T-CARRIER ADMINISTRATION SYSTEM (TCAS)
CENTRAL ENGINEERING
OPERATING SUPPORT SYSTEMS

CONTENTS PAGE

1. GENERAL

1.01 This section provides information on engineering the T-Carrier Administration System (TCAS) central (computer and peripherals). It also covers the floor plan, power requirements, environmental requirements, and information on ordering the TCAS central.

1.02 This section is being reissued to include changes required with generic 4. These changes are as follows:

- Memory is expanded
- Additional disc controller
- The Hewlett-Packard (HP) 7906 disc drive is required.

Revision arrows are used to emphasize the more significant changes. Equipment test lists are not affected.

1.03 The TCAS central equipment, together with TCAS remote office equipment and E-telemetry, provides an automated centralized maintenance system for metropolitan digital networks. The system provides the ability to quickly recognize terminal or line failures, sectionalize the trouble, and coordinate the restoration and repair with a minimum of personnel time and effort.

1.04 ▶The computer cabinet, along with the HP 7920S disc drive and HP 2645A control console, is the nucleus of the TCAS central equipment. The control console, disc drive, and computer cabinet are composed of Hewlett-Packard equipment, exclusively. The computer cabinet is a double-bay cabinet accessible from both front and rear. It contains an HP 2113 computer, HP 7906 disc drive (required for generic 4), HP 7970E magnetic tape unit, and one or two HP 12979 input/output extenders. The HP 7920S

disc drive is in a separate cabinet, and the HP 2645A control console with an HP 9876A printer must be placed on a table or desk. The table or desk must be furnished separately. This complete HP equipment assembly is designated as an HP System 1000.

1.05 For generic 4 operations, the computer's memory must be expanded from 256K words to 512K words. In addition to the memory, an additional disc controller is required. This disc controller converts the HP 7920S to an HP 7920M and will allow parallel access to both the HP 7920 and the HP 7906 disc drives.◀

1.06 ▶The TCAS central was designed to use a 1.0 mil nonstandard magnetic tape since the data base disc image could not be contained on a single 2400-foot tape. To allow the use of a standard 1.5 mil tape, a multireel capability was designed.◀ Changes to normal disc-image configurations are as follows:

- An operator must be present to exchange the tape reels at the time the first tape is completed (about 20 minutes).
- After reconfiguration, (computer will output another tape mount message) disc image will automatically continue.
- The total quiet time required for multireel disc image is approximately 37 minutes.

Verification of the last tape reel will begin after quiet time is cleared. After normal TCAS operations resume, the first reels of tape can be verified at any time. ▶The 1.0 mil tape may still be used at the telephone company's option.◀

1.07 The dial-out capability enables TCAS to deliver reports more timely and with less effort. This capability is also used to transmit periodic reports to the remote locations over the direct distance dialing (DDD) network. This will support multiple facility maintenance and administration centers—metropolitan (FMAC-M) from a single TCAS central.

1.08 Digital facilities that interface with the switch using digroup terminals cannot use the hard-wired method for monitoring facility failures. The digital failure information derived from the digroup terminals is fowarded to TCAS via a Circuit Maintenance System (CMS) 1C interface. This arrangement will allow TCAS to monitor the status of all T1 facilities which terminate on a No. 4 Electronic Switching System (ESS). Data links are also used between TCAS and the No. 2 Switching Control Center System (SCCS) for alarm information from T1 facilities that terminate on the No. 1, No. 1A, and No. 2 ESS offices. ▶Generic 4 provides a link between the Telecommunications Alarm Surveillance and Control (TASC) System and the T-Carrier Administration System. This link will allow TCAS to use its capabilities in small electromechanical offices using the discrete carrier monitoring provided by TASC.◀

1.09 Additional equipment located at a TCAS central serves as an interface between the processor input/output (I/O) ports and the E-telemetry data networks. This equipment takes the parallel 16-bit data word from the computer and converts the word to a serial E2A data format.

