COMPUTERIZED ELECTRONIC BILLING SYSTEM/RECORDER ONLY GENERAL DESCRIPTION NO. 5 CROSSBAR

Contents Page

1. GENERAL

1.01 This section provides descriptive information on the Computerized Electronic Billing System/Recorder Only (CEBS/RO).

Note: Information presented in this section is based on Pacific Telephone Engineering Letter (PTEL) 2032 which rates the CEBS/RO as standard for use in the Pacific Company (PAC).

1.02 It is reissued to:

- Revise the Table of Contents.
- Remove the Operations Support Center (OSC) from Figs. 2 and 4.
- Add Telecommunications Alarm Surveillance and Control (TASC) Interconnection Information.
- Remove references to OSC from Part 4.

Note: Marginal arrows used to denote changes are omitted.

1.03 CEBS/RO may be applied, where appropriate, toward the implementation of the plan for eliminating paper tape in electromechanical switching machines.

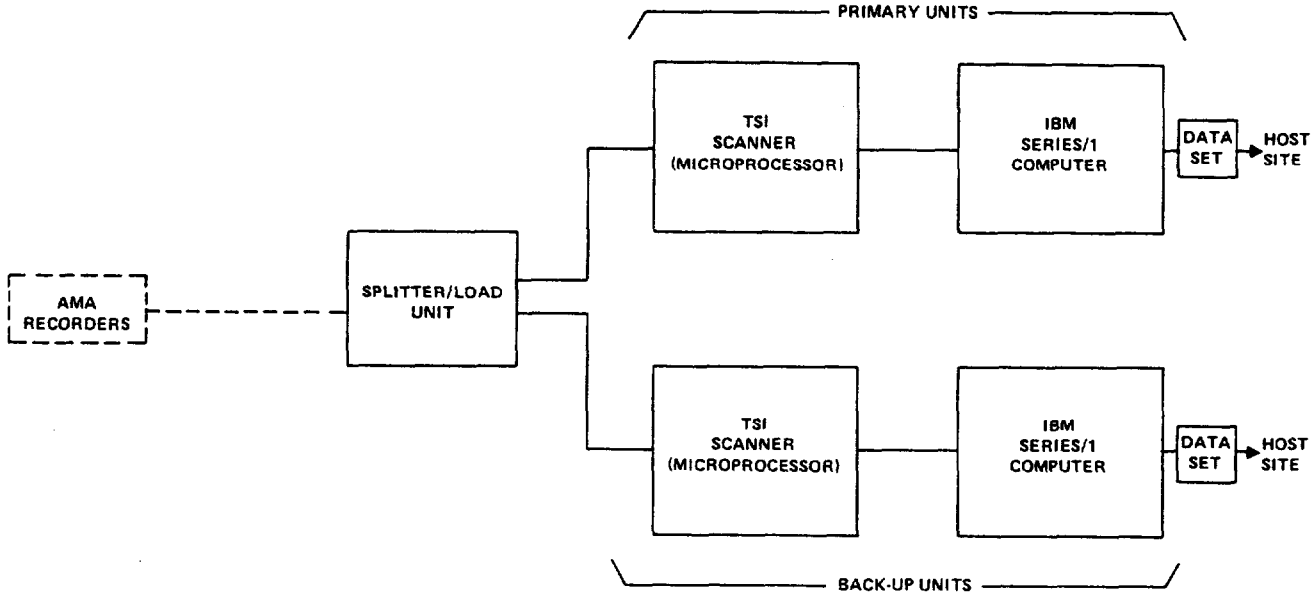
1.04 CEBS/RO is a replacement for the electromechanical perforators used in the paper tape Automatic Message Accounting (AMA) system.

1.05 This system is a composite system consisting of an International Business Machine (IBM) Corporation Series/1 minicomputer coupled via TeleSciences Incorporated scanners to the perforator output of electromechanical AMA recorders. (See Fig. 1.)

(a) The scanner is interfaced into the recorder via electrically simulated perforators (splitter/load unit). Thus, the system may be connected without modification to the AMA system.

(b) A microprocessor in the scanner selects the significant data generated by the recorder, formats and stores the information for transfer to the minicomputer. An error and fault recognition program is also provided in the scanner's microprocessor.

(c) The information gathered by the scanner is stored in a disk file in the minicomputer. A program in the Series/1 assembles the call data into complete AMA entries for later transmission to a Host location.



Elements of CEBS/RO Basic Central Office Equipment
Fig. 1

1.06 A Host Series/1 minicomputer, installed at a central location, completes the CEBS/RO system. (See Fig. 2.) Periodically, the Host polls the end office machines and requests the data from the disk file. The received AMA information is recorded onto magnetic tape for transportation to the Accounting Department's processing center.

