

Port	Int	CRU	Peripheral
1	8	1700	
2	14	1740	
3	6	1780	

13-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	N/A	N/A	✕
2		02E0	02C0	
3		02A0	0280	
4		0260	0240	
5		0220	0200	
6		01E0	01C0	
7		01A0	0180	
8		0160	0140	
9		0120	0100	
10		00E0	00C0	
11		00A0	0080	
12		0060	0040	
13		0020	0000	

17-Slot Chassis

Slot	Int	Bottom P2 Connectors	Top P1 Connectors	Int
1		†	†	
2		†	†	
3		†	†	
4		†	†	
5	11	** †	† **	11
6	10	** 2C0	2E0 **	10
7	15	280	2A0	15
8	12	240	260	12
9	8	200	220	8
10	3	1C0	1E0	3
11	13	180	1A0	13
12	9	140	160	9
13	10	100	120 **	10
14	11	0C0	0E0 **	11
15	7	080	0A0	7
16	4	040	060	4
17	6	000	020	6

†These slots are not available for CRU in CPU chassis

**For slots that share interrupts between each other (intra-slot interrupt sharing) the following rule must be followed: TILINE devices cannot share an interrupt with another TILINE or CRU device. CRU devices may share interrupts.

Software

All TI operating system packages and some subscription updates to these packages include a prelinked load-and-go operating system. This linked operating system has assigned TILINE and CRU addresses and interrupt signals to particular peripherals. The hardware configuration must match these preassignments in order for the operating system to run:

- TILINE address switches on disk and tape controllers and memory boards must match the operating system specification
- CRU peripherals must be plugged into assigned slots
- Interrupt crossover plug must be wired to deliver interrupts to assigned levels.

Each 990 chassis has a plate on the top which specifies the expected module for each slot, the TILINE and CRU address assignments and the interrupt assignments for that particular chassis. TI personnel will routinely update the plate when assignments are changed. We request that customers who change the assignments also update the plate.

The conventional assignments for 990 CPUs are specified in the figures in this section. There are potential minor effects on performance in deviating from these standards. For example, raising the interrupt level of a terminal might improve terminal response at the expense of disk access.

In addition to the prelinked operating system, the OS packages include linkable object modules which may be linked by a system generation (sysgen) with any desired TILINE, CRU, and interrupt assignments. The sysgen operation itself must be performed on a working system using either the prelinked OS in the package or else a previously generated OS. The sysgen could be performed with only the system disk and terminal at preassigned addresses.

TI will furnish custom linked operating systems to customers who order an operating system package under certain conditions:

- The purchase order must include a complete, functional system.
- Adequate documentation must accompany the PO to define the desired OS.
- There may be restrictions on subscription services.

TI sales representatives will be happy to assist in defining such systems and in preparing the documentation.

Impact of Volume

The decisions on module placement, TILINE and CRU addresses, and interrupt assignments which are addressed by this section are reversible. The task of reconfiguring a single system, including sysgen, can usually be accomplished in a few hours. Most of our customers reconfigure their development system when their requirements change. It is not appropriate to expend much time or effort optimizing a single system, since, based on actual experience, reconfiguration is easy, economical, and yields better results.

The situation is quite different where a large number of identical systems are involved, and particularly where the systems are geographically dispersed. In these cases, TI strongly recommends that the customer consult our field sales representatives for assistance.

Conventional Slot and Interrupt Assignments for 990/4 CPU

6-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	990/4 CPU		✕
2	✕	Memory Expansion		✕
3	3	911 VDT #2	911 VDT #1	3
4	7	CRU Diskette Controller		7
5	6	Line Printer	Card Reader	4
6	6	PROM Programmer	733 ASR	6

13-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	990/4 CPU		✕
2		Memory Expansion		
3		Memory Expansion		
4				
5				
6				
7				
8	6			6
9	6			6
10	3	911 VDT #2	911 VDT #1	3
11	7	CRU Diskette Controller		7
12	6	Line Printer	Card Reader	4
13	6	PROM Programmer	733 ASR	6

Conventional Slot and Interrupt Assignments for 990/5 CPU

6-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	990/5 CPU		✕
2	3			4
3	11	911 VDT #2	911 VDT #1	11
4	7	Diskette Controller		7
5	9			9
6	12			13

990/5 Comm Ports

Port	Int	CRU	Peripheral
1	8	1700	820 KSR
2	14	1740	810 Printer
3	6	1780	MODEM

13-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	990/5 CPU		✕
2	3			4
3				
4	15			15
5	15			15
6	10			10
7	13			13
8	12			12
9	10			10
10	11	911 VDT #2	911 VDT #1	11
11	7	Disk or Diskette Controller		7
12	9			9
13	15			15

Conventional Slot and Interrupt Assignments for 990/10 CPU

At right is a single-chassis 990/10 system with DS990 system configuration.

The two chassis below are an example of a DS990 system with a combination of both TILINE and CRU in the expansion chassis. For TILINE-only or CRU-only expansion, eliminate the CRU expander and buffer or TILINE couplers, respectively.

13-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	990/10 AU2		✕
2		990/10 AU1		
3		Memory		
4		Memory		
5		Memory		
6		Memory		
7	13	Disk Controller		13
8	9	TILINE Device		9
9	8	911 VDT #1	911 VDT #2	10
10	12	911 VDT #3	911 VDT #4	11
11	3	Diskette Controller		7
12	14	Printer	Comm I/F	4
13	15	PROM Programmer	EIA Terminal	6

CPU Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	990/10 AU2		✕
2		990/10 AU1		
3		Memory		
4		Memory		
5		Memory		
6		Memory		
7	13	Disk Controller		13
8	9	TILINE Coupler		9
9	8	911 VDT #2	911 VDT #1	10
10	12	911 VDT #4	911 VDT #3	11
11	3	CRU Expander		7
12	14	Printer	Comm I/F	4
13	15	PROM Programmer	EIA Terminal	6

Combination CRU/TILINE Expansion Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕	CRU Buffer		✕
2		TILINE Coupler		
3				
4				
5				
6				
7	13	Disk Controller		13
8	9			9
9	10	911 VDT #6	911 VDT #5	10
10	12	911 VDT #8	911 VDT #7	11
11	3	Diskette Controller		7
12	14	911 VDT #9	911 VDT #10	4
13	15			

Planning Charts

6-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕			✕
2				
3				
4				
5				
6				

13-slot Chassis

Slot	Int	P1 Connectors	P2 Connectors	Int
1	✕			✕
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

990/5 Comm Ports

Port	Int	CRU	Peripheral
1	8	1700	
2	14	1740	
3	6	1780	

Conventional Slot and Interrupt Assignments for 990/12 CPU

Planning Chart

Slot	Int		Int	Slot	Int		Int
1		990/12 SMI		1			
2		990/12 AU1		2			
3		Mem Controller		3			
4		Mem Array		4			
5	11	Mem Array **	11	5			
6	10	**	10	6			
7	15		15	7			
8	12		12	8			
9	8		8	9			
10	3		3	10			
11	13	System Disk (TILINE F800)	13	11			
12	9	979 A (TILINE F880)	9	12			
13	10	** 911 CRT #1 911 CRT #2 **	10	13			
14	11	** 911 CRT #3 911 CRT #4 **	11	14			
15	7		7	15			
16	14	Card Reader Line Printer	4	16			
17	6	733 ASR	6	17			

**For slots that share interrupts between each other (intra-slot interrupt sharing), the following rule must be followed: TILINE devices cannot share an interrupt with another TILINE or CRU device. CRU devices may share interrupts.

Cabinet Planning Worksheet

Texas Instruments strongly recommends that our customers follow the standard packaged system configurations shown on the next page. Please consult your local TI sales engineer if additional assistance is needed. Complete the following steps to determine your cabinet requirements.

1. Use a separate copy of the form for each cabinet (sheet 4).
2. List equipment in desired locations in rack. Tick marks are at 45-mm (1.75-in.) intervals. TI standard

equipment rackmount requirements, heat load, ac power, and starting current are shown below.

3. Verify that each item is at a convenient working height.

4. Attach a copy of cabinet layout to your system purchase order. TI will configure the cabinet as indicated. On the 1.78-m (70-in.) rackmount cabinet, blank panels are supplied at no charge. (System, enclosure, and installation must be on one purchase order.)

Description	Mounting Space (mm)	Heat Load (Btu/Hr)	Ac Power (VA)	Starting Current (Amperes)
6-Slot Chassis	178 mm (7.0 in.)	928	340	—
13-Slot Chassis (including expansion)	311 mm (12.25 in.)	1911	700	—
17-Slot Chassis	622 mm (24.5 in.)	4805	1760	—
FD800 Chassis	178 mm (7.0 in.)	682	250	—
FD1000	178 mm (7.0 in.)	682	250	—
DS10 Drive	267 mm (10.5 in.)	1502	550	10
DS25/DS50 Drive	311 mm (12.25 in.)	2357	836	25
979A Tape Transport	667 mm (26.25 in.)	1440	527	10

Considerations in Cabinet Layout

1. CPU, TILINE, and CRU chassis should not be mounted in the left bay of a double-bay desk. There are no vents in the desk kneehole, which interferes with the exhaust from these chassis.