1.10 Additional information on the TCAS central is covered in Section 190-200-010.

2. PHYSICAL ENVIRONMENT FOR TCAS CENTRAL

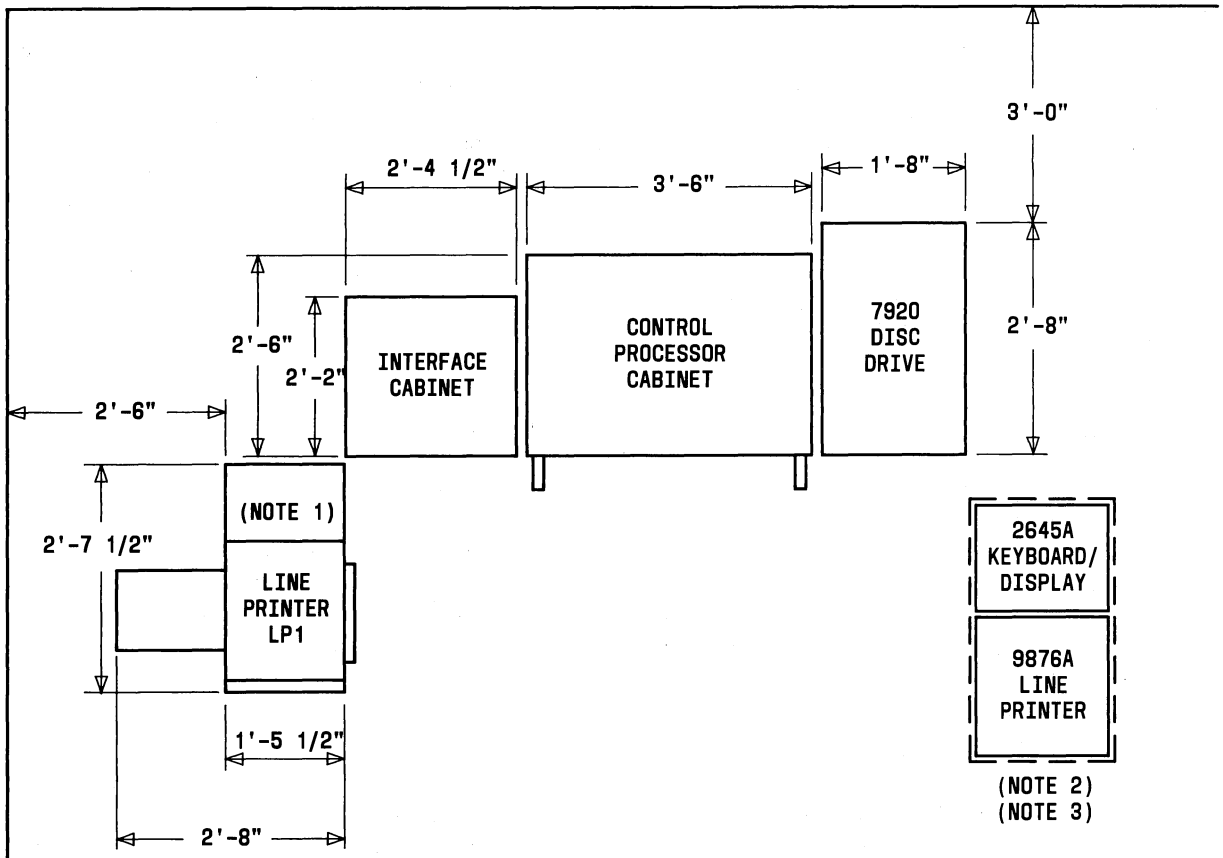
A. Floor Plan

2.01 The floor plan for the TCAS central must allow sufficient room to accommodate the central processor cabinet, interface cabinet, and associated peripheral equipment. The area must be large enough to allow room to work on the various pieces of equipment. A possible floor plan is shown in Fig. 1.

2.02 It is recommended that the central processor cabinet, interface cabinet, and ▶HP 7920M◀ disc drive unit be located as shown in Fig. 1. This is because of the short interconnecting cables between the processor and ▶HP 7920M◀ disc and between the processor and interface cabinet. The HP 2645A cathode-ray tube (CRT) and ▶HP 9876A◀ thermal printer should be located within a short distance of the central processor cabinet to aid in system initialization and operation.

