FEATURE DOCUMENT

SYSTEM FEATURES

NO. 2 AND NO. 2B ELECTRONIC SWITCHING SYSTEMS

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FEATURE DEFINITION AND DESCRIPTION

1. DEFINITION/INTRODUCTION

1.01 The No. 2/2B Electronic Switching System (ESS) is a small to medium electronic central office that has been developed to offer modern telephone service to nonmetropolitan areas. It is intended to serve offices for initial installations in the 1000- to 10,000-line range, growing to a total of 10,000 to 20,000 lines, depending on traffic. The No. 2 ESS has an average busy season busy hour capacity of 19,000 busy hour calls for LO-1 and EF-1 noncentrex only. With the EF-1 generic program, the capacity of a No. 2 ESS serving only centrex calls is somewhat reduced. The No. 2B ESS with the EF-1 generic program (2B-EF-1) has an average busy season busy hour capacity of 28,000 busy hour calls. (See Traffic Facilities Practices, Division D, Section 12.)

1.02 The No. 2/2B ESS uses stored program control to offer service and maintenance features that are commonly associated with ESS offices. Every effort has been made in No. 2/2B ESS to simplify both program store and call store engineering.

1.03 The system was designed primarily to provide the advantages of stored program control in the small to medium sized central office range while competing economically with basic No. 5 Crossbar and small No. 1 ESS systems.

1.04 The benefits of connectorization to No. 2/2B ESS include subsystem factory testing, earlier field testing, shorter installation intervals, and simplified growth in critical areas such as program stores, call stores, networks, and communication bus circuits.

1.05 A broad offering of service features are available in No. 2/2B ESS. A sample of these includes centrex, customer changeable speed calling, Threeway Calling, call forwarding, call waiting, prepay coin, dial-tone-first, automatic number identification (ANI), local automatic message accounting (LAMA), range extension, wide area telecommunications service (WATS), extensive traffic and plant measurements, and load controls.

1.06 This feature document, while briefly touching on the hardware aspects of No. 2/2B ESS, is mainly concerned with the system and software features provided. No. 2 ESS hardware aspects are covered in Section 232-100-100 and No. 2B ESS hardware aspects are covered in Section 232-300-100.

2. USER PERSPECTIVE

2.01 The No. 2/2B ESS uses stored program control to offer service and maintenance features that are commonly associated with ESS offices. For details on No. 2/2B ESS features, refer to the 232-190 series of Feature Documents.

3. SYSTEM PERSPECTIVE

NO. 2/2B ESS

3.01 The No. 2/2B ESS is a common control switching system. Switching actions are separated from the equipment being switched. A centralized or "common" group of control equipment can direct call connections for many lines through a switching network and other peripheral equipment. The control equipment routes a call through the network and is released to act on other calls. A No. 2 ESS system schematic block diagram is shown in Figure 1. A No. 2B ESS system schematic block diagram is shown in Figure 2.

3.02 The No. 2/2B ESS makes use of high-speed devices such as ferreed switches for network switching, ferrod sensors for scanning, and wire spring relays for trunk circuits. Maintenance is simplified by extensive use of plug-in circuit packs with printed wiring. The system also uses integrated circuits.

Stored Program Control

3.03 The No. 2/2B ESS performs the functions of a local telephone central office under the control of a stored program acting through data processing, input-output, and 2-wire switching equipment. Virtually all the actions of the system are determined by the sequences of instructions coded and stored in memory. This data is grouped into functional categories called programs. A program contains all the data necessary to control the accomplishment of a specific task. These programs consist of combinations of precisely defined instructions which are read from memory and transmitted one at a time to the central processor for execution. The stored program makes use of stored data called translation data which contains information pertaining to customer lines, dialing

arrangements, trunk groups, etc. To alter system operation, changes must be made only to the stored program and translation data rather than to hardware or wiring.

Use of Subroutines

3.04 The subroutine is widely used to keep program size small, even though some real time is used in preparing data and transferring to the subroutine. A subroutine is a relatively short program that is accomplished on a called-in basis (not a part of the main program). The programs make use of many levels of nesting (subroutines calling other subroutines) such that the lowest level subroutine does a very specific task in a very straightforward manner. Higher level subroutines have larger tasks to perform, but these tasks are accomplished primarily by manipulating data and calling on lower level subroutines for further action. This structure leads to a compact basic call handling program which consists mainly of calls to subroutines.

Stored Program Organization

3.05 Stored programs are grouped according to the functions they perform. The No. 2/2B ESS contains the following three major classifications of programs:

- Administrative programs
- Operational programs
- Maintenance programs.

3.06 Administrative programs include all programs that pertain to the control of administrative tasks, such as adjustment of service provided and adjustment of equipment to meet changing traffic conditions or to report on areas that need maintenance attention. Some of the functions performed by these programs are as follows:

- To administer changes to stored data to accommodate service orders or plant changes
- To record office traffic characteristics
- To report on plant measurements including service measurements and performance measurements which reflect the basic health of the system through cumulative error counts and failure rates
- To report system trouble conditions.

3.07 Operational programs include all programs that pertain to operation of the system. The bulk of these programs deals with the processing of calls. Some of the functions performed by these programs are as follows:

- Input and output data
- Line scanning to detect originations
- Digit Recovery
- Digit interpretation
- Digit outpulsing
- Network connections
- Various decisions based on class of service, digits dialed, availability of equipment, translation items, etc.

3.08 Maintenance programs include the following:

(a) Routine tests which detect the existence of trouble

(b) Fault checking routines which, in response to the detection of a failure, determine which major unit is in trouble and cause appropriate switching actions to be taken

(c) Diagnostic tests which pinpoint the location of a trouble within a unit and make this information available as a printout on the TTY

(d) Peripheral unit testing which provides diagnostic tests for operational testing and X-ray tests which are used for the factory and initial testing at the site, and/or for testing frames being added to an operational office. The X-rays may only be requested manually.

Teletypewriter Facilities

3.09 The teletypewriter (TTY) facilities contained in the maintenance frame include the TTY control circuits and the maintenance TTY. In addition to the two maintenance TTY channels in each No. 2/2B ESS, as many as four additional independent TTY channels can be accommodated. Standard teletype devices, such as send-receive or