2. The CPU should be mounted at the top of the bay of a desk or low-profile cabinet. The front panel controls are occasionally used by an operator for boot load, memory read, or other operation.

3. TILINE chassis should always be adjacent to the CPU in the same bay. This minimizes cable length and, hence, transfer time between chassis. Also, the CPU, TILINE, and CRU chassis have a contoured front panel, which offers the best appearance when these chassis are adjacent.

4. The DS10 disk loads from the top when extended on slides. Operator convenience favors mounting at the top of desk-height enclosures. Rackmounted DS10 disk should be in the bottom position of a rack or bay. The bottom position is convenient for an operator and the low mounting improves rack balance. A second DS10 drive may be mounted above the first.

5. The first disk drive should be as close to the CPU chassis as possible (after TILINE and CRU expansion chassis) to minimize the cable length. Place rackmounted disks in the same enclosure where possible. Pedestal-mounted disks should be immediately adjacent to the CPU enclosure, but leave a 305-mm (12-in.) air space to the right side of desk enclosure. Where multiple disk types are present, DS31, DS10, DS25, or other, the first drive of each type should be as close to the CPU as possible.

6. Model 979A Magnetic Tape Transports should be mounted in the top of a 1.78-m (70-in.) cabinet. This is most convenient to the operator. Also, standard TI maintenance rates assume this mounting for maintenance access.

7. The major consideration in disks and diskette drives is operator convenience. DS31 and diskette drives are front-loaded and should be mounted at the top of desk-height enclosures or next to the main chassis in 1.78-m (70-in.) racks. Desk or rackmounting is preferred over tabletop for the diskette drive.

8. Close attention should be given to all cable lengths involved to insure that the chassis may be extended for serviceability.
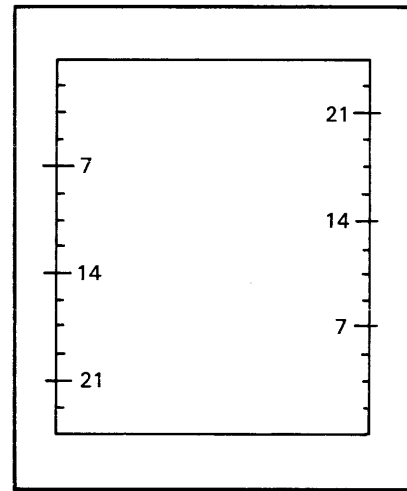
Cabinet Layout Worksheet (Sheet 4)

45 mm
(1.75 in.)

1.6 m
(63 in.)

7

14

21

28

35

42

49

56

56

49

42

35

28

21

14

7

Full-Size Cabinet

45 mm
(1.75 in.)

622 mm
(24.5 in.)

7

14

21

21

14

7

Half-Size Cabinet

7

14

21

21

14
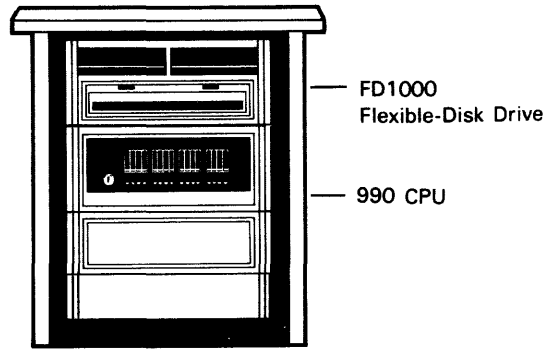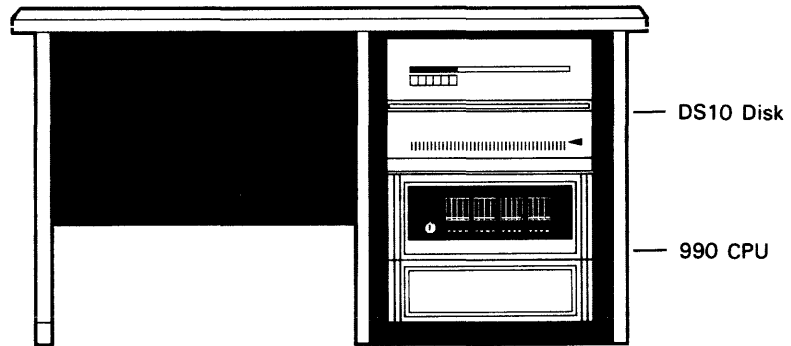
7
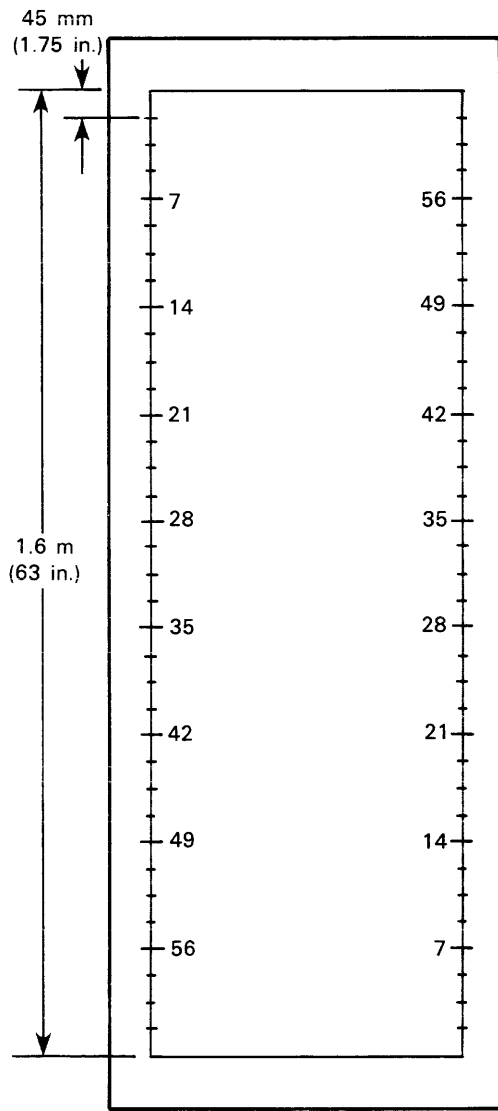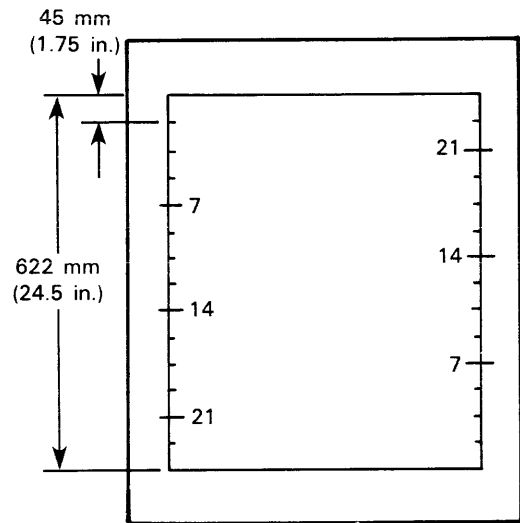
Half-Size Cabinet