2.03 A DATASPEED® 40 tractor-feed printer is used as the line printer (LP1) and can be located up to 200 feet (using four 50-foot connecting cables) from the TCAS central processor cabinet. The printer can be located any distance from the central using 202T data sets and a 3002 data facility. This printer is the report printer and should be located at the primary FMAC-M.

2.04 The floor must be capable of supporting a concentrated load of 300 pounds per square inch



NOTES:

1. LINE PRINTER LP1 CAN BE LOCATED UP TO 200 FEET (USING FOUR 50-FOOT CABLES) AWAY FROM THE CONTROL PROCESSOR CABINET WITHOUT USING DATA SET FACILITIES. THE LP1 IS NORMALLY LOCATED AT THE PRIMARY FMAC-M.
2. THE HP 2645A KEYBOARD DISPLAY AND HP 9876A LINE PRINTER CAN BE LOCATED UP TO 50 FEET AWAY FROM THE CONTROL PROCESSOR CABINET, BUT IS RECOMMENDED TO BE AS CLOSE AS POSSIBLE TO THE CABINET.
3. NO CHAIR OR TABLE IS FURNISHED WITH THE SYSTEM, BUT IS RECOMMENDED.

Fig. 1—Typical Central Floor Plan for TCAS

(lb/in²) to accommodate the heavily loaded TCAS central processor cabinet and support any lifting equipment used to assist with installation. Tile, concrete, and other industrial floors, or raised floors, are suitable for the system. Because of static discharge problems, carpet should be avoided, but carpet with copper filament can be used.

2.05 Figure 1 provides overall dimensions for all cabinets and accessories as well as appropriate floor space recommended for stand-alone accessories. Ceiling height should be at least 8 feet high to facilitate ventilating exhaust from the top of the system cabinets.

2.06 A supervisory control position supports the multi-FMAC-M arrangement (Fig. 2) and facilitates location of the TCAS central in a minicomputer operations center. This position performs some of the functions that before had to be done from the computer control console. Each FMAC-M may configure one of its terminals to function as a supervisory control position. However, some of the functions that remain at the computer control console (telemetry trouble sectionalization for one) require that proper agreements be made between the FMAC-M and the minicomputer operations center to ensure appropriate response to telemetry and TCAS central failures. The TCAS operations personnel should be consulted to determine the number of control positions that are required.

2.07 The TCAS software has the capability of supporting up to five independent FMAC-Ms from one centrally located computer. The arrangements for multi-FMAC-M operations are as follows:

- Two or three dedicated printers
- Two dedicated printers and one dial out port
- One dedicated printer and two dial out ports.

One of these arrangements is required for multi-FMAC-M and automatic report distribution features. Figure 2 is a typical multi-FMAC-M arrangement.

B. Grounding Requirements

2.08 A proper ground is required for the computer system to operate without error. The grounding conductor should be an insulated conductor equal in size to the power circuit conductors. With power disconnected, the resistance between the neutral and ground conductors at the computer input power terminal shall be less than 6 ohms.

C. Power Requirements

2.09 The TCAS System and accessories must be powered from a single main source that is stable and noise free to assure uninterrupted operation. AC power can be connected to TCAS with one of the following methods:

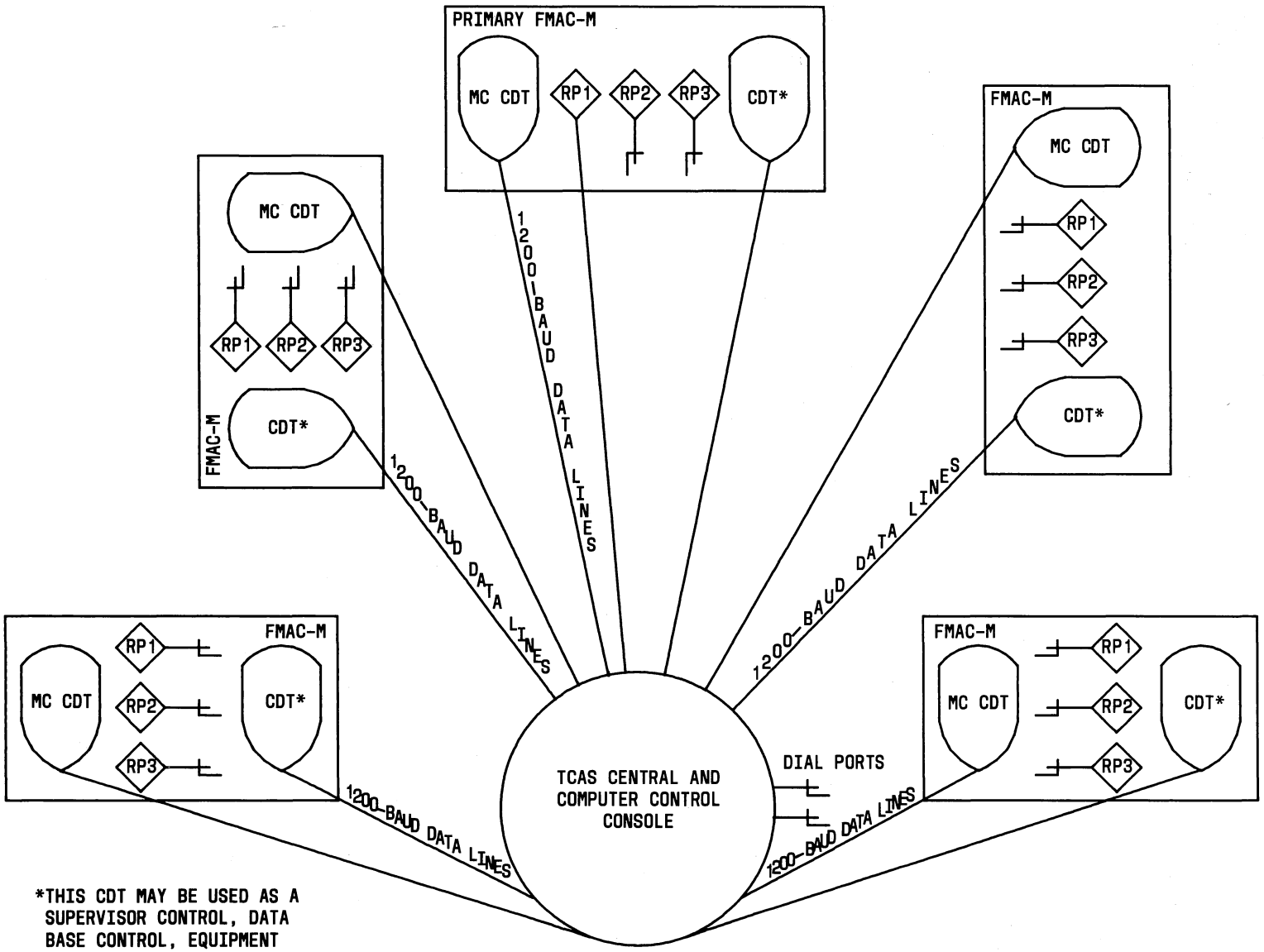
- Three 110V single phase at 20A
- One 110V single phase at 20A and one 110/220 two phase at 20A
- One 110/208 three phase at 20A.

2.10 A voltage measurement should be made between neutral (white) and ground (green) under a loaded condition (Fig. 3). The Hewlett-Packard equipment requirement on the voltage measurement is a maximum of 1 volt peak-to-peak. Hewlett-Packard will not guarantee proper operation of its equipment if the voltage requirement is not met.

2.11 If noise or voltage problems are detected, a possible solution is to use isolation transformers to isolate the power output from the TCAS central input power. Figure 4 depicts the use of a 2.5 KVA 120:120 isolation transformer for each phase (or branch if three 120V single phase is used) of the computer power. The following are several possible isolation transformers:

- Deltec Company, 3-DT250T1 super isolation transformer (single phase)
- Topaz Electronics, 91002-22 ultra isolation transformer (single phase)
- Topaz Electronics, 91407-11 (three phase).

Note: All federal and local electrical codes must be met when connecting power to TCAS central.



*THIS CDT MAY BE USED AS A SUPERVISOR CONTROL, DATA BASE CONTROL, EQUIPMENT AND FACILITIES ASSIGNMENT CONTROL, MAINTENANCE ALARM CONTROL, OR AN ADDITIONAL MAINTENANCE CONTROL POSITION.