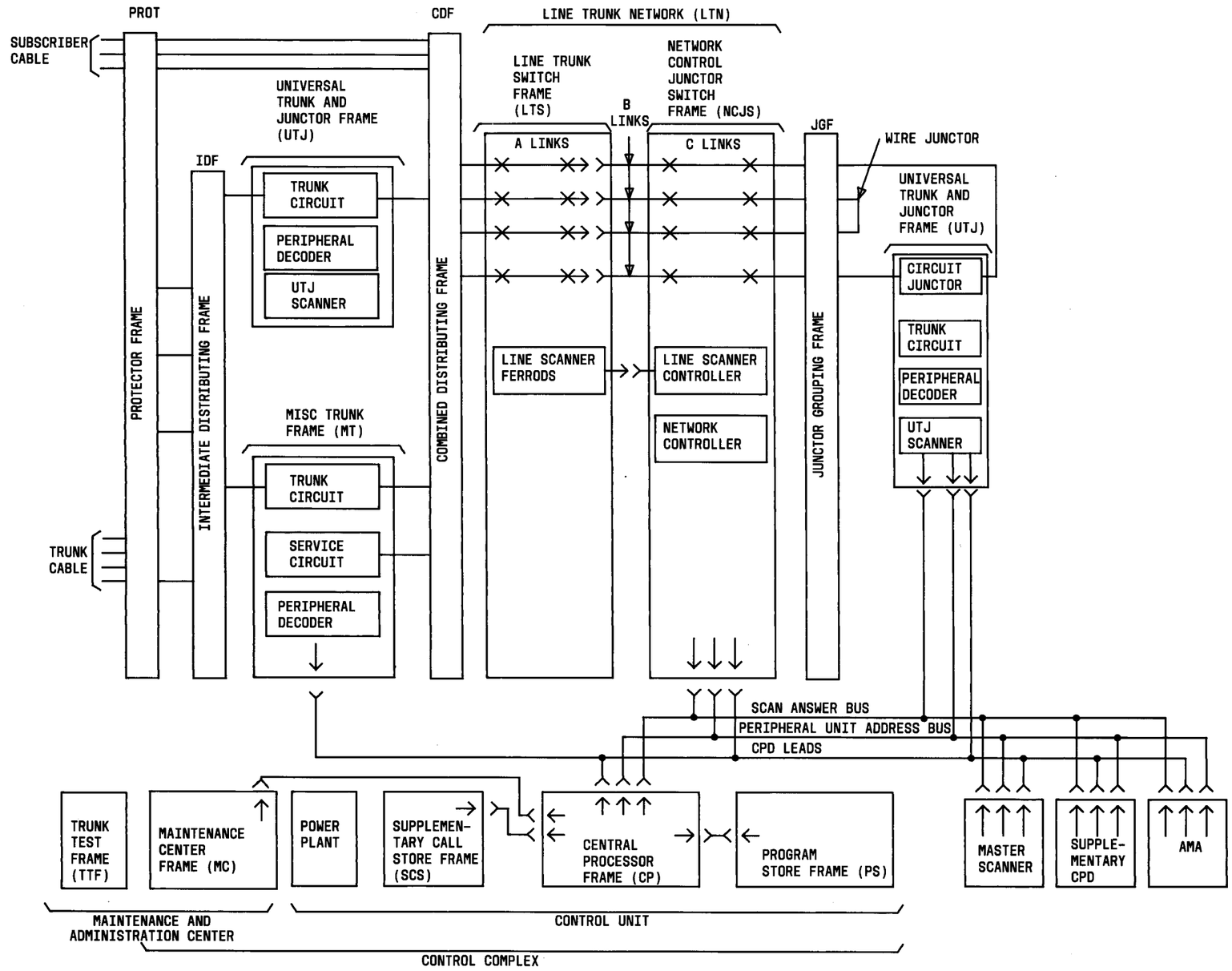

Fig. 1—No. 2 ESS Schematic Block Diagram

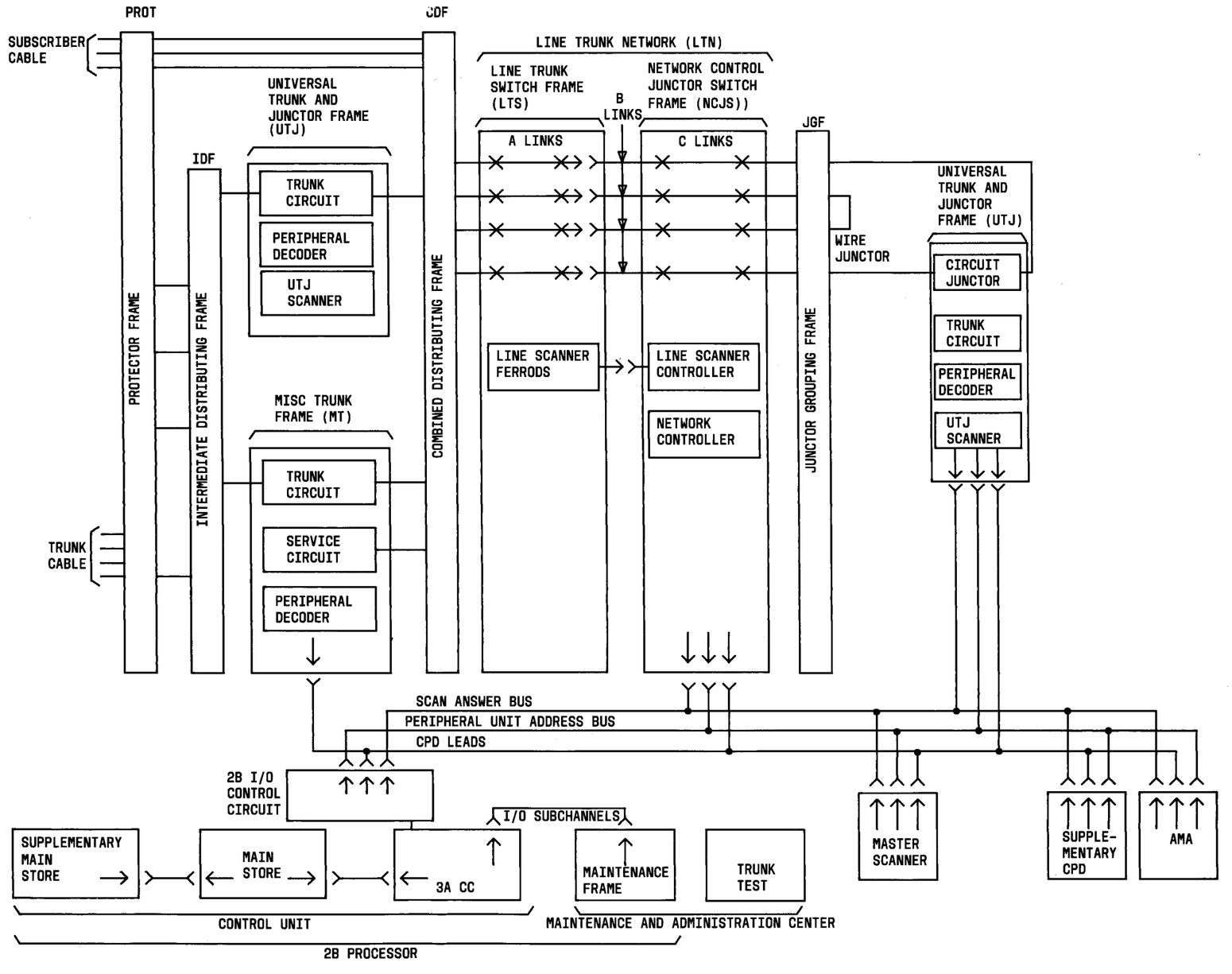

Fig. 2—No. 2B ESS Schematic Block Diagram

receive-only TTY, can be attached to a channel, either individually or in series combination.

3.10 In a typical No. 2/2B ESS office, the following channels may be used:

- Local and remote maintenance
- Traffic
- Service order
- Local test desk.

3.11 A trunk and service circuit channel is available for use only when there are two trunk test frames in the office.

Peripheral Equipment

3.12 The peripheral equipment is the equipment used by the control complex to switch calls through the office and perform other related tasks. Upon commands from the control unit, the periphery performs tasks such as scanning customer lines, selecting paths through the network, etc.

3.13 The No. 2/2B ESS periphery consists of the following major units:

- Scanners
- Line Trunk Network
- Trunk Frames (Universal and Miscellaneous)
- Miscellaneous Frames
- Distributing Frames
- Trunk Test Frame
- Range Extension Frame
- Recorded Announcement Frame
- Automatic Message Accounting Frame
- Centrex Data Link Frame
- Automatic Identified Outward Dialing Frame
- Ringing and Tone Frame
- Remote Office Test Line Frame.

More detail on these items may be found in Section 232-100-100 (No. 2 ESS) or Section 232-300-100 (No. 2B ESS).

No. 2 ESS

3.14 The No. 2 ESS (Figure 1) is a stored program controlled switching system. The major equipment areas in No. 2 ESS are a control complex, a communication bus system, and peripheral equipment.

3.15 The No. 2 ESS offices are equipped with either the local office (LO-1) or extended feature (EF-1) generic program and offer a full range of features. Centrex features are available with the EF-1 generic program.

Control Complex

3.16 The control complex consists of a maintenance frame and a duplicated control unit (Figure 1).

Control Unit

3.17 The No. 2 ESS control unit (CU) directs the processing of calls and system maintenance. The CU consists of a central processor (CP), a program store (PS), a supplementary call store (SCS), and a 6.7V power frame.

Central Processor

3.18 The central processor frame provides the primary control for operating the No. 2 ESS central office. The central processor contains the following equipment:

- Program control (PC)—is used for information processing and translations.
- Call store unit (CS)—is used for temporary information storage.
- Input-output unit (IO)—is used for communication with peripheral equipment.

Program Store

3.19 The program store (PS) is a high-capacity, semipermanent memory which stores the operational program and translation information

regarding lines and trunks. A permanent magnet twistor (PMT) memory is used as the program store. Each PS frame may contain up to four modules, each with 16,384 22-bit words, yielding the total frame capacity of 65,536 words. A maximum of four PS frames (262,144 words) per control unit may be supplied.

No. 2B ESS

3.20 The No. 2B ESS uses a processor based on the 3A Central Control (3A CC) to improve the call handling capability, reduce floor space requirements, and decrease power consumption over the No. 2 ESS processor design. The peripheral equipment used by the No. 2B ESS is the same as the No. 2 ESS periphery. A No. 2B ESS system schematic block diagram is shown in Figure 2.

3.21 The No. 2B ESS offices are offered with the 2B version of the extended features (EF-1) generic program 2B-EF-1 and offer a full range of features including centrex.

2B Processor

3.22 The No. 2B ESS processor directs the processing of calls and system maintenance. The 2B processor consists of a 2B processor frame containing two CUs, two supplementary store frames, and the maintenance frame.

Control Unit

3.23 The control unit provides the primary control for operating the No. 2B ESS central office. Each control unit contains the following equipment:

- 3A Central Control (3A CC)
- 2B Input-Output Control Circuit
- Main Store (MAS)
- Power and Fuse Unit

Main Store

3.24 The MAS is an electrically alterable (writable) store made up of insulated gate field effect transistors (IGFET). The MAS is installed in 32K word modules (actually 32,768 words) and is growable in increments of 32K modules up to a maximum of 256K words (262,144). This memory is a voltage store, meaning power is required to retain the store information. The IGFET storage element is dynamic and must be refreshed at specified intervals to preserve the stored information. If a total power failure occurs, a "bootstrap" operation using a backup tape can be used to reload the information. The Supplementary Main Store can contain up to an additional 512K (524,288) words in 32K increments. This yields a total memory size for 2B ESS of 768K (768,432) words.

3.25 The 2B processor, which cannot be used with the LO-1 generic program, may be retrofitted into a working No. 2 ESS office without impairment of service. The 2B equipment is installed in such a manner that both the processors have access to the peripheral units.

HARDWARE FEATURES

3.26 The following is a list of No. 2/2B ESS hardware features available independent of the generic.

- Connectorization—The benefits of connectorization in No. 2 ESS include:
  - (a) Earlier field testing
  - (b) Shorter installation intervals
  - (c) Simplified growth.
- Duplication—Duplicate units protect against loss of service through error or equipment failure in major units.
- Functional Concentration—The system equipment is concentrated in a small number of highly efficient units, each specialized in some broad system function, such as control, input-output, memory, etc.
- High-Speed Facilities—High-speed facilities are used to switch duplicated equipment in and out of service and to combine system units into various configurations.
- Modular Design—Traffic-dependent units are provided in modular blocks so that growth can be accomplished economically and conveniently.