Note: The top two inches of a full-size cabinet are unuseable unless a mag tape drive occupies the upper section of the cabinet.
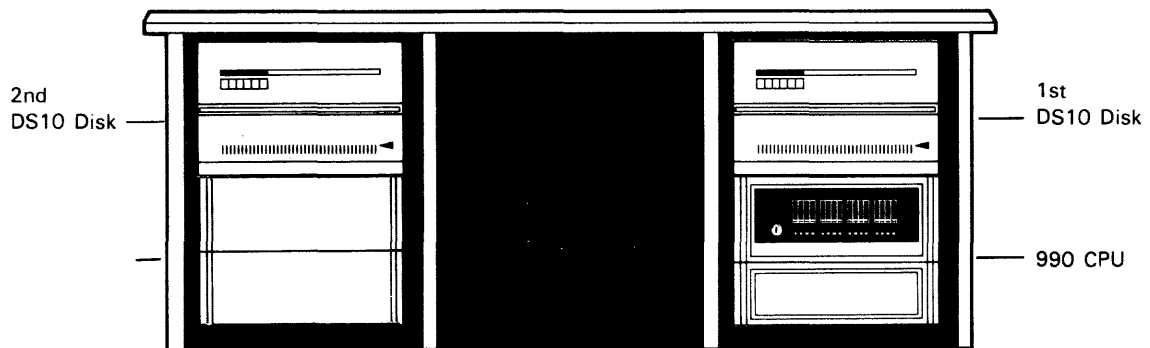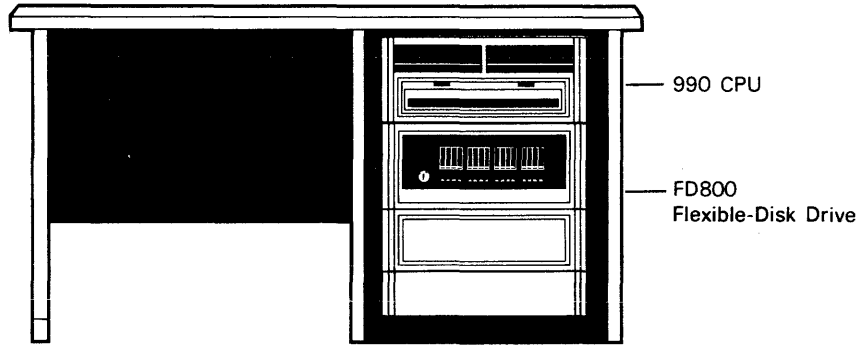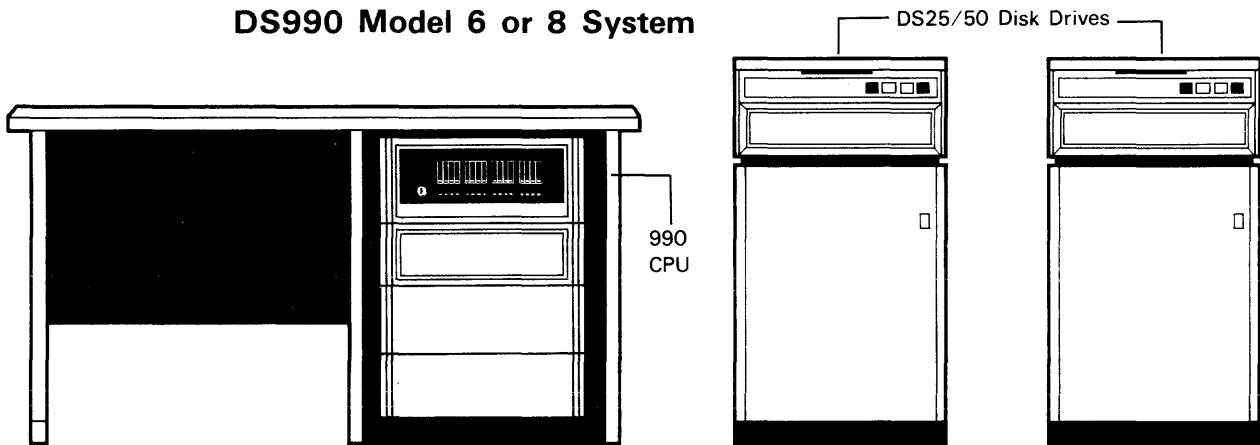
**DS990
Model 2**

FD1000
Flexible-Disk Drive

990 CPU

DS990 Model 4 in Single-bay Desk

DS10 Disk

990 CPU

DS990 Model 4 in Double-bay Desk

2nd
DS10 Disk

1st
DS10 Disk

990 CPU

FS990 System

990 CPU

FD800
Flexible-Disk Drive

DS990 Model 6 or 8 System

DS25/50 Disk Drives

990
CPU

1.78-metre (70-inch) Rackmount Cabinet

DS990 Model 6 or 8 Recommended Selections		DS990 Model 20 or 30 Recommended Selections
979A Tape Transport	667 mm (26.25 in.)	979A Tape Transport or blank panel
	178 mm (7.0 in.)	
2 Dual Flexible-Disk Drives 2 6-Slot Chassis 1 13-Slot Chassis	356 mm (14 in.)	1 DS31 1 Dual Flexible-Disk Drive 1 6-Slot Chassis or blank panel
1 DS10 Disk Drive plus 6-slot chassis or blank panel or Any of first four selections accompanied by an 84-mm (3.5-in.) blank panel	622 mm (24.5 in.) 445 mm (17.5 in.)	17-Slot Chassis
PWR panel and cable exit	133 mm (5.25 in.)	Vent Blank

95

DS990 Model 20 System

667 mm
(26.25 in)

667 mm
(26.25 in.)

864 mm
(34 in.)

DS990 Model 30 System

667 mm
(26.25 in.)

667 mm
(26.25 in.)

864 mm
(34 in.)
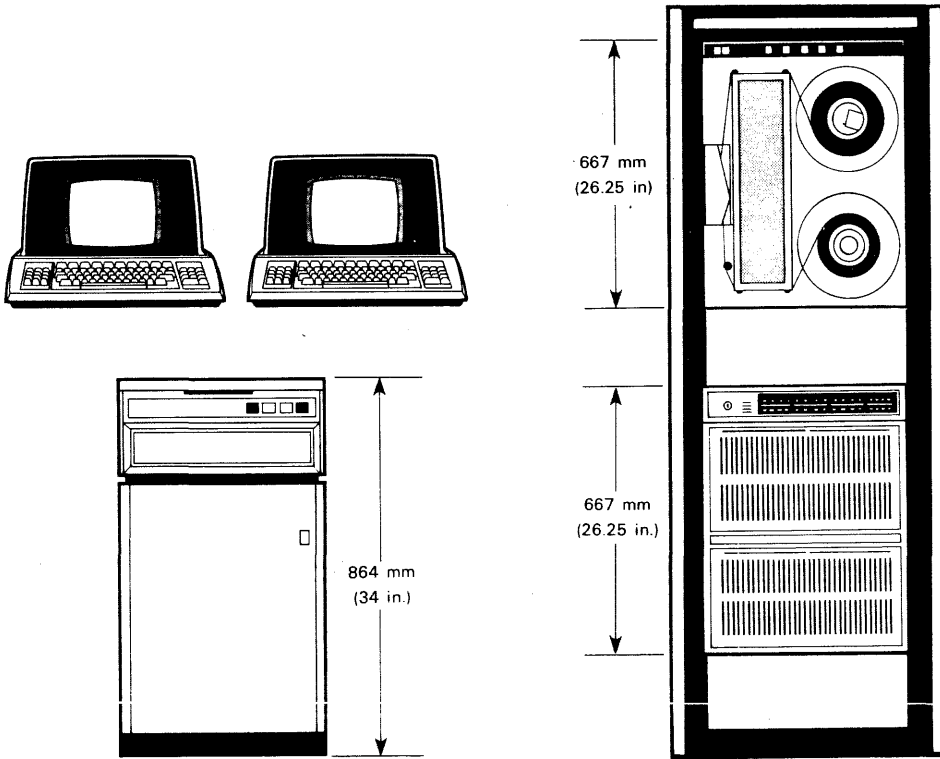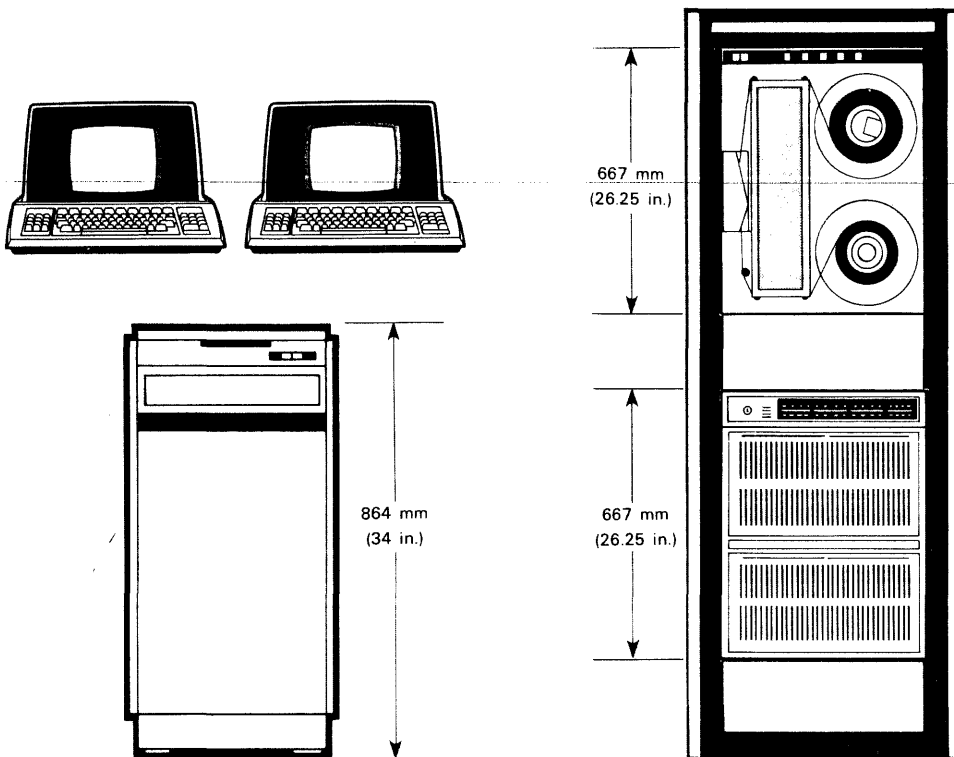
Customer Services

Field Sales

Texas Instruments maintains a fully-trained field sales group in numerous local sales offices throughout the United States. The 900 Series Computer and Series 700 Distributed Processing Systems equipment technical data sheets, brochures, and reference manuals are available locally and TI welcomes the opportunity for our field sales engineers to discuss application requirements with you.