Fig. 2—Multi-FMAC-M Application

2.12 The ac power is connected to the TCAS terminal strip on three 120V single-phase branches or a three-phase branch. It is recommended that the three separate branches (or phases) be connected as follows:

(1) Right half of cabinet with an HP 2113 disc controller and an HP 7906 disc

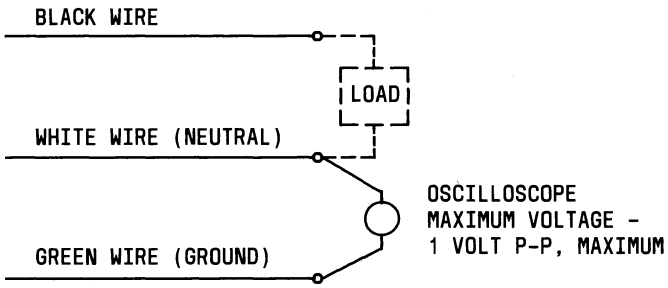
(2) Left half of cabinet with an ➧HP 7970E➧ magnetic tape unit and an I/O extender

(3) An interface cabinet, HP 7920 disc drive, HP 2645 control console, and a printer.

D. Environmental Considerations

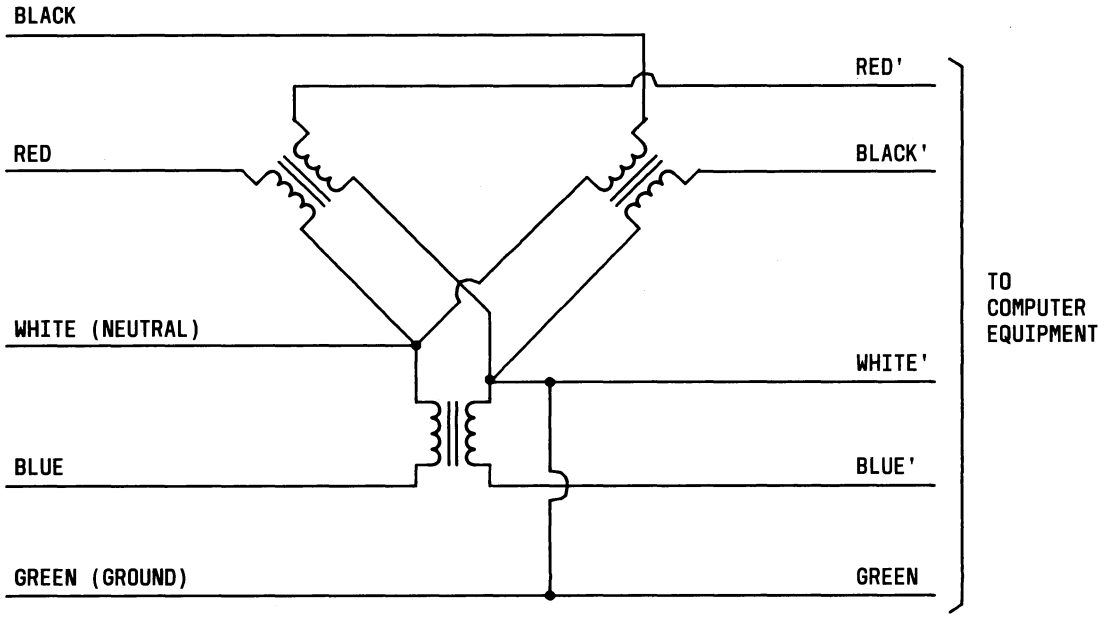
2.13 Environmental considerations will require planning and preparation time to meet Hewlett-Packard 1000 Computer System Environmental Specification. Ventilation, air conditioning, heating, etc, of the operating site must be adequate to maintain the desired environmental condition within the specified limitations.

2.14 The operating temperature has to be between 50-to-86 degrees Fahrenheit or 10-to-30 degrees Celsius. Allowance has to be made for the maximum heat dissipation of the TCAS central equipment (16,000 British termal units [BTU]), taking into consideration the lights, people, and other equipment in the area. Relative humidity has to be between 20 to 80 percent with no condensation.