1.07 Polling may be via:

- Dial-up through the message network (recommended method).
- Dedicated data link.
- Dedicated multi-drop data lines.

1.08 CEBS/RO is designed to operate in an unattended office environment. The system is fully duplicated on site. The back-up unit runs "hot" via independent scanners, and continually monitors the primary system. Faults are printed out locally and also stored in memory for retrieval by a Switching Control Center (SCC).

1.09 Maintenance programs at the Host send diagnostic test messages to the end office machines for trouble identification. These messages are sent via the primary Series/1, through the primary scanners to the back-up scanners to the back-up Series/1 and returned to the Host — thus providing a round-robin call through test of the system.

1.10 At the end office, CEBS/RO is a self contained system requiring only connection to the Central Office (CO) battery for power and access via connectorized cable to the 32 perforator leads from each recorder.

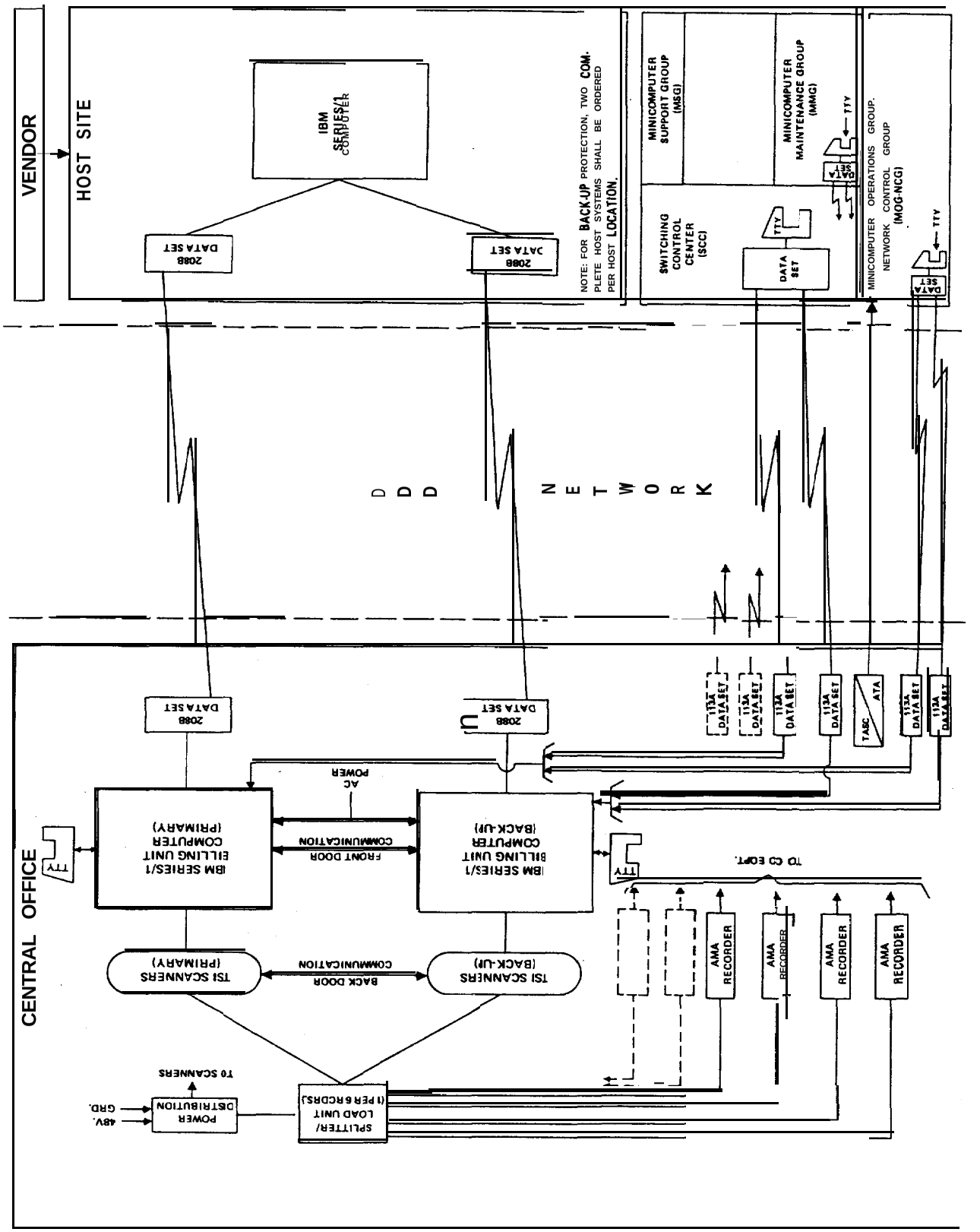
2. DESCRIPTION

On-Site

2.01 Scanner — The TeleScience Incorporated scanner is connected to the CO recorders by connectorized cables terminated on the recorder to perforator terminal blocks. Load units provide the equivalent impedance of each perforator magnet coil which allows the switching machine to see a "perforator", thus, not disturbing normal functions. The load unit also provides the "split" for two independent scanners.