- Plug-in equipment units—Many portions of No. 2/2B ESS equipment are mounted on circuit packs which are plug-in units with printed wiring. Faulty circuit packs can be quickly replaced.

- Reliable Circuits—Circuits that are made reliable by using long-life components and by providing liberal operating conditions.

- Stored Program Control—The No. 2/2B ESS stored program, controlling a configuration of data processing, input-output, and switching equipment provides telephone and administrative functions of a local telephone office.

- Time-Shared Control—A single control unit exercises all program instructions. The control equipment is time-shared by all the calls handled in the system.

MAINTENANCE FEATURES

3.27 Maintenance features for No. 2/2B ESS consist of the following:

- Automatic Fault Location and System Reconfiguration: Extensive program and hardware facilities are provided to detect system malfunctions. The faulty unit is automatically identified and taken out of service, a working system results with the duplicate unit reconfigured, and maintenance personnel are notified that a malfunction has occurred and are given the results of the diagnostic test.

- Diagnostic Programs

  (a) Table A lists all the circuits used in No. 2/2B ESS. Where so indicated, these circuits can be tested either automatically or by typing the appropriate TTY message. For message to diagnose these circuits, refer to IM-2H200 or Section 232-105-302.

TABLE A

CIRCUITS USED IN NO. 2/2B ESS

SD-	TITLE	NO. 2 ESS	NO. 2B ESS	TEST-ABLE
1C900	3A CC CIRCUIT		√	√
1C901	3A CC CONTROL PANEL		√	√
1C902	MAS CONTROLLER AND MEMORY CIRCUIT		√	√
1C904	TAPE DATA CONTROLLER		√	√
1C905	TTY CONTROLLER		√	√
1C906	SYSTEM STATUS PANEL		√	√
1C907	SYSTEM STATUS PANEL CONTROLLER		√	√
1C908	SYSTEM STATUS PANEL RELAY CIRCUIT		√	√
1C909	MAINTENANCE FRAME POWER		√	√
1C910	PROCESSOR FRAME CIRCUIT		√	√
1C911	PROCESSOR FRAME POWER UNIT		√	√
1C912	MAINTENANCE FRAME CIRCUIT		√	
1C913	COMMON SYSTEMS ELECTRONIC REMREED PULSER CKT	√	√	√
1C914	SUPL MAS POWER UNIT		√	
1C915	SUPL MAS FRAME CIRCUIT		√	
2H003	NO. 2 ESS CKT PACKS	√	√	
2H005	CALL STORE	√		√
2H007	PROGRAM CONTROL	√		√
2H008	INPUT-OUTPUT CONTROL	√		√
2H009	MAINTENANCE CENTER	√		√
2H010	TELETYPEWRITER CONTROL	√		√
2H066	AUTOMATIC MESSAGE ACCOUNTING	√	√	√
2H071	SUPL CENTRAL PULSE DISTRIBUTOR	√	√	√
2H074	SINGLE CARD WRITER	√		√

TABLE A (Cont)

CIRCUITS USED IN NO. 2/2B ESS

SD-	TITLE	NO. 2 ESS	NO. 2B ESS	TEST-ABLE
2H075	TRUNK TEST	√	√	
2H076	LINE SCANNER	√	√	√
2H078	COMMUNICATIONS BUS	√	√	√
2H083	+6V PWR DISTRIBUTION	√		
2H084	+24V and −48V PWR DISTRIBUTION	√	√	
2H086	JUNCTOR GROUPING CKT	√	√	√
2H091	+48V SUPPLY AND DISTRIBUTION	√	√	
2H095	TIMER CKT	√	√	√
2H096	GROUND CROSS DETECTING CKT	√	√	
2H097	ADMINISTRATIVE DATA TERMINAL	√		√
2H100 to 2H158	TRUNKS, SERVICE CKTS, AND MISC CKTS	√	√	√
2H161	UNIVERSAL TRUNK FRAME SCANNER CKT	√	√	√
2H162	PROGRAM STORE CKT	√		√
2H163	LINE AND/OR TRUNK SWITCHING CKT	√	√	√
2H165	ELECTRONIC FERREED PULSER CKT	√	√	√
2H166	PERIPHERAL DECODER ASSIGN RULES	√	√	
2H167	SCANNER ASSIGN RULES	√	√	
2H168	CPD ASSIGN RULES	√	√	
2H169 to 2H174	TRUNKS, SERVICE CKTS, AND MISC CKTS	√	√	√
2H175	TOMUS CONTROLLER CKT	√		√
2H176 to 2H180	TRUNKS, SERVICE CKTS, AND MISC CKTS	√	√	√
2H181	TOMUS VERIFIER	√		√
2H182 to 2H186	TRUNKS, SERVICE CKTS, AND MISC CKTS	√	√	√

TABLE A (Cont)

CIRCUITS USED IN NO. 2/2B ESS

SD-	TITLE	NO. 2 ESS	NO. 2B ESS	TEST-ABLE
2H194	10C REMREED GRID CKT	√	√	√
2H195	14A REMREED CONCENTRATOR GRID CKT	√	√	√
2H196	SUPPLEMENTARY REMREED NETWORK SCANNER CKT	√	√	√
2H197	REMREED NETWORK SCANNER CKT	√	√	√
2H211	REMREED SWITCHING NETWORK CKT	√	√	√
2H223	SEMICONDUCTOR CALL STORE CKT	√		√
2H301	2B I/O CONTROL CIRCUIT		√	√
81870	RING AND TONE (841A PLANT)	√	√	√
81880	+6.7V, 200A POWER PLANT	√		
81884	+6V, DC-DC CONVERTER	√		
1A126	PWR DIST FRAME	√	√	
1A133	MASTER SCANNER APPLIQUE	√	√	√
1A139	RECORDED ANNOUNCEMENT	√	√	√
1A144	+130V DISTRIBUTION	√	√	
1A148	+24V AND −48V DISTRIBUTION	√	√	
1A156	EMERGENCY MANUAL LINE	√	√	
1A158	OFFICE ALARM	√	√	
1A173	TOUCH-TONE CALLING DETECTOR	√	√	√
1A199	TOUCH-TONE STATION TEST	√	√	√
1A209	MASTER SCANNER	√	√	√
1A210	REMOTE MS APPLIQUE	√	√	√
1A213	AC DISTRIBUTION	√	√	
1A243	EMERGENCY MANUAL LINE	√	√	
1A265	CENTREX DATA LINK CKT	√	√	√
1A301	AIOD INTERFACE CKT	√	√	√

(b) Remote Office Test Line (ROTL) is a feature that allows interoffice trunk testing automatically from a centralized automatic reporting on trunks (CAROT) system. See Section 232-190-205. No. 2 ESS cannot function as a near-end ROTL office with the LO-1 generic program.

- Exercise Program

(a) The short-term exercise tests are run frequently, and quickly detect processor and certain peripheral unit faults missed by check circuits.

(b) The long-term periodic exercise tests detect processor troubles in circuits not normally tested by other programs and circuits.

- Maintenance Center—A maintenance center provides a centralized control point for communicating, controlling, testing, and recording requirements of the system.

- Office Alarm System—An office alarm system is provided for both system-detected and locally-detected failures.

- Peripheral unit testing which provides diagnostic tests for operational testing and X-ray tests which are used for the factory and initial testing at the site, and/or for testing frames being added to an operational office. The X-rays may only be requested manually.

- Redundancy, Information—Various types of redundancy are used in the information transmitted between units in order to detect errors.

- Switching Control Center System (SCCS)—The No. 2 SCCS is a centrally located monitor and control system that provides administrative, operational, and maintenance functions for central offices with Stored Program Control.

ADMINISTRATIVE FEATURES

3.28 Administrative features for No. 2/2B ESS consist of the following:

- Call Tracing—On both intraoffice and interoffice calls, provides originating line identification or incoming trunk identification on calls completed to the specified line. The EF-1 and later generic programs allow tracing of calls in a transient state. See Section 232-190-106.

- Complaint Observing—Provides detailed billing for a line that is ordinarily bulk billed. See Section 232-190-204.

- Hundreds Block Intercept—Provides the ability to specify by hundreds block any one of three intercept treatments for unassigned numbers within a hundreds block. (Not available with the LO-1 generic.)

- Plant and Traffic Measurements

(a) Table B summarizes the types of plant and traffic measurements that can be recorded. See Section 232-120-301.

(b) With the LO-1 generic program, a limited number of quarter-hourly (Q) registers are available on the hourly-busy hour (H) and hourly-nonbusy hour (C) schedules. With the EF-1 generic program, all Q schedule registers are summarized and printed on the H and C schedules.

- Recent Change Capability—Provides automatic means of changing office parameters, translation data, and accepting service orders via TTY input messages. The EF-1 generic program expands the recent change capability to provide the following features:

(a) Recent Change Hundreds Group Route Index (HRI)—Permits the routing of terminating calls to a block of 100 directory numbers to go to an announcement, trunk group, intercept, or terminate locally.

(b) Route Index Changes by Recent Change—This feature is an expansion of the recent change capability to provide the ability to change any route index.

(c) Trunk Group Changes by Recent Change—This feature expands the capability to provide the ability to change any data in a trunk group or service circuit group.