NOTE: VOLTAGE MEASUREMENT HAS TO BE MADE UNDER A LOAD CONDITION.

Fig. 3—Measuring Ground Voltage Differences



NOTE: CONNECT TRANSFORMER CASES TO GROUND (GREEN). FLOATING NEUTRAL (WHITE') IS GROUNDED AT TRANSFORMERS.

Fig. 4—Connecting Isolation Transformers to TCAS Central

3. CENTRAL EQUIPMENT ENGINEERING

A. General

3.01 The TCAS central equipment, together with TCAS remote office equipment and E-telemetry, provides an automated centralized maintenance system for a digital network in a metropolitan area. Sections 824-101-106 and 865-201-100, and SD-1P061-01 should be used when ordering the needed TCAS central equipment.

B. Hardware

3.02 The TCAS central equipment consists of a processor control cabinet, a telemetry interface cabinet, and a number of associated peripheral items.

3.03 The processor control cabinet, the nucleus of the TCAS central equipment, is comprised solely of Hewlett-Packard equipment. The equipment consists of an HP 2113B minicomputer equipped with ⧫512K⧫ words of memory, a cartridge disc subsystem, a magnetic tape subsystem, and an I/O extender.

3.04 The basic TCAS installation includes an I/O extender which gives a basic capacity of the central of five data ports, seven telemetry-to-computer translators (TCT), and eight computer display terminals (CDT). If a TCAS installation requires more than seven TCTs and/or more than eight CDTs, or one or more dial ports, a second I/O extender is required in the processor cabinet. This extends the capacity of the central to 12 CDTs, 10 TCTs, 12 data ports, and 2 dial ports.

3.05 The TCAS central can be equipped to handle up to ten separate multipoint data networks. An individual data network may contain up to 16 E-telemetry remote terminals. However, ten remotes on a data facility may be considered typical. Because of addressing restrictions, the maximum capacity of the central is 128 remotes. A metropolitan TCAS application may involve 30 monitored offices (5000 T-Carrier Systems) requiring a basic TCAS central with five TCTs and an average of six remotes on each TCT. An operator position is required for each 1500 to 2000 monitored T-Carrier Systems.

3.06 Growth considerations for the TCAS central are in three general areas:

(a) Data links to CMS-1C and/or links to No. 2 SCCs (up to 12)

(b) Telemetry-to-computer translators for the number of (one to ten) telemetry data networks

(c) DATASPEED 40 terminal sets for up to 12 maintenance control, ⧫maintenance alarm control,⧫ data base, and supervisory positions. For large networks, a dedicated data base position and a supervisory position are recommended. Each position may be equipped with an optional printer.

⧫***Note:*** The maintenance alarm control position was added by generic 4 to handle high-capacity and miscellaneous alarms.⧫

3.07 At least one DATASPEED 40/1 printer is required for each central location and must be engineered and provided by the customer. This printer provides the necessary reports for the FMAC-M. The printer may be located up to 200 feet from the TCAS central using four 50-foot cables; for a distance greater than 200 feet, data facilities with 202T data sets have to be used. The reports from this printer must be available to the FMAC-M. If the computer is physically separated from the FMAC-M by a significant distance, it is desirable to place the printer at the FMAC-M location.

3.08 From 2 to 12 (using the second I/O extender) DATASPEED 40 teletypewriter terminals can be used for maintenance control functions. It is recommended that each maintenance control terminal be equipped with an optional printer. Both terminal and printer must be engineered and provided by the customer. The number of CDTs required for maintenance control positions depend upon the number of monitored systems and the failure rate. A typical arrangement is 1 maintenance control position for every 1500 T-Systems monitored.

3.09 The telemetry interface cabinet contains up to ten TCTs, a test TCT, a TCT test panel, and mounting space for up to sixteen 202T data sets. Each TCT is connected to the processor via a W7 cable and a + TRUE IN/OUT interface card in the I/O extender(s). The number of TCTs required depends upon the number of E-telemetry remotes deployed in the data network. Networks containing ten or less remotes are recommended.