2.02 From the load units, the A-F digits and 4 control indicators are derived from each CO recorder. Data acquisition is accomplished by the microprocessor controlled scanner reviewing all data leads every 2.078 milliseconds.

2.03 Upon detection of data present (DTC lead), the data leads are sampled for the "A" digit 3 bit odd-parity code and the B-F digit 2-out-of-5 code. If found correct, the data is formatted for transmission to the Series/1. If errors occur, raw unformatted data is sent to the Series/1 for analysis



Simplified Block Diagram of Basic CEBS/RO System
Fig. 2

and local logging. Each entry carries a time "stamp" with 100 millisecond resolution.

2.04 Three communication channels are provided from each scanner. One to transmit data to the Series/1; one to interconnect with the back-up scanner; and, one for off-line diagnosis of scanner failures. Each scanner controls alarm relays that provide multilevel alarm inputs to the office alarm system. Status lamps indicate the specific conditions detected by the scanner.

2.05 Surveillance of the control leads is also maintained to alert the Series/1 that a transfer from a recorder to emergency, or back from emergency, has occurred (XFR Lead). Recorder recognized trouble is monitored by review of the "CK" lead.

2.06 Scanning of the "ON" lead detects when the recorder has been idle long enough to ensure that queueing has not occurred, (minimum reseizure threshold time).

2.07 Lorraine power inverters are contained in the cabinets to provide the AC supply for the Series/1 minicomputers. These are Uninterruptible Power Sources with a recovery time of less than ½ cycle.

2.08 Series/1 Computer — The IBM Series/1 receives recorder data from the scanners on a periodic poll via 9600 BPS serial sequences. Call data is identified by the recorder interface (load unit) from which it originated, then placed in a temporary buffer (one per recorder).

2.09 Upon receipt of enough data for an initial entry, the data in the buffer is converted into the first phase of a call record — Calling and Called numbers, MB1/COI, trunk number. This data is written to the fixed Head disk file in the area reserved for each trunk served by each recorder. The temporary buffer is then cleared for the next entry from its recorder.

2.10 When a time line is detected (A=1 or 3), a status indicator is tested to determine if this is a connect (no previous time line for the initial entry for this trunk) or a disconnect. The entry time data (digits B, C, D) are ***replaced*** with the ***current value*** of the Series/1 100 millisecond timer. ***Connect times*** are adjusted in the processor by a ***negative*** 2 seconds to correct the positive 2 second charge delay placed by the charge delay timer.

Note: This is one of the major steps in obtaining the more precise timing available with this magnetic tape AMA system.

2.11 When a disconnect time line is detected, a separate per recorder queue timer is interrogated to determine if this time line could have been delayed in queue after actual disconnect occurred. This queue timing is controlled by the recorder "ON" lead. If the recorder has been idle longer than the minimum reseizure time (106 millisecond ± 2), the queue timer is reset and no allowance is applied to the disconnect time.

Note: Should a number of entries hit the recorder simultaneously, the recorder would be reseized in less than minimum reseizure time. Under this condition, the queue timer will not reset, and will continue incrementing on a 100 millisecond basis up to a maximum of 5.4 seconds. The disconnect time entry would indicate that it could have been in queue and that disconnect time could be overstated by an amount equal to the current value of the queue timer, so the system adjusts the disconnect time by the current value of the queue timer.

2.12 Error Detection and Back-up — The end office installations are fully duplicated with identical configurations, including all scanning equipment. Both systems are operated in parallel and perform identical recording and call assembly tasks up to the point of writing the fully assembled call record to the 350,000 call record file.

2.13 If the back-up system is assured that the primary system is functional, it does not attempt to write its assembled call into its file. Should a primary switchover occur, the back-up system will take over (become "enabled") in about one second.