TABLE B

PLANT AND TRAFFIC MEASUREMENTS

ITEM	PEG COUNT	USAGE	OVERFLOW COUNT
Trunk Groups	X	X	X
PBX and MLH Groups	X	X	X
Service Circuit Groups	X	X	X
Junctor Groups	—	X	—
Network Concentrators	—	X	—
Lines	—	X	X
Call Types (Orig, Term, etc.)	X	—	—
Class of Service	X	—	—
Preroute	X	—	—
Office Counts	X	—	—
Networks	X	X	X
Centrex Groups	X	X	X

TYPES OF LINES

3.29 The No. 2/2B ESS provides for the following types of lines:

- Single Party Residence or Business
- Manual
- PBX
- Multiline Hunt Group
- Mobile Radio
- TWX
- Two-Party
- Four-Party
- Eight-Party
- Hot Line
- Hotel-Motel
- Coin
- Centrex.

LINE FEATURES (NONCENTREX)

3.30 The noncoin, noncentrex line features and combinations available are shown in Table C. The following is a list of the line features with references to feature documents that explain some of them further. All of these features are available in all generic programs unless otherwise noted.

TABLE C

LINE FEATURES AND COMBINATIONS (NONCENTREX)

LINE FEATURE	TYPE OF LINE								
	SINGLE PARTY							MULTIPARTY	
	RES/ BUS	MAN	PBX/ MLHG	COIN	TWX	MOBILE RADIO	INWATS WITH MLHG	2	4&8
Originating	X	X	X	X	X	X	—	X	X
Terminating	X	X	X	X	X	X	X	X	X
Flat Rate	X	—	X	—	X	—	—	X	X
Message Rate	X	—	X	—	X	X	—	X	—
Hotel-Motel	X	—	X	—	—	—	—	—	—
Free Terminating	X	X	X	—	—	—	—	—	—
TOUCH-TONE®	X	—	X	X	X	X	—	X	X
Dial Pulse	X	—	X	X	X	X	—	X	X
LAMA	X	—	X	X	X	X	—	X	—
ANI	X	—	X	X	X	X	—	X	—
ONI	X	X	X	—	X	X	—	X	X
Billed to Listed Number	X	X	X	X	X	X	—	X	—
Special Billing	—	—	X	—	—	—	—	—	—
Message Register	X	—	X	—	—	—	—	—	—
Reverting Calls	—	—	—	—	—	—	—	X	X
Plug Up List	X	X	—	X	X	X	—	X	X
Series Completion	X	X	—	—	X	X	X	X	X
Stop Hunt	—	—	X	—	—	—	X	—	—
Make Busy	X	—	X	—	X	X	X	—	—
Dynamic Service Prot	X	X	X	X	X	X	—	X	X

TABLE C (Cont)

LINE FEATURES AND COMBINATIONS (NONCENTREX)

LINE FEATURE	TYPE OF LINE								
	SINGLE PARTY							MULTIPARTY	
	RES/ BUS	MAN	PBX/ MLHG	COIN	TWX	MOBILE RADIO	INWATS WITH MLHG	2	4&8
Group Alerting	X	—	—	—	—	—	—	—	—
Call Waiting	X	—	—	—	—	X	—	—	—
Speed Calling	X	—	X	—	X	X	—	—	—
Threeway Calling	X	—	—	—	—	X	—	—	—
Call Forwarding	X	—	—	—	X	X	—	—	—
Toll Diversion	—	—	X	—	X	—	—	—	—
Toll Restriction	X	—	X	X	X	X	—	—	—
Compliant Observed	X	X	X	X	X	X	—	X	X
WATS	X	—	X	—	—	X	—	—	—
Call Tracing	X	X	X	X	X	X	X	X	—
Nonsynchronized Audible	X	X	X	X	X	X	X	X	X
Emergency Manual Line	X	X	X	X	X	X	—	—	—
Full Selective Ringing	X	X	X	X	X	X	—	X	4-pty
Coded Ringing	X	X	—	—	—	—	—	X	X
Sleeve Lead	X	X	X	X	X	X	X	X	X
Denied-Originatng	X	X	X	X	X	X	X	X	—
Denied-Terminating	X	X	—	X	X	X	—	X	X
Loop Start	X	X	X	X	X	X	X	X	X
Ground Start	X	X	X	X	X	X	—	—	—

TABLE C (Cont)

LINE FEATURES AND COMBINATIONS (NONCENTREX)

LINE FEATURE	TYPE OF LINE								
	SINGLE PARTY							MULTIPARTY	
	RES/ BUS	MAN	PBX/ MLHG	COIN	TWX	MOBILE RADIO	INWATS WITH MLHG	2	4&8
Immediate Ring	X	X	X	X	X	X	X	X	X
Extended Range	X	X	X	—	—	—	X	X	X
Auxiliary Line Circuit	X	X	X	X	—	X	X	X	X

RES — Residential
BUS — Business
MAN — Manual
PBX — Private Branch Exchange
COIN — Coin Station
TWX — Teletypewriter Exchange
MLHG — Multiline Hunt Group
X — Given line feature is available on the type of line shown.
— — Given line feature is not available on the type of line shown, or does not apply.

- AIOD—Permits the automatic identification of calling stations in PBXs making outward calls. (This feature is available only with EF-1 or later generic programs.) See Section 232-190-321.

- ANI—Automatic Number Identification. Both calling and called numbers are outpulsed to the CAMA or TSPS office. See Sections 232-190-101, 232-190-109, and 232-190-140.

- Auxiliary Line Circuit—Circuit used to prevent false originations caused by excessive noise on ground start lines. See Section 232-190-102.

- Bill to Listed Number—AMA recording of billable calls to the listed directory number. See Sections 232-190-101 and 232-190-104.

- Call Forwarding—When activated by a customer, this feature automatically routes calls intended for the line to another line designated by the customer. With the LO-1 generic program, only calls that are in the free calling range of the forwarding line can be forwarded. EF-1 generic has no such restriction. See Section 232-190-105.

- Call Waiting—Allows a subscriber who is engaged in a telephone conversation to know when another calling party is attempting to reach the subscriber. Also has hold feature. See Section 232-190-107.

- Dial Pulse—No. 2/2B ESS accepts 10 pulses per second (PPS) from customer lines and telephone company operators and either 10 or 20 PPS from PBX operators.

- Dynamic Service Protection—Lines designated class A (fire, police, etc.) may be given preference over class B lines for originating calls when overload conditions are reached in emergency situations. See Section 232-190-113.

- Emergency Manual Line—Line which is given temporary manual service under emergency conditions. When the service is activated, the customer is connected directly to an operator position. See Section 232-190-114.

- Extended Range—When lines have loop resistance of 1300 to 1600 ohms, zone 16 service is provided directly by No. 2/2B ESS. Range-extension equipment is used when lines have loop resistance of 1600 to 3600 ohms. See Sections 232-190-020 and 232-190-115.

- Free Terminating—No charge is recorded or answer signal returned when a free terminating line is called. See Section 232-190-116.

- Group Alerting—This feature provides means, independent of the switching network, to alert a special group of customers over regular message telephone lines for the purpose of disseminating an alert message.

- Ground Start—Origination of a call is detected as the result of completing an electrical circuit by applying a ground to one side of the pair facilities at the customer location.

- Hotel-Motel—Provides message registers used to bill calls to individual rooms over third wire in addition to local AMA or message register indications. See Section 232-190-123.

- Hot Line—Provides for automatically connecting a manual line (nondialing) to a terminating directory number immediately after going off-hook. (This feature is available only with EF-1 or later generic programs.) See Section 232-190-207.

- INWATS—Permits an INWATS customer to receive directly dialed or operator assisted calls from points within a specific service area or band with no charge to the calling party. No AMA INWATS record is available in No. 2/2B ESS. See Section 232-190-118.

- LAMA—Local Automatic Message Accounting 9-Track Magnetic Tape, Triple Entry Format. EF-1 and later generic programs allow

printouts of the number of data blocks recorded on the AMA tape per busy hour. See Section 232-190-204.

- Loop Start—Origination of a call is detected as the result of closing the tip and ring loop through the customer telephone set.

- Make Busy—Allows designated lines to look busy to the central office by means of a key operation. See Section 232-190-121.

- Message Rate—Permits completion of calls to a group of selected single and multimessage unit destinations, which are assigned initial and overtime message periods, with charges made accordingly. Up to 16 of charging rates and intervals are available. See Sections 232-190-101 and 232-190-204.

- Message Register—Mechanical registration of message units used by a subscriber. See Sections 232-190-123 and 232-190-101.

- Mobile Radio—Provides customer-dialed 2-way telephone service between mobile subscribers within a given coverage area and all land-line subscribers. The No. 2/2B ESS provides the necessary interconnections (customer lines, all-channels busy indication and alarm and tone leads) to the mobile radiotelephone system's base station control terminal. See Section 232-190-124.

- Multiline Hunt—Allows calls to be routed to an idle line in a group of lines designated by one of more telephone directory numbers. See Section 232-190-125.

  (a) Night Stop—Allows one member of a multiline hunt group to be designated as a night stop number when a night stop key on the customer's premises is operated.

  (b) Stop Hunt—Allows the size of a multiline hunt group to be decreased by means of a key operation.

  (c) Remote Make Busy—Up to seven keys can be used to make individual members (or groups of members) appear busy to incoming calls.

  (d) Different Originating Major Class Codes—EF-1 and later generic programs allow PBX/MLHG lines to be assigned different originating major class codes and/or screening within the same MLHG.

- Multiparty Service—Provides 4- or 8-party telephone service to a maximum of eight customers on a common line. See Section 232-190-132.

- ONI—Operator Number Identification—Calls requiring charging are routed through the CAMA or TSPS operator. See Sections 232-190-101, 231-190-109, and 232-190-149.

- Plug-Up List—Calls to lines on this list are routed to trouble intercept. See Sections 232-190-022 and 232-190-023.