Field Support Marketing

Though the local Field Sales Representative should always be the customer's first contract, it is sometimes necessary to communicate with someone at the TI Austin facility. The field support marketing group offers this direct contact with the factory. A staff of product marketing engineers and sales support specialists provide presales assistance for product literature, delivery times, and procedural questions.

The customer's general postsales interface for inquiries such as sales order status information, sales order revisions, corrective rushes, and rescheduling of sales orders is the sales order support group. Either group can be reached by calling (512) 250-7305.

TWX: 910-867-4702 (answer back - TEXINS R DAL)
Address your message to:
ADSD Attn: Marketing SSS
TELEX:73324 (answer back - TEXINS DAL)
Address your message to:
ADSD Attn: Marketing SSS

Customer-Support Line: (Hot Line) (512) 250-7407

The Customer-Support Line (Hot Line) is a telephone number for customers to use for direct technical contact with the factory. A selected staff of senior engineers and programmers provides technical assistance on all Texas Instruments computer-system products.

Technical assistance on software products is limited to those current subscribers of the subscription/support service as detailed in the Software section of this catalog.

The Hot Line makes available the software-design, hardware-design, and manufacturing-engineering expertise of the entire manufacturing facility. Customers may call the Customer Support Line any time between 7:30 a.m. and 6:30 p.m. Central Time, Monday through Friday.

Information Service (214)238-6611

The TI Customer Response Center (CRC) is available to assist you in obtaining information about TI products and services not covered by this catalog. CRC information specialists will provide immediate responses to routine inquiries. Technical inquiries will be referred to experts who are committed to a two-hour response time goal. The CRC is staffed Monday through Friday from 8:00 a.m. to 5:00 p.m. CST. Inquiries received at any other times are recorded for response at the beginning of the next workday. The CRC may be contacted at:

Address: Customer Response Center
Texas Instruments Incorporated
P. O. Box 225012, Mail Station 57
Dallas, Texas 75265

Education Classes

Texas Instruments offers regularly scheduled courses in programming and hardware maintenance to users of Model 990 Minicomputers and Series 700 distributed processing systems. These courses are conducted at the Digital Systems Division Education and Development Center in Austin, Texas. TI educational classes benefit customers in several ways. Course formats include a variety of instructional strategies such as lecture, lab exercises, independent study projects, coding-debug and execution exercises, and tutorials with self-study packages. This technical understanding of standard TI hardware and software prior to installation, application system design, and development enhances successful project implementation.

Education classes are purchased items and are not included in the prices or lease rates of the packaged systems, hardware products, or other services listed herein.

The Education and Development Center welcomes requests for customer-site courses on standard or special customer classes. Prices for these courses will be furnished on request. Please contact your field sales office for course schedules and further details.

Lease

Texas Instruments offers a full service leasing program for its customers which includes such services as hardware and software installation, hardware maintenance, and education classes. Lease rates are available for packaged systems, mass storage devices, peripherals, software, and communications hardware and are offered for 90-day, 12-month, 36-month and 60-month periods. Lease information is detailed in the Lease section of this catalog.

Field Services

Texas Instruments has developed a broad range of customer services to accommodate the diverse needs of a growing customer base that represents all segments of the marketplace. It is TI's goal to be the complete source of all minicomputer products and services for our customers. Therefore, the services presented in this section cover all phases of computer system project implementation. All services are presented and priced individually and can, therefore, be selected to best suit application and customer requirements. As unique requirements develop, please consult with your local TI field sales engineer to determine the best resolution to your application needs.

TI field services encompass the following areas: hardware installation, hardware maintenance, fixed-price hardware repair, and TI-CARE.*

Hardware Installation

Installation of all standard 990 computer family hardware products listed herein is available within the contiguous 48 United States and portions of the Hawaiian Islands. Contact your local TI field service office for details. Hardware installation provides the following services:

- Proper unpacking of all equipment
- Verification of shipment completeness
- Signal cabling connection between CPU and peripherals
- Verification of hardware operational status
- Loading and execution of Hardware Demonstration Test software.

Technically skilled and trained personnel familiar with the technical and operational details of the equipment perform the installation in accordance with correct configuring and start-up procedures. This approach provides the following benefits:

- Installation and start-up time is minimized
- Multisite concurrent installations and start-up is greatly simplified at customer sites where no customer technical staff exists.
- System functional operation is assured prior to start of on-line use.

All continental U.S.A. installations are scheduled via the TI-CARE facility in Houston, Texas, which is the focal point for handling the scheduling and dispatching of installation services. Installation requests should be made by calling the TI-CARE telephone numbers: 800-231-2807 or 713-937-1200 (Texas only-collect call).

Hawaiian Islands installation requests should be made by calling 808-955-2617.

Pricing Information

Customer site preparation, including installation of cabling and power source electrical contract work, is not included in this service.

Unless otherwise stated, there is a basic installation call charge of $125 applicable to each installation, plus the published installation rate per item.

The basic installation call charge of $125 and standard item installation rates pertain to installations within 100 miles of the nearest TI Digital Systems Division service office wtihin the contiguous 48 United States. Installations requiring travel beyond this radius will be charged in accordance with TI's then-current standard service rates.

Information on the installation of nonstandard computer family products or customer-furnished peripheral equipment can be obtained by contacting your local TI field sales representative.

Series 700 Distributed Processing Systems and DS990 Model 1

Hardware installation for the Series 700 Distributed Processing Systems with software (excluding Model 774 Intelligent Terminal Systems) and DS990 Model 1 systems with software is included in the purchase price of each system, and the basic installation call charge of $125 does not apply. Installation of systems purchased without software, and all leased systems, will be invoiced at the respective standard item installation rates, and the $125 basic installation call charge does not apply. Additional terminals installed at the same time as the base system will be invoiced at the standard installation rate per item, less $125 per terminal.

Installation charges for factory-installed internal options are included in the purchase price of the systems with software and included in the system installation rate for leased systems or systems purchased without software. Internal options installed at a later date will result in an invoiced charge of the $125 basic installation call charge plus $75 for the first option and $25 for each additional option. External options, such as the Model 810 Printer, installed with the base system will be charged at the individual item installation rate without discount. External options installed at a later date will be invoiced at the $125 basic installation call charge plus the standard item installation rate.

*Service mark of Texas Instruments

98

Packaged Systems and Model 774 Intelligent Terminal Systems

Hardware installation for the FS990 and DS990 packaged systems with software (excluding the DS990 Model 1) and Model 774 Intelligent Terminal Systems with software is included in the purchase price of each system. The basic installation call charge of $125 does not apply. Options installed concurrently with the base system installation will be invoiced at the then-current standard item installation rate.

Leased systems or systems purchased without software will be invoiced at the standard item installation rate for that system plus the standard item installation rate for additional options installed concurrently.

Options purchased or leased and installed at a later date will be invoiced at the $125 basic installation call charge plus the sum of the standard item installation rates.

Standard Computer Products

Hardware installation of systems comprised of standard 990 computer family components is invoiced at the $125 basic installations call charge plus the sum of the then-current standard item installation rates when purchased on the same purchase order and installed at the same time. Options purchased for installation at a later date will be invoiced at the $125 basic installation call charge plus the sum of the then-current standard item installation rates.

Warranty

At the time of shipment, Texas Instruments warrants the equipment, other than expendable items, against faulty workmanship or the use of defective materials for a period of 90 days.

During the standard warranty period, TI at its option, will repair or replace the defective part or parts. Service labor required to replace defective equipment parts, will be provided free of charge, during the standard warranty period.

Warranty service will be performed during the hours of 8:00 a.m. to 5:00 p.m., Monday through Friday (excluding TI holidays), at a point located not more than 25 miles from the nearest TI Service Office. The customer will pay TI's then-current Standard Field Service Rates for travel time, labor, transportation, and subsistence expenses where such service is performed during the standard warranty period, outside the 25 mile limit stated above. If preferred, the customer may return equipment to TI-Austin for warranty repair, with shipment both ways, and in-transit damage at the customer's expense.

If installation is purchased at the time the equipment is ordered, TI will adjust the start of the standard warranty period to the date of installation, providing the equipment is scheduled and installed within 30 days from the date of shipment.