2.14 When the back-up system is enabled, partially assembled calls in the back-up's call assembly file will be flagged to indicate that they are the responsibility of the back-up system. Simultaneously, the primary system flags its partially assembled records as invalid. Thus, the only calls lost during the switchover are those with a disconnect time entry during the 1 second switchover.

2.15 The back-up system retains responsibility for billing all calls in progress when the primary returns to service. Upon return to service, the primary will record, for billing, only new calls occuring after the back-up has been told not to bill any new calls.

2.16 Upon system initialization, both communications paths are checked in both directions by echo checking messages from Series/1 to Series/1. Thereafter, each system uses whichever paths are available to inform the other system of its status. The back-up indicates if it is functioning and capable of picking up the billing function, while the primary continually indicates that it is performing the billing function. When the primary no longer is able to perform the billing function due to a hard failure, the back-up system will detect loss of primary messages on both channels and will automatically assume the billing function. In the case of a soft failure, the primary will inform the back-up to assume the billing function.

2.17 If the primary system detects that the back-up is not available, no soft shutdowns are permitted. When the failure of the primary is remedied, both communication channels are tested and the primary reassumes the billing function.

Note: The back-up system will disable itself when it detects internal or scanner failures and so notify the primary.

2.18 Alarms — Currently, 5 alarms from the primary and 5 from the back-up system are wired into Telecommunication Alarm Surveillance and Control (TASC) System. Each alarm is identified as to the cause and severity level of the problem. The Series/1 processor can set alarm bits by sending alarm status to the scanner which in turn will activate the alarms. In the event the scanner is no longer functioning, a "dead man timer" will time out causing a major alarm. If the scanner does not receive the periodic system status message from the Series/1, it will activate a major alarm.

Note: Extensive on-line diagnostic routines in both the scanners and Series/1 are utilized to detect both hard and soft errors in the CEBS equipment. Additional analysis routines detect switch (recorder) or cabling failures.

2.19 Failure Conditions — Failure conditions are assigned to 5 different alarm categories:

Level 0 — Hard failures in either the scanner or the Series/1 of such magnitude that further system operation is impossible.

Level 1 — Data Integrity from the recorder is becoming questionable due to excessive mutilations or apology levels.

Level 2 — Soft failures and warnings such as intermittent but recoverable disk errors, extremely poor transmission quality or the sequential disk buffer has exceeded 80% full and a demand poll should be scheduled.

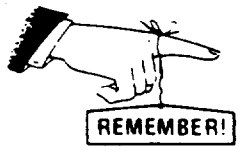
Level 3 — Indicates that the scanner has not received a Series/1 data inquiry in 9 seconds. Data inquiry normally occurs in 5 seconds.

Level 4 — Power alarm condition exists in scanner cabinet.

2.20 Each CEBS processor can communicate to the other via two independent channels, one is a direct connection between the Series/1 communications facilities (front door), the second through the primary Series/1 to primary scanner to back-up scanner to back-up Series/1 communications facilities (back door).

2.21 Power failure and blown fuse alarm is independent of CEBS control. The soft failure alarms are controlled by the Series/1 and will be reset when the conditions causing the alarm are eliminated — such as a demand poll eliminating the 80% file full alarm. Reset of hard failure alarms can only occur on system reinitialization.

2.22 All switchover events are logged on both system logs along with all the scanner and Series/1 messages indicating the cause of the switchover. These messages are available to the SCC and Minicomputer Operations Group-Network Control Group (see Part 4) through the dial-up port and will be retrieved from the disk file on demand. For example, the SCC could request all mutilation messages, disk failures or communications failures, and they would be retrieved by their message type and transmitted.



Messages can only be retrieved by type, not by time and type. You can poll the remote for messages by the hour, and you will receive all messages for that hour.

Host

2.23 Series/1 Computer — The Series/1 Host is similar to the on-site Series/1 machine except that it is equipped with a 1600 BPI magnetic tape drive for preparing the call record tape for the accounting system.

2.24 Each Host has a list of its primary billing site machines and a polling schedule for each location (nominally every 4 hours). Each remote may have a different schedule which is alterable by the operator. Each Host will also have the polling list and schedules for all other Hosts in the system so that it may take over the polling duties in the event of a Host failure. Each Host operates independent of the other hosts although they communicate with each other so that each host is cognizant of total system status.

2.25 The CEBS has multiple bisynch communications adapters so that several remote locations can be polled simultaneously. When a site is polled certain security conventions are employed to eliminate the possibility of unauthorized access to the billing file. Each block of data transmitted from the remote to the Host has a sequence number assigned so that retransmission of faulty blocks can be easily accomplished.