- Prevention of Black Box Fraud—A change in the answer procedure, interrupts the talking path between an incoming trunk call and the called line when signals are received from the called line which indicate potential fraudulent use of the telephone. (This feature is available only with EF-1 or later generic programs.)

- Reverting Call—Allows calls to be placed between customers who share the same party line. See Section 232-190-132.

- Series Completion—Allows calls to be routed to another designated directory number if the original is busy. A call may be routed through a maximum of eight directory numbers. See Section 232-190-133.

- Service Observing—Permits dial line service observing either locally or remotely. See Section 232-190-013.

- Sleeve Lead—A third wire (in addition to tip and ring) is used to provide an indication that a call is active on the line. It can be used to provide service observing, noise suppression, or busy indication etc. See Section 232-190-134.

- Special Billing—Allows for oral identification to the operator of the PBX/MLHG extension placing the call (formerly called QZ billing). See Sections 232-190-109 and 232-190-149.

- Speed Calling—Allows a subscriber to originate calls to frequently called numbers by dialing predesignated codes of one or two digits. Speed calling lists may contain 8 or 30 entries. Individual entries may be changed by the subscriber at the option of the telephone company. See Section 232-190-136.

- Threeway Calling—A subscriber can add a third party to any established call for 3-party conference without the assistance of an operator. See Section 232-190-138.

- Toll Diversion—This feature sends a diversion signal to the originating party (usually a PBX) when certain codes are dialed. The PBX can then divert the call or let it complete. See Section 232-190-139.

- Toll Restriction—Allows certain customers to be restricted as to which calls the No. 2 ESS will complete. See Section 232-190-139.

- TOUCH-TONE—Accepts digits 0-9, *, and #. Each button pushed produces a combination of two audible tones representing a digit.

- Two-Party Service—Provides telephone service to a maximum of two customers on a common line. See Section 232-190-132.

- WATS—Wide area telecommunications service—Permits a customer to have special access to the toll switching network for long distance calls on a dial basis. See Section 232-190-142.

COIN FEATURES

3.31 The coin features and combinations available are shown in Table D. The No. 2/2B ESS provides the following coin features.

TABLE D

COIN FEATURES AND COMBINATIONS

COIN FEATURE	PREPAY	DIAL-TONE-FIRST
Ground Start	X	—
Loop Start	—	X
Retain Coin on 0 or X11	X	—
Return Coin on 0 or X11	X	X
LAMA Records for Division or Revenue	X	X
Local Overtime	X	X
Coin Zone	X	X
Stuck Coin Operator Connection	X	X

- Coin First (Prepay)—Requires deposit of initial coins before dial tone is received. See Section 232-190-112.

- Coin Station Test Line—Permits a craftsperson to test the operation of a coin station from the coin station without the aid of central office personnel. See Section 232-190-201.

- Coin Zone—Operator monitors the initial deposit, then releases. Another operator is called in at end of initial period. See Section 232-190-112.

- Dial-Tone-First—Dial tone is received without deposit. No deposit is required for 0, 0+ or X11 calls, or other free calls designated by TELCo. See Section 232-190-131.

- Local Coin Overtime—After a timed initial period, coin is collected and an overtime period is timed; an operator and/or announcement is called in if no overtime deposit is made. See Section 232-190-112.

PERMANENT SIGNAL AND PARTIAL DIAL TREATMENT

3.32 The No. 2/2B ESS provides the following permanent signal and partial dial treatment. (Refer to Section 232-190-129.)

- Partial Dial—Such a condition exists if a line fails to complete dialing after one or more digits have been dialed. Such calls are given permanent signal treatment if necessary, except that a different announcement is used in Step (b). (See Partial Dial/Permanent Signal treatment.)

- Partial Dial/Permanent Signal treatment is as follows:

  (a) If an MLHG line, the line is given a one-second open to drop holding bridges.

  (b) A tone or recorded announcement is returned to the line.

  (c) Receiver off-hook tone is applied.

  (d) The line is connected to a permanent signal operator (optional).

Any of the above steps can be omitted according to local option. After the final step, the line is put on a "high and dry" list. Periodically, the system attempts to restore the line to service. Lines on the "high and dry" list are printed on the local test desk TTY periodically.

- Permanent Signal—Such a condition exists if a line fails to disconnect after a call is torn down or if an originating line remains off-hook for an excessive period of time without dialing. (See Partial Dial/Permanent Signal treatment.)

ROUTING FEATURES

3.33 The No. 2 ESS provides the following routing features. See Section 232-190-011.

- Access Codes—0+ and 1+ digits can be routed separately from nonprefixed numbers. Zero may be routed with or without time-out to the operator.

- Alternate Routing—Up to five alternate routes per primary route are permitted.

- Dialing Plan—1-, 3-, 7- or 10-digit dialing is permitted (exclusive of access codes). The format is NXX-NXX-XXXX where N is 2-9 and X is 0-9. NXX can also be 11X or 190-199.

- Directory Assistance (Information) Codes With AMA Records)—Directory assistance with optional AMA record is reached with the following: 411, 1+411, 555-1212, 1+555-1212, NPA+555-1212, 1+NPA+555-1212, or any other combination, as desired. See Section 232-190-202.

- Emergency Service (911)—Calls to 911 emergency service are routed to an emergency bureau. Ringback is offered as an option. See Section 232-190-203.

- Extended Area Service—Extended area service is available through screening.

- Foreign Area Translation—Up to seven Foreign Area Translators (optional) can be used.

- Interchangeable Area and Office Codes—Conflicts of area and office codes are resolved by a time-out.

- International Direct Distance Dialing (IDDD)—IDDD calls are routed to a TSPS operator.

- Local Tandem—Connecting through from one class 5 office to another is permitted.

- Service Codes—X11 or 11X service codes (originating only) service codes can be dialed.

- TSP/TSPS Access—TSP/TSPS can be accessed by dialing 0, 0+, or 1+ or no prefix. See Section 232-190-149.

TRUNK FEATURES

3.34 The No. 2/2B ESS provides the following types of trunks:

- Outgoing—Local, Tandem, Operator and Test

- Incoming—Local, Tandem, Operator and Test

- Two-Way—Local and Tandem.

3.35 General Trunking is covered in Section 232-190-024. CAMA is covered in Section 232-190-109. TSP(S) is covered in Section 232-190-149.

3.36 The trunk features and combinations available are shown in Table E. The following is a list of the trunk features.

TABLE E

TRUNK FEATURES AND COMBINATIONS

TRUNK FEATURES	LOCAL			OPERATOR			LOCAL TEST DESK	
	OGT	ICT	2-WAY	REC COMP	TOLL SWITCH	OGT CAMA OR TSP/TSPS	OGT	#14 & 16 INC
E&M Lead	X	X	X	X	X	X	—	—
Reverse Battery	X	X	—	X	X	X	X	X
Immediate Start	X	X	—	—	—	—	—	—
Wink Start	X	X	X	—	X	X	—	X
Delay Dial (Method A)*	—	X	—	—	—	—	—	—
Delay Dial (Method B)**	X	X	X	—	X	X	—	—
Stop — Go	X	—	X	—	—	—	—	—
Dial Pulsing 10 PPS	X	X	X	—	X	—	—	X
Multifrequency Pulsing	X	X	X	—	X	X	—	X
Inband Coin & Rering	—	—	—	X	X	X	—	—
Class of Service Tone	—	—	—	X	—	—	—	—
3 — 12 Digits	X	X	X	—	X	X	—	X
Automatic Ring	—	X	X	—	X	—	—	—
No Test Access	—	—	—	—	X	—	—	X
Local Tandem	X	—	X	—	—	—	—	—

OGT — Outgoing Trunk

ICT — Incoming Trunk

REC COMP — Recording Completing

* METHOD A — Incoming Trunk goes off-hook in less than 50 ms. Off-hook to on-hook transition to start pulsing

** METHOD B — Off-hook to on-hook transition to start pulsing

- Automatic Ring—On calls from a switchboard, ringing is applied immediately. (See Controlled Ring.)

- Carrier Group Alarms—Automatically removes all trunks from service that are on a failing carrier group immediately and attempts to restore them when carrier is restored. (This feature is available only with EF-1 or later generic programs.) See Section 232-190-030.

- Class of Service Tone—A short burst of tone is given to an operator to identify the type of calling party. High tone or low tone is available.

- Controlled Ring—Ringing is applied only upon receipt of signal from a switchboard.

- DC Signaling—Provides a switchboard trunk interface using dc signaling for coin collect,

coin return, and telephone rering. See Section 232-190-501. (This feature is available only with EF-1 or later generic programs.)

- Delay Dial—A type of start dial signal. There are two types generally known as Method A and Method B. Method A works as follows: When the seizure is recognized by the incoming office, the trunk remains off-hook until the receiving equipment is ready, then goes on-hook. With Method B, the trunk goes off-hook within 50 milliseconds when seized. It remains off-hook until receiving equipment is ready, then goes on-hook.

- Dial Pulsing—Dial pulsing at the rate of ten pulses per second is accepted from incoming trunks. Dial pulse outpulsing to other switching machines is at a rate of ten pulses per second. Twenty pulses per second are allowed from a PBX operator.

- Direct Interface With T1 Carrier—The direct interface with T1 carrier feature permits optional direct control of T1 carrier D3 or D4 channel units by the No. 2/2B ESS processor rather than through conventional trunk circuits. The direct interface with T1 carrier is primarily a hardware feature that results in the elimination of trunk circuits and trunk frames as well as simplification of maintenance and engineering. This feature requires EF-1 or later generics. See Section 232-190-027.