3.10 A TCAS can also obtain information concerning digital systems through a data port interface with other computer-controlled systems, such as the CMS, Switching Control Center Systems (SCCS), and ▶TASC.◀ The interface consists of a buffered-asynchronous interface connected to a 202T data set. Up to 5 data port interfaces can be placed in the first I/O extender, and up to 12, using a second I/O extender. For the CMS—TCAS link, one data port is required for each No. 4 ESS office that is monitored. For the No. 2 SCC—TCAS link, one data port is required for each No. 2 SCC serving No. 1, No. 1A, or No. 2 ESS that is monitored by TCAS. ▶For the TASC—TCAS link, one data port is required for each TASC system used to monitor T-carrier.◀

3.11 Refer to Section 865-101-106 for information on ordering currently available hardware.

C. TCAS Software

3.12 Software is supplied on a magnetic tape and minicartridge cassette tapes. The magnetic tape contains ▶real-time executive (RTE) VI◀ Hewlett-Packard software and TCAS operating software developed for TCAS operation. The minicartridge cassette tapes contain the programs required to boot up the TCAS System and diagnostics for the TCAS central.

3.13 Refer to Section 824-101-106 for information regarding currently available software.

D. Consumable Supplies

3.14 Tape requirements include provision of at least 20 reels of 1/2-inch magnetic tape (3600 feet, 1.0 mil each) with tape seals (not required using multireel feature). These reels are used for making backup disc images of the TCAS System. Also needed will be 20 reels of 1/2-inch magnetic tape (1200 feet, 1.5 mil each) and 10 reels of 1/2-inch magnetic tape (2400 feet, 1.5 mil each), all with tape seals.

> ***Note:*** If the 1.0 mil tape operation is not desired, use 40 reels of 2400-foot, 1.5 mil magnetic tape.

3.15 Although disc packs are not normally changed for TCAS operations, it is recommended that one spare pack of each type be ordered in case of damage to the disc platter being used. For the HP 7906 drive, order one Hewlett-Packard 12940A disc cartridge. For the HP 7920 drive, order one Hewlett-Packard 13394A disc pack.

3.16 The HP 2645 control console is equipped with five minicartridge cassettes. Although this is adequate for the initial installation, if additional cassettes are required they must be ordered from Hewlett-Packard as Part Number 9162-0061 mini-data cartridges.

3.17 The ▶HP 6876A◀ printer used with the control console requires a special thermal paper. It is recommended that ten rolls of this paper be ordered from Hewlett-Packard as Part Number 9281-0414 (two-roll packages).

3.18 Paper must be ordered for the line printers. This is standard fanfold tractor-fed teletypewriter paper, 9-1/2 inches wide.

4. REFERENCES

4.01 The following sections pertain to TCAS and may be used as necessary:

SECTION	TITLE
190-200-010	TCAS—Overall System Description
190-200-030	TCAS—Maintenance Controller—General Operating Procedures
190-200-031	TCAS—Maintenance Controller—Typical Trouble Handling Procedures
190-200-100	TCAS—Functional Description
190-200-300	TCAS Central—Operating Procedures
190-200-310	TCAS—Data Base Controller Operations
190-200-500	TCAS Central—Test Procedures
201-644-100	E2 Status Reporting and Control System—Overall System Description
365-330-100	TCAS—General Description
365-330-110	TCAS—Remote Office Equipment Description
365-330-200	TCAS—Remote Office Equipment Turnup Procedures

SECTION	TITLE
365-330-201	TCAS—Turnup Procedures for Remote Office Equipment and Bridged Arrangements
365-330-500	TCAS—Remote Office Equipment Maintenance and Trouble Location Procedures
824-101-104	(J98722) TCAS Remote Office Equipment—Requirements
824-101-106	(J1P025) TCAS Central Terminal Equipment—Requirements
865-100-101	E-Telemetry Systems—Data Network—Engineering
865-201-100	TCAS—Overall Engineering
865-201-101	TCAS Central—Engineering
865-201-102	TCAS—Data Base Preparation
865-201-103	TCAS—General Code Catalog
865-201-110	TCAS—Remote Office Engineering
855-201-111	TCAS—Engineering Assignments
865-201-190	TCAS—Engineering and Implementation Methods System (EIMS) Guide