If prior to shipment, the customer elects to sign a Maintenance Service Agreement, TI will include travel coverage up to 100 miles from the nearest TI service office. In addition, if the Maintenance Service Agreement modifies the service availability period to extended or full coverage, shorter response time, or zone charges beyond 100 miles, TI will extend these coverages during the standard warranty period, and the customer must agree to pay for the additional service adders for these options for the warranty period.

The foregoing warranties for goods are in lieu of all warranties, express, implied, or statutory, including but not limited to, any implied warranties of merchantibility and fitness for a particular purpose and of any other warranty obligation on the part of TI.

Customer Requirements

- The customer will notify TI-CARE in Houston to install his system after delivery providing the site is prepared. In the event the Customer Engineer cannot install the system upon arrival at the customer site, due to no fault of TI, the customer will be invoiced at the then-current Standard Field Service Rate for labor and travel for that call. If delays on the part of the customer do not allow the installation within the 30-day window, the warranty commencement will remain the date of shipment.
- Factory-installed warranty labels must remain affixed to assemblies and subassemblies that require repair, indicating date and type of warranty coverage purchased, or the warranty will be voided.
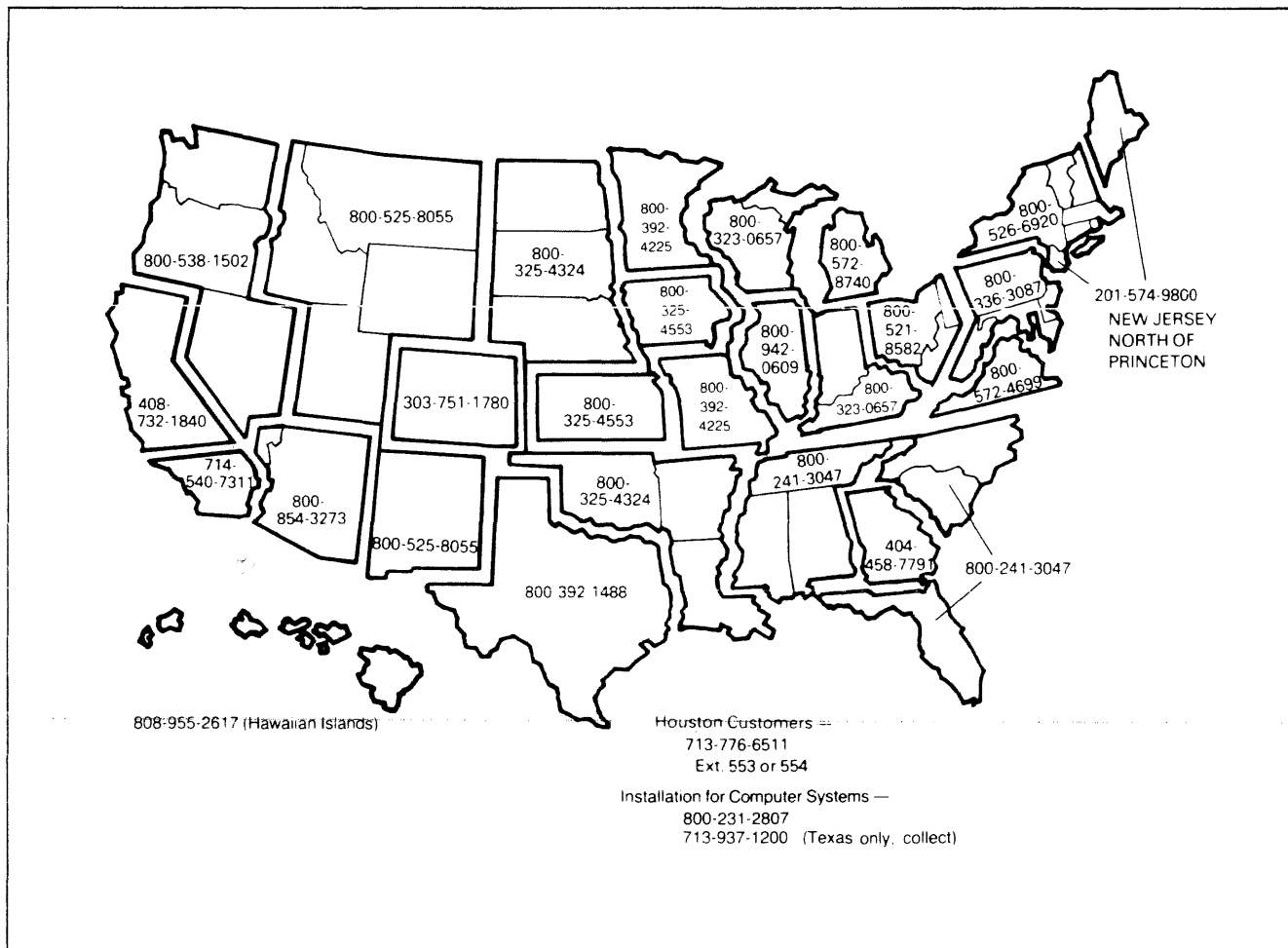
TI-CARE

Customer satisfaction is the primary goal of Texas Instruments Incorporated. To meet this goal the TI-CARE System was developed and implemented. The TI-CARE System is a nationwide, computerized network which facilitates the entry, dispatch, and completion of all customer service requests.

To initiate any service request, a customer should use the Centralized Dispatch telephone number assigned to the area in which he is located (see map below). The customer provides the dispatcher with: customer name, the address of the product needing service, telephone number, the name of a contact, the model and serial number of the product, the problem, and a purchase order number (if it is purchased equipment and not covered by warranty or a maintenance agreement). The dispatcher enters this information into the TI-CARE System. If the service request is for equipment located in another geographical area, the TI-CARE System automatically transfers the request to the TI Service Office nearest the equipment needing service.

The dispatcher at the location nearest the equipment will assign the service request to a Customer Engineer for action. When the Customer Engineer completes the service request, all pertinent data is entered into the system and a real-time service status is maintained.

The TI-CARE System enables Texas Instruments to provide fast, efficient service to every customer, whether their operations are concentrated in one geographical area or nationwide. If the customer is not satisfied with the service provided by the TI-CARE System, the nearest district or regional manager should be notified.

Centralized Dispatch Telephone Numbers
for Requesting Service

800-525-8055

800-538-1502

800-392-4225

800-325-4324

800-323-0657

800-572-8740

800-526-6920

800-336-3087

201-574-9800
NEW JERSEY
NORTH OF
PRINCETON

800-325-4553

800-521-8582

408-732-1840

303-751-1780

800-325-4553

800-942-0609

800-392-4225

800-323-0657

800-572-4699

714-540-7311

800-854-3273

800-525-8055

800-325-4324

800-241-3047

800-241-3047

404-458-7791

800-241-3047

800 392 1488

808-955-2617 (Hawaiian Islands)

Houston Customers —
713-776-6511
Ext. 553 or 554

Installation for Computer Systems —
800-231-2807
713-937-1200 (Texas only, collect)

Hardware Maintenance

Two types of on-site hardware maintenance arrangements are available nationwide from Texas Instruments: Maintenance Agreement Service (Basic, Extended, and Full Coverage) and On-Call Service. Service personnel are supplied with a spare parts inventory locally stocked in accordance with the local base of system configurations and backed up by additional parts inventories at the district offices and the TI Austin, Texas, factory.

The range of service coverage is provided to allow customers to select the best service plan for each application. Nationwide service personnel and computerized dispatching coordinate every effort to meet the needs of TI customers.

Maintenance Agreement

The Basic Coverage monthly rate for Maintenance Agreement Service is shown for each 990 computer family product and for each Series 700 Distributed Processing Systems product in the itemized price list. Extended and Full Coverage are offered only where TI can ensure the adequate availability of personnel to maintain acceptable service and response time. Service calls resulting from failures or problems not the fault of TI equipment will be separately invoiced at TI's then-current standard service rates.

Maintenance Agreement Service covers all routine maintenance (including labor, travel, and material) except those customer responsibilities such as cleaning tape transport heads, air filters, printheads, and other first-line maintenance items as specified in the equipment manuals. Customer care is equally important to ensure trouble-free operation and optimum performance levels.

Agreement Coverage	Description
Basic Coverage	Service on your equipment for eight hours during the period from 8:00 a.m. to 5:00 p.m., Monday through Friday, excluding holidays.
Extended Coverage**	Service on your equipment for 16 hours during the period from 8:00 a.m. to midnight each day, Monday through Friday, and during the period from 8:00 a.m. to 5:00 p.m. on Saturday, excluding holidays.
Full Coverage**	Service on your equipment 24 hours per day, seven days per week.
Transportation	The transportation rate applies to all travel by automobile and commercial surface and air carriers. This rate includes charges for travel time in transit as well as travel expenses.
Service Zone	The primary zone for maintenance agreement service is 100 miles from the nearest TI-DSD service location.