- E & M Lead—A signaling method where signals are transmitted between offices on a pair of wires separate from the tip and ring leads. With certain equipment, these signals can later be multiplexed onto the tip and ring leads.

- Immediate Start—The originating switching system does not wait for a start signal before sending dial pulses. The No. 2/2B ESS can be ready to receive pulsing within 70 ms of receiving the initial originating off-hook.

- Inband Coin and Rering—Coin collect, coin return, and rering signals are transmitted from an operator to the No. 2/2B ESS by a wink followed by a multifrequency signal.

- No Test Access—Allows a trunk to be bridged onto an existing connection via a no test vertical.

- Reverse Battery—This is a signaling method whereby the terminating office indicates a signal by reversing the battery on the tip and ring leads to the originating office.

- Stop-go—This is an off-hook signal returned from the terminating office during an interdigit interval to delay pulsing from the originating office.

- Trunk Transmission Testing Arrangements for Trunks Terminating on a No. 5 Crossbar ACD—Permits semiautomatic testing of trunks to a No. 5 Crossbar automatic call distributor (ACD) from the No. 2 ESS Trunk Test Panel (TTP). This feature requires EF-1 or later generics.

- Wink Start—A 140- to 290-ms off-hook signal returned from the terminating office to the originating office to indicate that pulsing can begin.

CENTREX FEATURES

3.37 Centrex service, sometimes referred to as centrex customer group service, includes facilities for interconnecting telephones within a customer group and for connecting those telephones to other telephones associated with the local central office, with other central offices, and with other centrex customer groups. Attendant facilities are generally provided to assist in completing station-originated or incoming calls. Centrex service can have many custom features such as add-on, call forwarding, etc. Telephones, and generally attendant equipment such as consoles, switchboards, etc., are located on the customer's premises. See Section 232-190-012.

3.38 In some cases, a No. 2/2B ESS arranged for Centrex-CO operation is located on the customer's premises. This No. 2/2B ESS, even though it is located on the customer's premises, is a central office and is engineered and administered in the same way as a central office located on the telephone company premises. This type of No. 2/2B ESS is not capable of homing on a class 5 central office, nor is it capable of performing ANI operation to another central office for "dial 9" calls.

3.39 The following list defines centrex features as they operate in No. 2/2B ESS. See Table F for a summary of centrex features. These features are all available with the EF-1 or later generic programs.

TABLE F

SUMMARY OF CENTREX FEATURES

FEATURE	FEATURE CAPABILITY	
	PER STATION	PER GROUP
Add-On	X	—
AMA Recording		
CCSA	—	X
FX	—	X
Identified Outward Dialing	—	X
MER	—	X
Tie Trunk	—	X
Attendant Call Forwarding	—	X
Attendant Camp-On	—	X
Attendant Conference (6-Port)	—	X
Attendant Control of Trunk Group Access	—	X
Attendant Position Options		
1B & 2B Console	—	X
27 & 47 Console	—	X
CALL DIRECTOR®	—	X
Attendant Restriction	—	X
Attendant Speed Calling	—	X
Busy Verification — Station Lines	—	X
Call Forwarding	X	—
Call Forwarding — Busy Line	X	—
Call Forwarding — Don't Answer	X	—
Call Forwarding — Don't Answer — All Calls	X	—
Call Hold	X	—
Call Pickup	X	—
Call Transfer — Attendant	X	—
Call Transfer — Individual	X	—
Call Transfer — Individual — All Calls	X	—
CCSA Access	X	X
Code Call	X	X
Code Restriction	X	—
Consultation Hold	X	—
Consultation Hold — All Calls	X	—
Dial Access to Attendant	X	—

TABLE F (Cont)

SUMMARY OF CENTREX FEATURES

FEATURE	FEATURE CAPABILITY	
	PER STATION	PER GROUP
Direct Inward Dialing	X	—
Direct Outward Dialing	X	—
Directed Call Pickup	X	—
Flexible Numbering of Stations	—	X
Fully Restricted Terminating Station	X	—
FX CO Access	X	X
Identified Outward Dialing (IOD)	X	—
Incoming Call Identification	—	X
Indication of Camp-On	—	X
Intergroup Dialing	—	X
Inward Restriction	X	—
LDN Access	—	X
Manual Line Service	X	—
Miscellaneous Trunk Restrictions	X	—
Most Economical Routing	X	X
Night Service	—	X
Pad Switching on Tie Trunk	—	X
Paging — Loudspeaker	X	X
Paging — Radio	X	X
Power Failure Transfer — Attendant	—	X
Recorded Telephone Dictation	X	X
Reserve Power	—	X
Restriction from Outgoing Calls	X	—
Simulated Facilities	—	X
Speed Calling	X	X
Station Hunting	X	—
Tandem Tie Trunk Dialing	X	X
Threeway Calling	X	—
Thru Dialing	—	X
Tie Trunks	X	X

TABLE F (Cont)

SUMMARY OF CENTREX FEATURES

FEATURE	FEATURE CAPABILITY	
	PER STATION	PER GROUP
Timed Reminders	—	X
Toll Restriction	X	—
TOUCH-TONE Calling	X	—
Trunk Answer from Any Station	—	X
Trunk Group Busy Lamps	—	X
Two-Way Splitting	—	X
WATS Access	X	X

- Add-On—A station can add another party to an existing incoming exchange network, or common control switching arrangement (CCSA) call to establish a 3-party conference. This can be done without attendant assistance. See Section 232-190-301.

- AMA Recording of CCSA, FX, Dial 9, MER, and Tie Trunk—Permits AMA recording of common control switching arrangement, foreign exchange, most economical routing, or tie trunk calls that originate from a centrex line or attendant. See Sections 232-190-204, 232-190-313, 232-190-338, 232-190-339, and 232-190-354.

- Attendant Call Forwarding of Stations—This feature provides the attendant with the ability to call forward any station with the Call Forwarding feature. See Sections 232-190-305 and 232-190-308.

- Attendant Camp-On—Any call which the attendant attempts to complete to a busy station line within the PBX or centrex system is held waiting until the called station becomes idle. The called station is then automatically rung and connected to the incoming call upon answer. See Section 232-190-302.

- Attendant Conference—This feature allows the attendant to establish a conference connection, via the switching equipment, of up to five conferees. See Section 232-190-303.

- Attendant Control of Trunk Group Access—Attendant Control of Facilities—An attendant can restrict dial access by all station lines to FX, WATS, and/or tie trunk groups by operating a key or dialing a code. Calls to trunk groups so restricted are routed to the attendant or to a tone or announcement. See Section 232-190-305.

- Attendant Hold—This feature allows the attendant to put any call in progress on hold for the purpose of supervising the call and at the same time releasing the attendant from the loop. See Section 232-190-305.

- Attendant Joint Holding of Stations—Attendant may hold a station busy, and be connected to it even though the station might be on-hook. See Section 232-190-305.

- Attendant Position—The equipment, usually a 1B-, 2B-, 27- or 47-type console, from which listed directory numbers and other calls requiring assistance can be answered and completed by the attendant. See Section 232-190-305.

- Busy Verification, Station Lines—This feature allows the attendant to establish a "talking" connection to an apparently busy station line

to determine if the station line is in working order. See Section 232-190-307.

- Call Forwarding—When call forwarding is activated by a station user, calls intended for the station line automatically route to any other station line selected (or to the attendant) within the same centrex group. See Section 232-190-308.

- Call Forwarding—Busy Line (CFBL)—If the station has CFBL and is busy, incoming DID or CCSA calls are automatically routed to the attendant or another centrex line within the same centrex group. See Section 232-190-309.

- Call Forwarding—Don't Answer (CFDA)—If the station has CFDA and does not answer within a prespecified amount of time, incoming DID or CCSA calls are automatically routed to the attendant or another centrex line within the same centrex group. See Section 232-190-309.

- Call Forwarding—Don't Answer—All Calls—This feature is similar to CFDA but works with all calls. See Section 232-190-309.

- Call Hold—This feature allows a station user to put any call in progress on hold, thus freeing the same line to originate another call, answer an attendant camp-on call, or return to a previously held call. See Section 232-190-311.

- Call Pickup—A station user can answer any call directed to another station line within the station's own preset pickup group by dialing a special code. See Section 232-190-312.

- Call Transfer—Attendant—This feature allows the called station user, while connected to an incoming exchange network or CCSA call, to reach (recall) the attendant so that the attendant may transfer the call to another party. See Section 232-190-301.

- Call Transfer—Individual—A station user can transfer incoming exchange network, or CCSA calls to another party without the assistance of the attendant. See Section 232-190-301.

- Call Transfer—Individual—All Calls—A station user can transfer any established call to another party without the assistance of the attendant. See Section 232-190-301.

- Code Call—This feature allows attendants and station users to dial an access code and a called party code to activate signaling devices (bells, gongs, horns, etc.) with a coded signal corresponding to the called code. The calling party can then be connected to the calling party when the called party dials an answering code from any nonrestricted station within the centrex group. See Section 232-190-314.

- Code Restriction—See Toll Restriction.

- Common Control Switching Arrangement (CCSA)—CCSA is an assemblage of switching and other facilities used to arrange an automatic switching system to serve as a switching center for one or more switched services networks. In addition, CCSA provides access to a CCSA network for network inward calling to the centrex group, direct outward dialing to the network, and other features similar to access to the exchange network. See Section 232-190-313.