2.26 The sequence numbers for all blocks transmitted are maintained by the Host and the remote on a continuous basis, so that in the event of line failure or Host failure, an alternate Host could dial the remote location and the remote would begin transmission with the next "good" block of data.

2.27 In the case of a lost or damaged tape, the operator at the Host could repoll and request blocks XXXXX to YYYYY based on the system log at the host location. A number of safeguards are employed to prevent the transmission of duplicate data blocks, eliminating the possibility of duplicate billing records.

2.28 When a host polls the remote location and has completed transmission from the primary, it will then poll the backup system for messages received when the backup was handling the billing function (ie, the primary was down).

2.29 The Host system has the capability under operator control to invoke an "end to end" test where automatic testing of the communication path from the Host to the remote to the scanner, with individual test points isolated so that specific failures can be logged out for use by maintenance personnel.

2.30 The nominal capacity for a Host system is shown in Table A.

TABLE A

Ports	Messages Per Hour	Baud Rate	Polling
4	160,000	4800	Dial-up
4	240,000	4800	Private Line
4	480,000	9600	Private Line

3. EQUIPMENT SPECIFICATIONS

On-Site

3.01 Hardware

(a) Basic system:

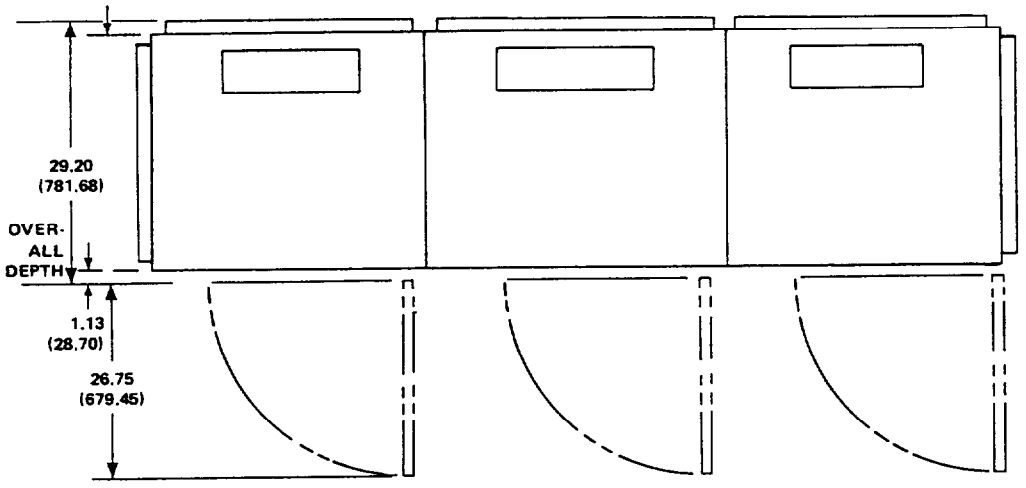
- Fully duplexed Series/1 Computers
- Fully duplexed Scanners
- Two 43 type teletypewriters (TTYs)
- Two 208B-type data sets
- Two 113-D type data sets
- Two TTY pedestals
- One data cabinet

(b) Power Requirements:

- −48V DC and central office ground
- 115 V AC single phase stand-by power

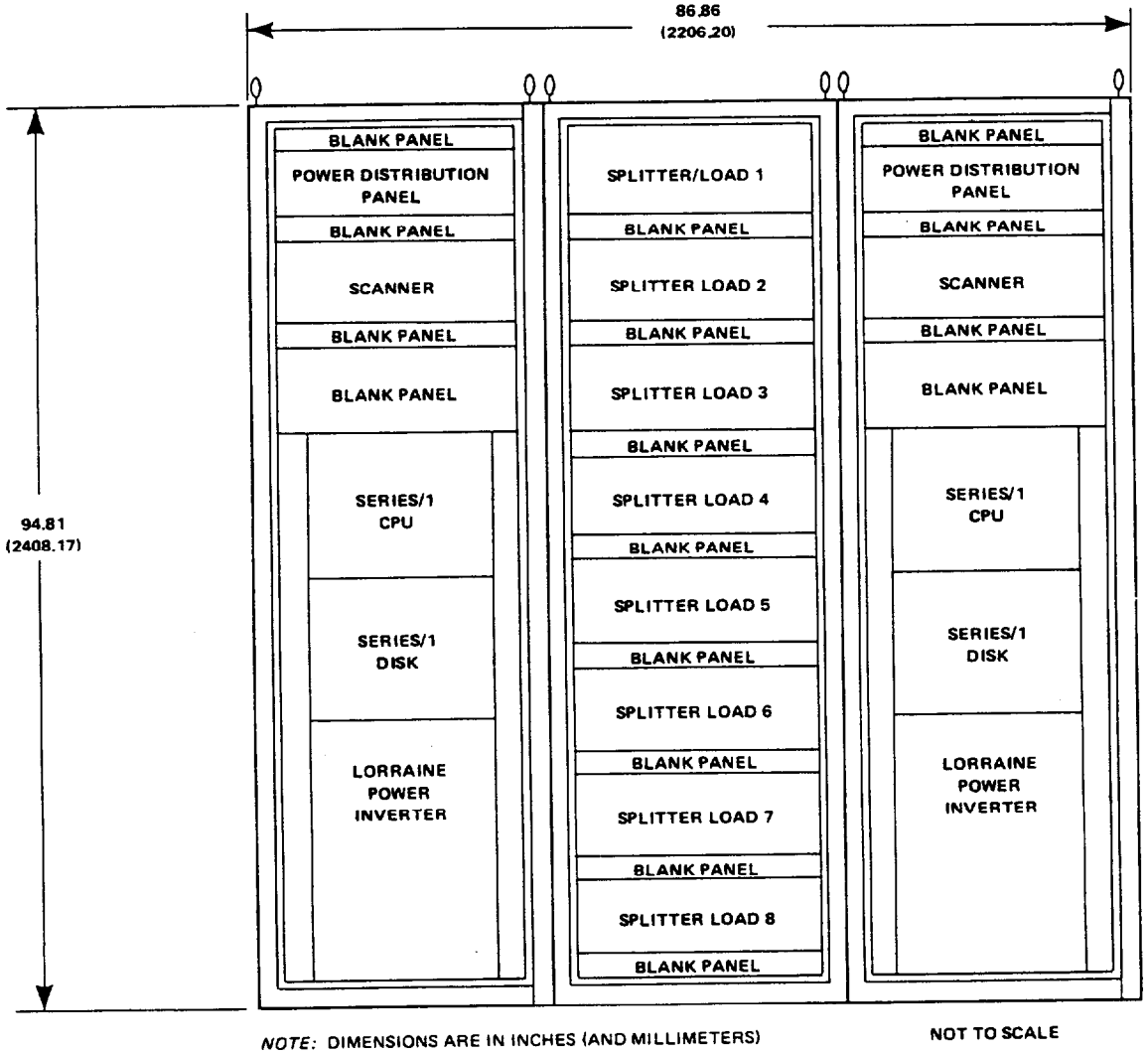
(c) Dimensions — The basic CEBS/RO system (CO) is enclosed in 3 cabinets (see Fig. 3) with total dimensions of:

- Height — 94.81 (inches)
- Depth —
  Doors Closed — 29.20 (inches)
  Doors Open — 82.70 (inches)
- Width — 86.86 (inches)



NOTE: REAR DOORS LIFT OFF.

(Top View)



NOTE: DIMENSIONS ARE IN INCHES (AND MILLIMETERS) NOT TO SCALE

CEBS/RO Cabinet Arrangement
(Front View)
Fig. 3

Host

3.02 Hardware

(a) Basic System:

- One Series/1 Computer
- One line printer
- One magnetic tape drive
- One 43 type teletypewriter
- One TTY pedestal
- (1-4) 208B-type data set(s)
- One 113D data set
- (1-2) Automatic calling unit(s)

Note: For backup protection, two complete Host systems shall be ordered per Host location.

(b) Power Requirements:

- 208 V AC single phase supply
- 115 V AC single phase supply

3.03 Air Conditioning Requirements for On-Site and Host:

- 72°-78° Fahrenheit
- 40%-50% Relative Humidity

Caution: Maximum operating temperature (point at which scanner failure may occur) is 104° Fahrenheit.

4. MAINTENANCE SUPPORT

4.01 The Minicomputer Maintenance Group (MMG) and the Minicomputer Support Group (MSG) will provide maintenance support for the CEBS at the central offices. (See Fig. 4.)

Note: There are no preventive maintenance requirements for the systems, therefore, maintenance forces will only be required to provide assistance when a system malfunctions.

4.02 Since CEBS is compatible with the TASC system, the Minicomputer Operations Group-Network Control Group (MOG-NCG) personnel will receive reports of CEBS failures from this support system. In most cases, the system will identify the general type of problem (based on the TASC alarm priority code).

Note: For central offices which are not yet connected to TASC, CEBS alarm surveillance by local alarming will be the same as for other Automatic Message Accounting Recording Center (AMARC) equipment.