**Contact your local TI Sales Representative for coverage available in your area.

On-Call Service

For customers who prefer service on an on-call basis (service performed outside the hours of an agreement and service for customers not covered by a service agreement), TI customer engineers are available at TI's then-current standard service rates for labor, travel, and subsistence as described in the *Computer Family Price List*. Rates are subject to change without notice. On-call service outside local TI office hours will be provided on a best-effort basis. Material will be charged at TI's then-current price.

Coverage	Description
Standard Field Rate	Up to eight hours work between the normal working hours of 8:00 a.m., and 5:00 p.m., Monday through Friday.
Overtime Field Rate	Work exceeding eight hours during normal working hours, before 8:00 a.m. and after 5:00 p.m., Monday through Friday, and any time on Saturday.
Sunday and Holiday Field Rate	Work performed on Sundays or holidays (New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, TI floating holiday).
Living Expenses	Meals and lodging are charged at actual cost.
Transportation Fees	The transportation rate applies to all travel by automobile and commercial surface and air carriers.

Customers covered by TI hardware maintenance service are benefited in several ways. Highly skilled, expertly trained TI customer engineers provide the maintenance service. Service work is performed at the board level to maximize system availability. All TI computer family products are designed and/or selected with reliability and board-level service as the primary guidelines. Maintenance Agreement service customers have priority in both service scheduling and spare parts during peak periods of service requests.

Pricing Information
Service calls resulting from failures or problems not the fault of TI will be separately invoiced at TI's then-current standard service rates.

Pricing for both types of standard service arrangements are described above. Customers with critical system uptime and unique application requirements not fully accommodated by the standard TI service coverages should consult with their local TI field sales engineer to outline the specific special arrangements best suited to their application.

Fixed-Price Repair Service
The fixed-price repair service is for those customers who stock their own spares of standard computer family products and service their own equipment. Factory fixed-price repair is a good means for the do-it-yourself customer to receive a quality repair. All repairs are made by skilled technicians using test equipment and facilities especially designed for making component-level repairs. To ensure a quality repair, all work is inspected for material and workmanship before it is returned to the customer.

When an assembly is deemed acceptable for repair by TI and no request has been made for the return of the same serial number assembly, TI will, at its option, exchange or repair the defective assembly. Repair or exchange of most assemblies will be accomplished within 14 days.

Fixed-price repair service offers the following services:

- Replacement assemblies will be of new or refurbished parts of equal quality and will be free of defects in material and workmanship for a period of 30 days from date of shipment to customer.
- Exchange assemblies are shipped from TI upon receipt of defective part from customer.
- Complete factory unit testing of each assembly is performed under strict accordance with TI's material and workmanship specifications.
- For an additional per part charge, the following options are available.

(A) Upon receipt of written notice, TI will repair and return to the customer the same serial number assembly. This option is applicable when the customer has made modifications to the assembly. Labor and material will be charged at TI's then-current standard shop rate for all necessary removals or repairs to customer-made

modifications, if such is required to test the returned assembly in accordance with TI's test specification for that assembly plus an additional $55 handling charge. The returned assembly should be tagged by customer to specifically indicate that "same-serial-number-assembly-return" is required. (B) A 48-hour fixed-price expedite option is available for an expedite charge of $55 per part. This expedite option is intended for "single-part emergency orders" only and is subject to the availability of replacement assemblies. This option is initiated by customer phone call to the fixed-price repair center for an authorization number and to provide shipping, billing, and purchase-order information. Subject to the availability of replacement parts, TI will provide the customer with delivery information. If parts are not available, TI will provide an estimated date of availability.

Benefits of fixed-price repair service include:

- Lowest cost equipment service approach when customer maintains his own on-site spare parts inventory and technical staff.

- Increased system uptime due to minimal time required for service response and exchange of defective assemblies.

- Optional repair and return of customer modified assemblies for an additional charge.

Pricing Information

The fixed-price repair service and associated options are restricted to repair of standard electronic interface assemblies. For those customers who need repair prices on non-TI-manufactured equipment, TI recommends that the customer contact the original equipment manufacturer.

TI reserves the right to refuse fixed-price repair in cases where (1) TI is not equipped to make such a repair and/or it would be in the best interest of the customer to have the repair made by the original manufacturer or vendor, (2) the assembly or unit is obsolete to the point that any repair or adjustment made could not be tested to satisfy the TI specifications for that assembly or unit, (3) the assembly or unit is deemed by TI to be non-repairable due to physical damage and/or modifications or for any other reason that will not practicably allow repair to meet with TI material and workmanship specifications. In such cases, TI will return the material to the customer unrepaired. There will be a minimum $55 handling charge for such returned assemblies or units.

Repaired or exchanged assemblies will be new parts or refurbished parts of equal quality and shall be free of defects in material and workmanship for a period of 30 days from date of shipment. TI's sole responsibility under this warranty shall be limited to the repair or replacement of the defective material at TI's designated repair center.

The foregoing warranties for goods are in lieu of all warranties, express, implied, or statutory, including but not limited to, any implied warranties of merchantibility and fitness for a particular purpose and of any other warranty obligation on the part of TI.

This service is available only at the designated repair center and to the original buyer and if examination by TI discloses to TI's satisfaction that such alleged defects actually exist and were not caused by misuse, neglect, improper installation or testing, attempt to repair, unauthorized alteration, use of the equipment with supplies not meeting TI's specifications, or any cause beyond the range of normal usage, accident, fire, or other hazard.

No obligation or liability shall arise or grow out of TI's rendering technical or other advice. TI shall not be liable for any loss of profits, loss of use, or consequential damages of any kind.

TI shall not be liable for the content of customer ROMs, PROMs, or EPROMs that are returned with standard TI AU, Memory, PROM, or EPROM assemblies.

Fixed-price repair service quotations are available upon request from your local TI field sales or service engineer.

TI will invoice upon return shipment, F.O.B. TI's Texas plant. Payment will be due net 30 days after date of invoice. The customer shall pay for the shipping and handling cost both to and from TI's designated factory. Return shipments shall be made air collect unless otherwise requested in writing.

Optional services are handled in the following manner: (A) Charges for optional repair and return of same serial number assembly additionally include a $55 handling charge plus labor and material charges (at TI's then-current standard shop rate) for all necessary removals and/or repairs of customer-made assembly modifications if such is required to test the returned assembly in accordance with TI's specification for that assembly; (B) the 48-hour expedite option charges include the fixed repair price plus a $55 per part expediting charge *per assembly*. If the defective part is not returned to TI within 30 days of the TI replacement part delivery, an additional invoice will be issued for the difference between the fixed repair price and the then-current spare parts price. Should the defective part not be acceptable for repair, TI will return the part to the customer unrepaired. TI will issue an invoice for the difference between fixed repair price and the then-current spare part price.

Detailed pricing information is available from your local TI sales or service office.

General Site Planning and Preparation

The potential user should be aware of the general power, environmental, and space requirements that directly affect the installation and ensure the trouble-free performance of a computer system.

Using specifications from the appropriate equipment catalog and the following general information, the user should have a better understanding of the planning necessary to prepare an efficient facility for the computer system in which he chooses to invest.

Power Requirements

A transient free power source and a properly installed earth ground are extremely important to the reliable operation of the system.

The system must be protected from the hazard of power surges, fluctuations, and impulses. To implement this protection, the user must install an isolated AC circuit for the computer system. Isolated means a circuit that has a dedicated circuit breaker at the distribution panel, with no other load on it except the computer system. In some cases where power company line isolation is not adequate, you will be required to provide an isolation transformer or a regulating isolation transformer to condition the computer power source.

To avoid electrical interference, there should be no sources of electrical noise (arc welders, air conditioners, copiers, typewriters, cleaning equipment, fans, room heaters, etc.) plugged or hand-wired into the line supplying the system.

All outlets providing power to the system should be connected to the same grounding point. Furthermore, you will need to restrict that grounding point to only those connections coming from the computer installation. There must be no more than 0.5 ohms measurable from the single point ground to true earth ground. It is not unusual for the connection-to-earth ground to be 61 meters (200 feet) or more from the ground point at the computer facility. In cases such as this, there may be an unacceptable amount of electrical noise induced on the line which will necessitate the installation of a dedicated earth ground much nearer the system.

Environmental Requirements

Generally, a normal office environment is adequate for most computer installations. The environment must be free from drastic fluctuations in temperature and relative humidity or excessive amounts of airborne dust and particulate matter. Dust and high or low extremes in humidity and temperature must be controlled, as they contribute to premature failure of electrical and mechanical components of the computer system. A clean, spacious facility which allows cooling systems to work efficiently is important to the reliability of the system.

The optimum ambient temperature range for the system is 60 to 80 degrees Fahrenheit (15.5° to 26.7° C), and 90 degrees Fahrenheit (32.3° C) is the recommended maximum for a disk-based system. The user must calculate the heat load for the proposed equipment (available in this catalog) and ensure that the above operating range can be maintained.