- Consultation Hold—With this feature, a station user can hold incoming exchange network or CCSA calls and, on the same line originate a call to another party for private consultation. Consultation hold is included with add-on and call transfer. See Section 232-190-301.

- Dial Access to Attendant—This feature allows station users, within the switching system or via dial repeating tie trunks, to reach the centrex attendant by dialing a code, usually a single digit 0. The attendant may then complete these calls. See Section 232-190-305.

- Direct Inward Dialing (DID)—This feature allows an incoming call from the exchange

network to reach a specific station line without attendant assistance. See Section 232-190-316.

- Direct Outward Dialing (DOD)—This feature allows a centrex station user to gain access to the exchange network without the assistance of the attendant. See Section 232-190-354.

- Directed Call Pickup—Using this feature, a station user can answer calls directed to a specific line from any other station line in the centrex group by dialing the unique answer code of the station whose calls are to be answered. See Section 232-190-318.

- Flexible Numbering of Stations—Flexible numbering of stations allows station numbers to be assigned to lines at the line of installation in accordance with a customer desired numbering plan. See Section 232-190-341.

- Foreign Exchange Access—This feature provides access to a distant central office via foreign exchange trunks. Incoming calls are answered by the centrex attendant, or a suitable centrex station. Outgoing calls are made on a dial access basis. See Section 232-190-313.

- Fully Restricted Station—This feature denies selected station lines the ability to place or receive any but station-to-station calls. Restricted calls are routed to an announcement or to a tone. This feature is implemented through the use of the Fully Restricted Terminating and Miscellaneous Trunk Restriction features. See Section 232-190-320.

- Fully Restricted Terminating Station—This feature denies selected station lines the ability to receive any but station-to-station calls. Restricted calls are routed to the appropriate error treatment. See Section 232-190-320.

- Identified Outward Dialing (IOD)—This feature provides automatic identification of the calling station line number to permit individual station billing on toll calls. See Sections 232-190-139 and 232-190-354.

- Incoming Call Identification (ICI)—This feature allows an attendant at a switched-loop console position to identify visually the type of service or trunk group associated with a call directed to that position. See Section 232-190-305.

- Indication of Camp-On—This feature provides an audible burst of tone to the busy called station to indicate that an incoming call is camped on. See Section 232-190-302.

- Intercentrex Calling Group—This feature allows a centrex station in one centrex customer group to dial a station in another centrex customer group within the same office on a 4-digit basis.

- Listed Directory Number (LDN)—Incoming exchange network calls to the centrex attendant are placed via the assigned local listed directory number. The attendant may complete these calls to station lines within the system or to certain trunk facilities. See Section 232-190-323.

- Manual Line Service—This feature provides for station lines which are arranged to alert the attendant when the station user goes off-hook for service. See Section 232-190-324.

- Miscellaneous Trunk Restriction—This feature denies attendants, stations, and incoming tie trunks the ability to use certain access codes to gain access to the various types of trunks or features. See Section 232-190-320.

- Most Economical Routing (MER)—This feature allows the switching machine to select a route from a preselected pattern of routes when the station user dials an MER access code. Routes may be selected from WATS, FX, CCSA, and local exchange network. See Section 232-190-339.

- Night Service—This feature provides arrangements to route incoming calls normally

directed to the attendant to preselected station lines within the centrex system. See Section 232-190-326.

- Pad Switching—This feature allows for switching transmission pads in or out on calls involving via net loss (VNL) facilities. See Section 232-190-313.

- Paging, Loudspeaker—This feature allows attendants and station users to dial customer-owned paging equipment and alert individuals by voice page. See Section 232-190-314.

- Paging, Radio—See Directed Call Pickup and Paging, Loudspeaker.

- Power Failure Transfer, Attendant—With this feature, calls to the attendant are routed to the night station during a power failure at a customer location where reserve power to the attendant consoles is not provided or, where battery reserve is provided, when the reserve is depleted. Service to and from the station lines is maintained by the power facilities at the central office location. See Sections 232-190-305 and 232-190-326.

- Recorded Telephone Dictation—This feature permits access to and control of customer-owned dictating equipment by station users within the centrex group. See Section 232-190-314.

- Reserve Power—This feature provides an alternate, independent source of power to maintain attendant console service for a limited time (normally eight hours) during a power failure at the customer location.

- Restriction From Outgoing Calls—Refer to Miscellaneous Trunk Restriction.

- Simulated Facilities—The number of simultaneous WATS calls, DOD calls, and LDN calls can be limited by software counters instead of hardware limitations. See Section 232-190-340.

- Speed Calling—This feature allows station users to assign abbreviated codes to certain called numbers. This permits the dialing of selected numbers using fewer digits than normally required. See Section 232-190-331.

- Station Hunting—Station hunting routes a call to a preselected station line when the called station line is busy. This feature can be arranged over a group of lines to provide circular hunting or terminal hunting (limit of 12 stations in one group). See Section 232-190-309.

- Station-to-Station Calling—The station user can directly dial other stations within the same centrex group without the assistance of the attendant. See Section 232-190-012.

- Tandem Tie Trunk Dialing—This feature permits station users to dial over private tie trunk facilities which may be switched through several additional switching points, under control of the originating party. See Section 232-190-338.

- Threeway Calling—With this feature a station user can add a third party to any established call for a 3-party conference, without the assistance of the attendant. See Section 232-190-301.

- Thru Dialing—This feature allows the attendant to dial a trunk access code, receive second dial tone, and to pass this dial tone to the calling party, thereby allowing the calling party (a centrex extension) to complete dialing. See Section 232-190-305.

- Tie Trunks—Tie trunks provide one or more one- or two-way circuits interconnecting two PBX or centrex systems. The trunks can be either manual or dial repeating. They are dial-selected by station users or attendants. See Section 232-190-313.

- Timed Reminders—With this feature the attendant is automatically alerted, after a prescribed time interval, to a camped-on or unanswered call completed through the attendant console position. See Section 232-190-305.

- Toll Restriction—This feature denies selected station lines from completing outgoing

exchange network calls to selected office and area codes. The restricted calls are routed to an announcement or to a tone. See Sections 232-190-139 and 232-190-354.

- Trunk Answer From Any Station—With this feature, when the attendant positions are in night service, calls normally directed to the attendant, activate a common alerting signal on the customer's premises. These calls may then be answered by any nonrestricted station user in the centrex group who dials a special answer code. See Section 232-190-326.

- Trunk Group Busy Lamps (TGB)—Trunk group busy lamps provide the attendant at a switch-loop console position with a visual indication when all trunks in a given trunk group are busy. Simulated trunk groups may also be associated with TGB lamps. See Section 232-190-305.

- Two-Way Splitting—The attendant can consult privately with either party on a call connected to the attendant's position. See Section 232-190-305.

- WATS Access—WATS access provides the customer with the capability to access the outward WATS service provided for by a combination of simulated facility groups and screening and charging by translations. See Section 232-190-142.

FEATURE ATTRIBUTES

4. APPLICABILITY

4.01 The No. 2/2B ESS is a small to medium electronic central office for use in nonmetropolitan areas. It is intended to serve offices for initial installations in the 1000- to 10,000-line range, growing to a total of 10,000 to 20,000 lines.

5. LIMITATIONS AND RESTRICTIONS

5.01 The No. 2 ESS has an average busy season busy hour capacity of 19,000 busy hour calls for LO-1 and EF-1 noncentrex only. With the EF-1 generic program, the capacity of a No. 2 ESS serving only centrex calls is somewhat reduced. The No. 2B ESS with the EF-1 generic program (2B-EF-1) has an average busy season busy hour capacity of 28,000 busy hour calls.

5.02 Refer to Table G for performance specifications and limitations.

TABLE G

PERFORMANCE SPECIFICATIONS AND LIMITATIONS

TRAFFIC CAPACITIES

Network traffic capacity — 110,580 switched network CCS

Call handling capacity — up to 19,000 BHC for No. 2 ESS with LO-1 or EF-1 generic programs.
Up to 28,000 BHC for 2B-EF-1.

LINE, TRUNK, SERVICE CIRCUIT CAPACITIES

	Min	Max
Terminals	1024	30,720
Lines	—	20,000 (approximate)
Trunks	—	256 per trunk group (511 groups) in EF-1, 2B-EF-1. 512 per trunk group (255 groups) in LO-1.

Up to 8 (noncentrex) serves completion lines per series completion group.

Up to 12 (centrex) series completion lines per series completion group.

255 Maximum PBX entities

Up to 127 CENTREX customer groups

BUILDING ENVIRONMENT

	Temperature (°F)		Relative Humidity (%)	
	Min	Max	Min	Max
*Recommended operating ranges	40°	100°	20%**	55%
Short term limits (3 days at a time, 15 days a year)	35°	120°	20%	80%

ESS equipment heat dissipation is not to exceed 20 watts per square foot.

Air conditioning — as required to meet temperature and humidity requirements.

BUILDING PARAMETERS

10 feet of clear ceiling height required.

Floor loading — 150 pounds per square foot.

**The 20% relative humidity minimum is set for electrical charge considerations. At very low humidity there is danger of static discharge between tools and electronic equipment which could damage semiconductor devices.

*Aisle ambient temperature is measured 5 feet above the floor along the aisle center line.

5.03 Noncentrex subscriber services may be allowed or restricted through the use of 40 major classes of service. These classes are assigned and unassigned via recent change TTY input messages.

6. COMPATIBILITY AND INTERACTIONS

6.01 For a listing of compatible circuits and systems refer to J2H031A, No. 2 ESS Trunk and Service Circuit Specification, and BSP series 179-100-301.