4.03 When an alarm occurs, this status will be passed to the MOG-NCG. The MOG-NCG will verify the problem by dialing up the malfunctioning system, and diagnose the nature of the trouble.

Malfunction of Scanner and Minicomputer

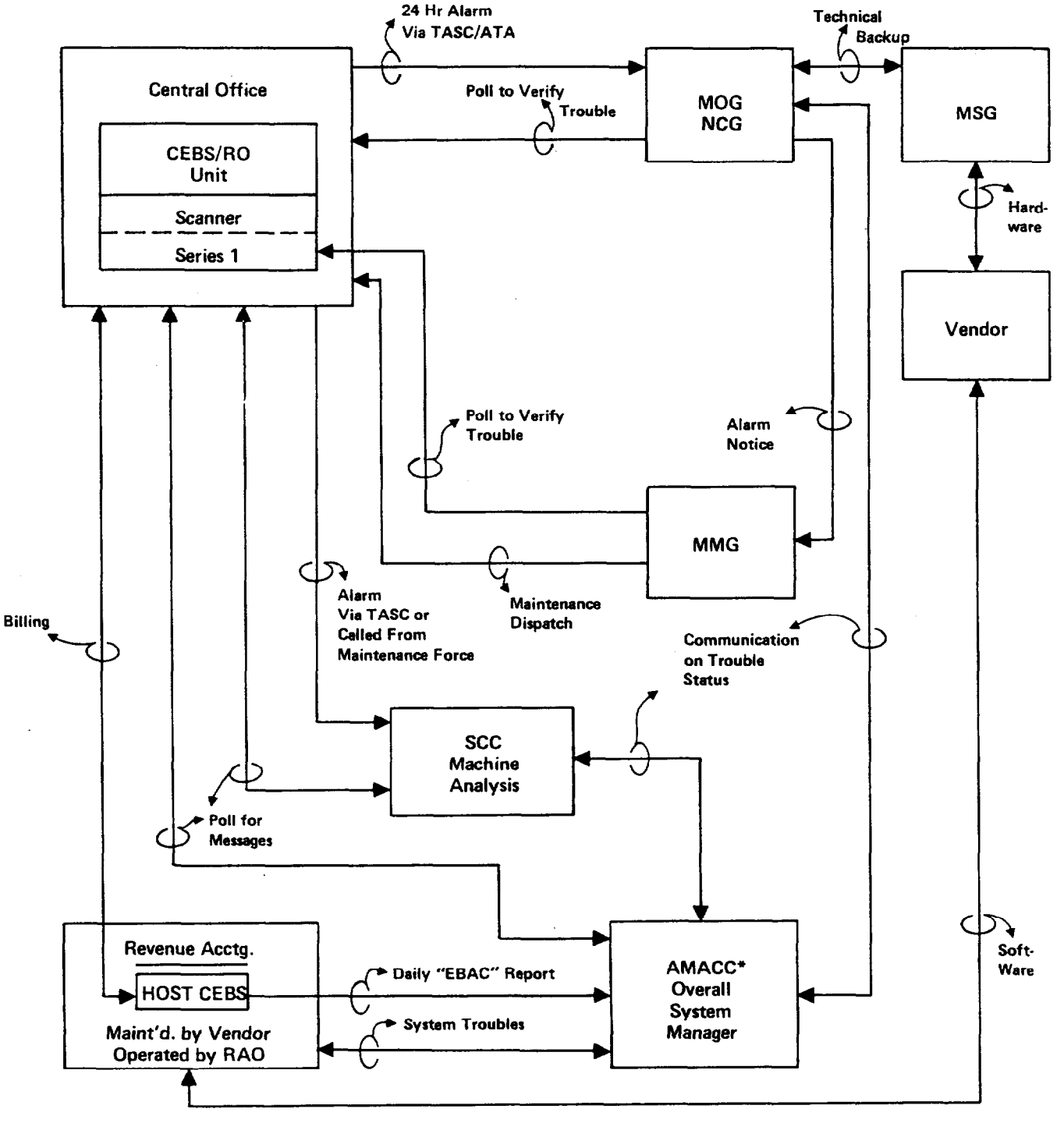
4.04 If there is a malfunction of the Telescience scanner or the Series/1 minicomputer, the MOG-NCG will notify the MMG. The MMG will dial-up the CEBS unit to verify the type of trouble and the exact sequence causing the alarm. With minicomputer trouble, the unit may be restarted remotely in some cases. Otherwise, the MMG technicians must go to the CO to repair the minicomputer and scanner problems.

Note: The MMG technicians will be trained in methods of isolating and repairing most minicomputer and scanner problems on-site.