The relative humidity must be in the range of 30 to 80 percent (non-condensing) with 55 percent plus or minus 10 percent being the optimum for equipment reliability.

The discharge of static electricity can be disastruous to computer operations. It will be necessary for the user to take precautions to avoid static discharge in areas of low humidity. Carpets should not be used, especially in a low humidity environment. Antistatic mats, antistatic spray treatments, and humidifiers are all possible ways for the customer to deal with static discharge problems.

There should be no equipment capable of producing electromagnetic radiation (such as heating and air conditioner motors and controllers or electrical switch gear) located near the computer facility.

Space Requirements

When planning the layout of the computer system, the user should be aware that the placement of the various components relies on the physical requirements of the equipment and maximum length of the various power and data cables, as well as the concept of efficient work flow.

A 914-mm (3-ft.) service clearance is ideal for most equipment, but in all cases, at least the minimum clearance as specified in the equipment catalog will be required. This will allow for adequate ventilation for the equipment and reasonable service access.

Cables should not cross walkways, but if necessary they must be covered with a suitable bridge to avoid injury and damage.

Do not lay cables near sources of electrical interference; do not route data cables in close proximity to high voltage power lines or in elevator shafts.

Tile, wood, or sealed concrete floors are all suitable for a computer installation.

Lease

Definitions

The definitions listed below should be helpful in understanding the terms used in this section.

- Computer—A configuration of functional equipment consisting of, as a minimum, a CPU, chassis, power supply, and memory.

- Equipment—Computers, systems, intelligent terminals, peripherals, terminals, software and any options thereof.

- Intelligent Terminal—A stand-alone programmable terminal that has internal processing capability and is not offered as a part of or as a peripheral for a system. The DS990 Model 1, Model 770, and Model 771 are intelligent terminals.

- Peripheral—An individual machine offered as a part of or an addition to a system. All disks and diskettes, tape drives, card readers, line printers, and the *Silent 700* and OMNI 800 machines offered as additions to a system are considered peripherals.

- Option—A hardware feature which can be inserted in or added on to an item of equipment to expand the capability of that item of equipment but which is not an operational item on a stand-alone basis. All cards and parts such as memory expansion kits and the various communications interface kits are considered options.

- Programs—The computer software, if any, delivered in whatever form under a Program License Agreement.

- System—Packaged system consisting of a computer, packaging enclosure, and associated peripherals but excluding intelligent terminals.

- Equipment Rate—The monthly charge(s) (excluding taxes and other incidental charges) minus the monthly Maintenance Rate (at the annual billing rate) and minus any monthly Software License Lease Rates.

- Hardware List Price—The quantity-one published purchase price minus any Software License Charge(s) in effect on the date the lease was executed and accepted by Texas Instruments, Austin, Texas.

- Software License Charge—The quantity-one published license charge on the specified media in effect on the date the lease was executed and accepted by Texas Instruments, Austin, Texas. This definition applies to the license charge included in the quantity-one published purchase price for equipment with software as well as programs leased on a line-item basis.

- Software License Lease Rate—The monthly charge (excluding taxes and other incidental charges) for programs under lease.

Terms and Conditions

All leases are to be at TI's standard lease rates which are subject to change until accepted by Texas Instruments, Austin, Texas. The lease of equipment is subject to Texas Instruments Standard Terms and Conditions of Lease as described on the lease agreement.

General

The lease term and monthly charges for the equipment, excluding systems and peripherals, shall begin on the first day of the month following shipment. The lease term and monthly charges for systems and peripherals shall begin on the date of installation or fifteen days after shipment, whichever is earlier, with the partial month charges prorated at 1/30th of the monthly rate. The monthly charges will be invoiced in advance for each month on or about the first day of that month.

All lease rates apply to a selected lease term which, upon completion, is automatically extended on a month-to-month basis until terminated by the required written notice.

The balance of the monthly equipment rate charges to complete the lease term will be required, as a cancallation charge, for any item of equipment terminated prior to the completion of its lease term.

All lease rates include basic prime shift maintenance within a 100-mile radius from the nearest TI service office but do not include hardware installation or removal charges. Two extended coverage options are also offered, as outlined in the service section.

Supplies, accessories, and other expendables, including disk packs and magnetic tapes, are *not* included in the hardware lease rates and, if required, must be specified separately as purchased items.

Lease rates are based on standard cable lengths which are approximately:

911 VDT	— 4.9 (16 ft.)
810 Printer	— 9.1 m (30 ft.)
2230/2260 Printer	— 9.1 m (30 ft.)
979A Tape Drive	— 4.3 m (14 ft.)
743 KSR Terminal	— 9.1 m (30 ft.)
CRU Expansion	— 3.7 m (12 ft.)
TILINE Expansion	— 3.7 m (12 ft.)

DS10 Disk	— Daisy 1.8 m (6 ft.)
	Bus 4.6 m (15 ft.)
DS25 Disk	— Daisy 2.4 m (8 ft.)
	Bus 4.6 m (15 ft.)
DS50 Disk	— Daisy 2.4 m (8 ft.)
	Bus 4.6 m (15 ft.)
DS200 Disk	— Daisy 2.4 m (8 ft.)
	Bus 4.6 m (15 ft.)
FD800 Diskette	— 1.8 m (6 ft.)
733 ASR Terminal	— 9.1 m (30 ft.)
820 KSR Printer	— 9.1 m (30 ft.)

All other cables are available only as purchase items. Cable length considerations must include internal cabinetry routing as well as the physical location of the Equipment.

Lessee must pay delivery and return transportation charges for systems and peripherals via space available air-ride van. Common carrier transportation is allowable for intelligent terminals.

The lease rate for options or peripherals subsequently added to a leased System will be determined as the current maximum whole term lease rate within the remainder of the committed system lease term or the 90-day lease rate if the remainder of the system lease term is eleven months or less.

Options are available for lease only as part of or additions to a leased system.

Peripherals are normally available for lease only as a part of or an addition to a leased system and will be leased as stand-alone items only on an "as available" basis from lease return inventory. Consult your local Field Sales Engineer for availability prior to submission of stand-alone peripheral leases.

TI offers the option of converting leased equipment (excluding programs) to purchase, with proper notice, at any time during the lease term. If the equipment is converted to purchase during the first six months of the initial lease term, 60 percent of the monthly equipment rates paid will be applied to the hardware list price. If the equipment is converted to purchase more than six months after the initial lease term, 30 percent of the monthly equipment rates paid will be applied to the hardware list price. In either case, lessee's conversion price may not be less than 50 percent of the hardware list price. Programs may also be converted to purchase as outlined in the Software section of this guide.

Hardware Installation and Removal

The price list charges apply for installation and removal service performed during Prime Shift Maintenance hours and within 100 miles from the nearest TI service office.

Customer site preparation, installation of cabling, power source electrical work, equipment movement (including inside delivery), and interconnection or testing of non-TI-supplied equipment are not included in this service. Failure by the lessee to have the site prepared at the time of installation will result in a service call billed at TI's then-current Standard Field Service Rates.

Installation of equipment is charged at the current Standard Service Installation Rates in effect on the date the lease was executed and accepted by TI, Austin, Texas.

Systems and Peripherals

Hardware installation and removal by TI personnel are required on all leased systems, options, and peripherals. Installation must be purchased as a separate line item on the Lease Agreement.

Upon arrival of the leased equipment (including options), Lessee must notify TI-CARE (1-800-231-2807) to schedule installation which will normally be completed within five working days after lessee notification.

More detailed installation information is outlined in the installation section of this guide.

Removal service provides for the in-place disassembly, equipment organization, and make-ready preparation for return air ride van shipment, but does not include any movement or relocation of equipment.

Removal service charges will be billed at TI's then-current Standard Field Service Removal Rates at the time of lease termination.

Option removal is allowed only after expiration of the lease term of the item of equipment in which the option is installed.

Intelligent Terminals

Hardware installation and removal of intelligent terminals by an authorized TI Service Engineer is recommended by not required.

Installation and removal by an authorized TI Service Engineer is required all options added to or removed from leased intelligent terminals.

Upon arrival of the options (and leased equipment, if installation is to be performed by TI), lessee must notify TI-CARE (1-800-231-2807) to schedule installation.

Option removal is allowed only after expiration of the lease term of the item of equipment in which the option is installed. Option removals must be performed by authorized TI service personnel and charged at the then current standard removal rates.

Pricing

Lease rates include prime shift maintenance within 100 miles of a TI service office. Details concerning pricing information and services provided are outlined in the Field Service section of this catalog.

Movement of Equipment

Leased equipment shall not be moved from the location listed in the Lease Agreement without the prior written approval of TI. Any such requests must be received by TI a minimum of 60 days prior to the requested relocation date. Upon approval by TI, the equipment moved to a new location is subject to any additional maintenance zone charges applicable for the new location. Deinstallation and reinstallation service is provided, at lessee's expense, at TI's current Standard Field Service Installation and Removal Rates.