4.05 If after examining the system on-site and the MMG technician is unable to diagnose and repair the trouble, additional technical assistance must be requested from the MSG Staff Advisors.

4.06 When requested, the MSG Staff Advisors will attempt to correct the malfunction. If they are unable to do so, they must further escalate the problem and serve as the company coordinator for contacting either Telescience or IBM to request maintenance support. At this point, the CEBS System Manager should also be notified of the problem.

Note: If billing data is being lost, or if there is a significant risk of losing data due to a malfunction, the System Manager should be notified immediately.



*AMACC — Automatic Message Accounting Control Center

Note: Prior to TASC the CO maintenance center forces will notify the SCC of Alarm conditions. The SCC will poll the CO unit and refer pertinent troubles to MOG-NCG. The MOG-NCG will dispatch the OSC or MMG as required. The SCC will be notified of action taken. During off hours the remote alarm center will notify the MOG-NCG who will dispatch, as required, the MMG or back to switching for a call out.

CEBS/RO Administration — Overall View
Fig. 4

4.07 Upon completion of any maintenance activity performed by the MMG or MSG, the personnel who perform the work should fill out a Minicomputer Maintenance Activity Report (MMAR) reporting the nature of the problem, system downtime, maintenance requirements, etc. A copy should be filed in a CEBS Maintenance Activity Tracking file in the MSG, and a second copy should be sent to the CEBS System Manager. The MOG-NCG should be notified when the system has been restored to normal operation.

Note: Troubles cleared will also be inserted into the message file by using the "I" command. This is a free form message input command showing trouble fix, time, date and name. AMACC will retrieve CO98 messages each day (see Section 8, IBM manual) giving ***immediate*** feedback to the CEBS System Manager.

5. MAINTENANCE TRAINING

5.01 For PAC personnel to properly maintain the CEBS units, both IBM Series/1 and Telescience scanner training is necessary.

5.02 IBM training consists of 32 days of classroom and laboratory instruction. IBM personnel teach the basic skills necessary for maintaining their portion of equipment in CEBS, including the opportunity for practical maintenance and trouble-shooting on the equipment.

5.03 Telescience scanner training is provided free of charge as part of the initial purchase. A one-day training course is given to acquaint the user with the scanner operation, maintenance requirements and diagnostic testing capabilities. A more detailed, 5 day course at the component (chip) level is also available and recommended.

5.04 Training for maintenance by PAC personnel is available for both instructors and craft persons. Arrangements may be made by contacting:

District Staff Manager
Terminal and Minicomputer
Contracting and Applications
180 New Montgomery Street, Rm. 461
San Francisco, CA 94105

6. SPARE PARTS

6.01 As part of ensuring the dependability of the CEBS self-maintenance program, an adequate quantity of spare parts and test equipment must be available to maintenance forces.

6.02 The spare parts and equipment for the IBM minicomputer will be controlled and tracked by the MMG and MSG.

6.03 The spare parts for the Telescience scanner will be controlled and tracked by the MSG.

6.04 The MMG and MSG will be responsible for determining the quantities of all parts needed and where they will be stocked.

Note: The MSG will be responsible for determining the exact mix of spare parts and test equipment to be initially purchased.

7. ORDERING

7.01 Refer to PTEL 2032 for ordering information, pricing and classification data.

8. WARRANTIES

8.01 Each CEBS unit is covered under the manufacturers warranty beginning from the shipping date.

8.02 IBM supplies an unlimited 90 day parts and labor warranty for the Series/1 components.

8.03 Telescience provides unlimited service calls for 30 days, and 1 year warranty for all parts replacement on the scanner portion of the unit.

Note: It is important to schedule shipping dates to coincide with office installation so that the warranty service period can be fully utilized. Most problems will occur in the early stages of operation.

9. DOCUMENTATION

9.01 Two complete sets of manuals will be furnished with each site. Additional sets are available on a charge basis, and should be ordered through the District Staff Manager — Terminal and Minicomputer Contracting and Applications.

CEBS/RO

9.02 Documentation supplied with each system includes:

- Telescience CEBS Instruction Manual
- IBM CEBS Operations Manual
- Series/1 4955 Reference Manual
- Series/1 4962 Reference Manual
- IBM Series/1 Customer Engineering Manuals

9.03 Product changes will be reflected in documentation updates, distributed by District Staff Engineer — Maintenance Systems.

TASC Interconnection

9.04 For TASC-CEBS/RO Interconnection information, see Drawing PED1P004-10. It may be obtained from the Engineering Services File Room.