Software

Software License

All software products listed herein are protected by a license. Reproduction of software products including software programs and documentation, in whole or in part, is prohibited except for use on the CPU and equipment designated by the TI lease agreement. A separate license must be leased for each CPU on which the software program will reside.

The lease term for each program is the same as the lease term for its designated equipment. However, the lease term for programs added to existing leased equipment is to be the unexpired portion of the lease term for its designated equipment with a minimum lease term of 90 days.

The monthly charge for each licensed program under lease shall begin on the designated equipment lease term start date or the first day of the month following shipment if the program is being added to existing leased equipment and shall be invoiced concurrently with the monthly charge for the designated equipment.

The monthly charges for programs under lease include TI's Software Subscription/Support Service.

The monthly charges for programs include the appropriate media unless ordered on an "add-on" basis.

The balance of the Software License Lease Rate charges to complete the program lease term will be required, as a cancellation charge, for any program terminated prior to the completion of its lease term.

At the time of termination, the media must be returned in good operation condition to TI and the lessee must certify that all copies of the program have been destroyed or returned.

Programs are provided under lease only when used on designated equipment that is leased from TI and the License for each program is coterminous with the Lease Agreement for its designated equipment.

Licensed programs under lease may not be sub-licensed.

With proper notice, TI offers the option of converting leased programs to purchase at any time during the lease term. If a program is converted to purchase, the terms for hardware purchase conversion apply except that Hardware List Price and Equipment Rate are changed to read Software License Charge and Software License Lease Rate and monthly maintenance is changed to be 1/12th of the annual renewal subscription service charge. In either case, the conversion price may not be less than 50 percent of the Software License Charge. The purchase conversion of each program entitles the lessee to receive TI's Software Subscription Service for the following 12-month period. If the designated equipment is converted to purchase, all associated leased programs must be converted to purchase or the lease of the programs must be terminated.

Software Installation

The leased Program License for the DX10 Operating System and all interrelated software include field analyst installation, at no additional charge to the customer. Interrelated software, including high-level languages or sort/merge, will be installed only at the time the DX10 Operating System is installed. Subsequent lease of interrelated software or receipt of software updates does not include installation. Hardware installation and test by a TI Customer Engineer are prerequisites for software installation.

Shipping

TI standard shipping procedures are outlined in the Ordering and Shipping section of this catalog.

All return transportation charges to TI are to be prepaid by the lessee.

Customer Services

Texas Instruments has specifically developed a broad range of customer services to accommodate the diverse needs of a growing customer base that represents all segments of the marketplace.

TI customer services encompass the following areas: hardware installation, software installation, software subscription service, hardware maintenance, and education classes.

Consult the Customer Services and software sections of this catalog for details concerning each of the services.

Ordering and Shipping

Telephone Orders

Telephone orders are accepted by Texas Instruments up to a maximum of $2500 at list price. The minimum order is $50.

Orders may be placed by calling:

Telephone Order Entry
Austin, Texas
512/250-7955

Customers are asked to provide the following information when placing telephone orders:

Purchase Order Number
Tax Status (if exempt, provide tax exempt number)
Billing and Shipping Addresses
Method of Shipment
Part numbers and descriptions

All verbal orders require written follow-up clearly marked "Confirming Telephone Order Placed with (*contact*) on (*date*)."

All shipments are F.O.B. Austin, Texas. No telephone orders are accepted F.O.B. destination.

Written Orders

Customers should supply the same detailed information requested for telephone order entry. It is important that the correct "Invoice To," "Ship to," and "Sold To" information is indicated on all purchase orders. (A post office box may not be used as the "Ship To" address.)

Please mail all purchase orders to the following address:

Texas Instruments Incorporated
P.O. Box 2909
Austin, Texas 78769

ATTN: Field Support Marketing
Mail Station 2025

Customers will receive a "Sales Order Acknowledgement" after entry of their purchase orders. If there are any problems with this acknowledgement, please refer to the Customer Services section of this catalog for contact information.

Ordering Documents

Texas Instruments primary goal is customer satisfaction. The following is a brief description of the documents which will aid in attaining this goal while you do business with TI.

Maintenance Service Agreement

Maintenance Service Agreements are as much a part of the sale of equipment as the equipment or system. A Maintenance Agreement provides the customer with priority maintenance during peak service needs. The Maintenance Agreement details such information as term of the agreement, equipment coverage, agreement coverage and charges, and limitations of the agreement. Maintenance Service Agreement quotes can be obtained from your local field sales representative.

Quantity Purchase Agreement

Texas Instruments, Digital Systems Division, offers a 900 Series Computer and Series 700 Distributed Processing Systems Quantity Purchase Agreement which allows the customer to order Series 700 Distributed Processing Systems. TI 900 Series minicomputers and systems, *Silent 700* and OMNI 800 Electronic Data Terminals (from the current 900 Series Computer and Series 700 Distributed Processing Systems price lists) under a single agreement.

Lease Agreement

The Computers and Distributed Processing Systems Equipment Lease Agreement outlines the terms and conditions of lease and offers the customer a vehicle for ordering lease equipment.

Credit Application

Customers desiring terms of net 30 days will have to submit a credit application, a current balance sheet, and income statement to TI's credit department. The information requested on the application is essential to the evaluation process and the application form provides a convenient method to secure it. All information should be submitted 60 days prior to scheduled shipment to allow ample time for processing.

Purchase Order Checklist

The following checklist is offered to assist in completing your purchase order and help avoid delays in processing.

Pricing
All prices are subject to change without notice. The price will be TI's standard purchase price in effect at the time TI accepts the order.

Shipping
- All shipments are F.O.B Austin, Texas.
- Please note if prepaid shipment is desired.
- Please note desired method of shipment.
- A post office box may not be used for the "Ship To" address.
- Please indicate if inside delivery is desired.

Insurance
Texas Instruments recommends the purchase of in-transit insurance by the customer through his individual agent for the full value of the equipment to be ordered. Normal freight coverage is for partial value only.

Tax Exempt Status
Exemption certificate number must be noted.

Quantity Purchase Agreement
If an agreement is currently on file with TI, please reference the agreement number on the purchase order. If you wish to execute such an agreement, please attach two copies to the purchase order.

Credit Application
Attach if not an established Digital Systems Division customer.

Installation
If installation by TI personnel is desired on those items where it is not included in the purchase price, please list installation as a separate line item on the purchase order.

Shipping Procedures

TI's standard shipping procedures are as follows:

- All equipment is normally shipped freight collect to the purchase customer or lessee.

- Purchased equipment is shipped motor or air freight.

- All leased systems and peripherals are shipped to and from the lessee via space available air-ride van.

- Leased intelligent terminals are shipped air freight unless otherwise specified on the lease agreement.

- All shipments are F.O.B. Austin, Texas.

- All transportation, rigging (including inside delivery) and customer requested insurance charges are at the customer's expense.

Since shipments are F.O.B. Austin, Texas, the customer assumes responsibility for the shipment as soon as it leaves TI's shipping dock. Unless otherwise directed by the customer, TI does not insure the shipment and only the normal carrier insurance that is included in the freight rates, which does not cover the full value of the equipment, will apply to each shipment. TI recommends that the customer obtain insurance, through his agent, to cover the full value of the equipment against loss during transit.

When the purchase order or lease is entered, a scheduled ship date, which complies as closely as possible with the customer's requested ship date, will be assigned by TI. However, because of the various production processes involved, the scheduled ship dates assigned by TI are approximate only.

Deferment and Cancellation Policies

Deferment

The customer may delay, or defer, shipments of part of an order or the entire order of standard catalog goods by providing TI with written notification at least 30 days prior to the original date of scheduled shipment:

1. Without charge for the first deferment up to a maximum of 60 days after the original date of scheduled shipment;
2. With a charge of 5 percent of the list purchase price in effect at the time the order was entered for the equipment affected for second or third deferments or any deferment greater than 60 days but less than six months.

There will be a charge of 15 percent of the list purchase price of the equipment affected for deferment where written notice is not received by TI 30 days prior to the original scheduled ship date.

Deferments beyond six months after the original date of scheduled shipment or four successive deferments will be considered a cancellation, and the cancellation policies will apply.

Cancellation

Should the customer wish to cancel an order, or a portion of an order, for standard catalog goods, he may do so with advance written notice to TI. If the customer's notice to cancel is received less than 30 days prior to the orginally scheduled ship date, there will be a cancellation charge of 25% of the list price of the goods affected.

For other deferment and cancellation charges see the Quantity Purchase Agreement terms and conditions.

Texas Instruments reserves the right to change its product and service offerings at any time without notice.

TEXAS INSTRUMENTS
INCORPORATED

DIGITAL SYSTEMS DIVISION
P.O. BOX 1444 ● HOUSTON, TEXAS 77001

Printed in U.S.A

TI-557B-20M-7/79