7. COST FACTORS

7.01 The No. 2/2B ESS is priced fully competitive with No. 5 Crossbar in small offices and that competitive position improves for larger offices or for offices with a large number of features.

7.02 For overall system costs, refer to the appropriate Western Electric Company pricing organization. For cost considerations for individual features, refer to the 232 division of Feature Documents.

7.03 Refer to Business Information System Practice (BISP) 759-150-156 ***Central Office Equipment Estimate Systems (COEES) Equipment Pricing Calculations No. 2 ESS Equipment*** for both No. 2 and No. 2B ESS prices.

8. AVAILABILITY

8.01 The No. 2 ESS is available with the LO-1 or EF-1 generic program. No. 2B ESS is available with the 2B-EF-1 generic program.

CONSIDERATIONS FOR INCORPORATION OF FEATURE INTO SYSTEM

9. PLANNING

9.01 For information concerning the planning of equipment quantities, refer to Traffic Facilities Practices, Division D, Section 12. For engineering of initial offices refer to Traffic Facilities Practices, Division D, Section 12-b(2).

9.02 For information concerning No. 2/2B ESS equipment estimation refer to the 759-150-1XX series of BISP(s) ***Central Office Equipment Estimation System (COEES) for No. 2 ESS Equipment.***

10. HARDWARE

NO. 2/2B ESS FRAMEWORK

10.01 The No. 2/2B ESS use frames that are single-sided, seven feet high with modular widths of one foot one inch. The components are arranged on frames in a manner which makes each frame, as nearly as practicable, a complete functional building block free of numerous options. Refer to Section 966-200-100 for a brief description of each of the No. 2 ESS frames. Refer to Section 966-200-101 for a description of the No. 2B ESS frames. Refer to Table H for a list of the frames available and to Table A for a list of the circuits used in No. 2/2B ESS.

TABLE H

EQUIPMENT FRAME REQUIREMENTS

FRAME	J-CODE	ABBREVIATION	NUMBER REQUIRED	NO. 2 ESS	NO. 2B ESS
Automatic Identified Outward Dialing	2H018A	AIOD	0 or 1 per office	√	√
Automatic Message Accounting	2H021A	AMA	0 or 1 per office	√	√
Centrex Data Link	1A068	CDL	0 to 4 per office	√	√
Combined Distributing	ED-1A222-31	CDF	1 to 8 per office	√	√
Intermediate Distributing	ED-1A224-31	IDF	1 to 5 per office	√	√
Junctor Grouping	2H022A	JG	1 to 3 per office	√	√
Line Trunk Switching	2H025A	LTS	1 to 4 per line trunk network	√	√
Maintenance Center	2H003A	MC	1 per office	√	
Maintenance Frame	1C060A	MTCE	1 per office; includes tape memory backup system		√
Master Scanner	1A043B	MS	Minimum of 1 per office†	√	√
Miscellaneous	1A048A	M	As required (no max.)	√	√
Miscellaneous Power	1A048C	MP	1 per office	√	√
Miscellaneous Trunk	2H018A	MT	0 to 99 per office	√	√
Network Control Junctor Switching	2H026A	NCJS	1 per line trunk network (maximum of 15)*	√	√
Power Distributing	1A035C	PD	2 or 4 per office	√	√
Processor, 2B	1C058B	PROC	1 per office; includes duplicated 256K words of storage and 512 central pulse distributor points		√

*11 for LO-1 with LAMA
12 for EF-1 with fixed CS layout (equipped for centrex)
15 otherwise

†A maximum of 12 MS plus UTJ and UTJ-HMS frames may be provided.

TABLE H (Cont)

EQUIPMENT FRAME REQUIREMENTS

FRAME	J-CODE	ABBREVIATION	NUMBER REQUIRED	NO. 2 ESS	NO. 2B ESS
Processor, Central	2H002A	CP	2 per office	√	
Program Store	2H027A	PS	4, 6, or 8 per office	√	
Protector	ED-1A220-31	PROT	1 to 5 per office	√	√
Range Extension	2H034A	RE	0 to 20 per office (in pairs)	√	√
Recorded Announcement	1A058A	RA	1 to 16 per office	√	√
Remote Office Test Line	2H039A	ROTL	0 to 8 per office	√	√
Remreed Network	2H124A	RN	0 to 15 per office	√	√
Ringing and Tone Power Plant	87804B	RT	1 per office	√	√
Supplementary Central Pulse Distributor	2H023A	SCPD	0 to 6 per office; supplements central pulse distributor in central processor or 2B processor	√	√
Supplementary Main Store	1C065A	SMAS	0 or 2 per office		√
Supplementary Remreed Network	2H124B	SRN	0 to 15 per office	√	√
Supplementary Ringing and Tone	87804C	SRT	0 to 3 per office	√	√
Trunk Test	2H024A	TT	1 or 2 per office	√	√
Universal Trunk and Junctor	2H017A	UTJ	0 to 11 per office†	√	√

†A maximum of 12 MS plus UTJ and UTJ-HMS frames may be provided.

Typical Floor Plan

10.02 Standard frame arrangements in an office minimize engineering and installation costs. A universal floor plan has been developed which grows naturally from the smallest to the largest installation (see Floor Plan Data Sheets, Section 16). These floor plans as applied to typical No. 2 ESS and No. 2B ESS offices are shown in Figures 3 and 4. Some important features of these are as follows.

(a) In No. 2 ESS the control complex frames, that is, maintenance frame, central processors, stores, and 6-volt power frames, have a fixed relationship in every office. The same is true of the 2B processor (maintenance frame, processor frame and supplementary store frames).

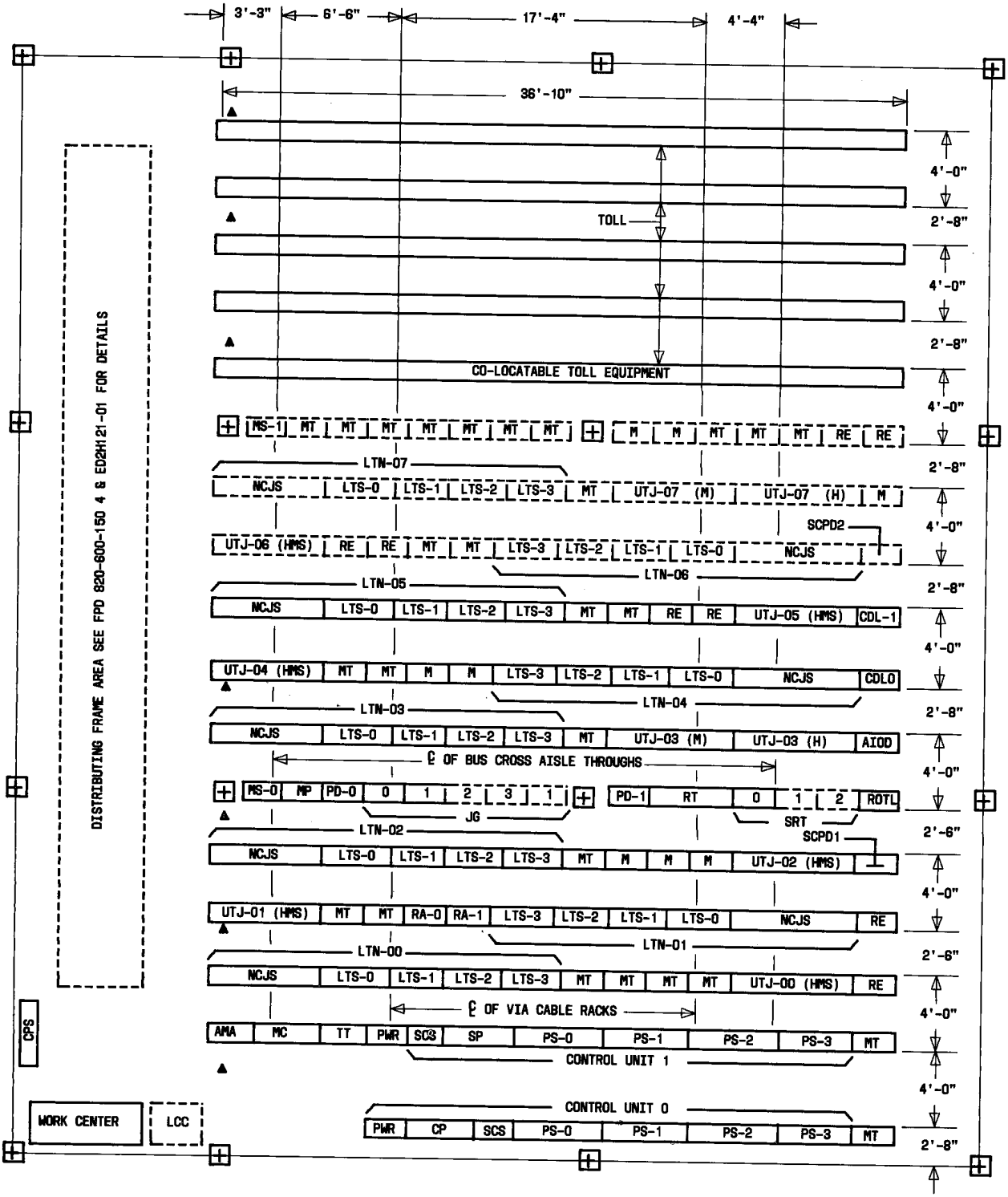

Fig. 3—Typical No. 2 ESS Office Floor Plan

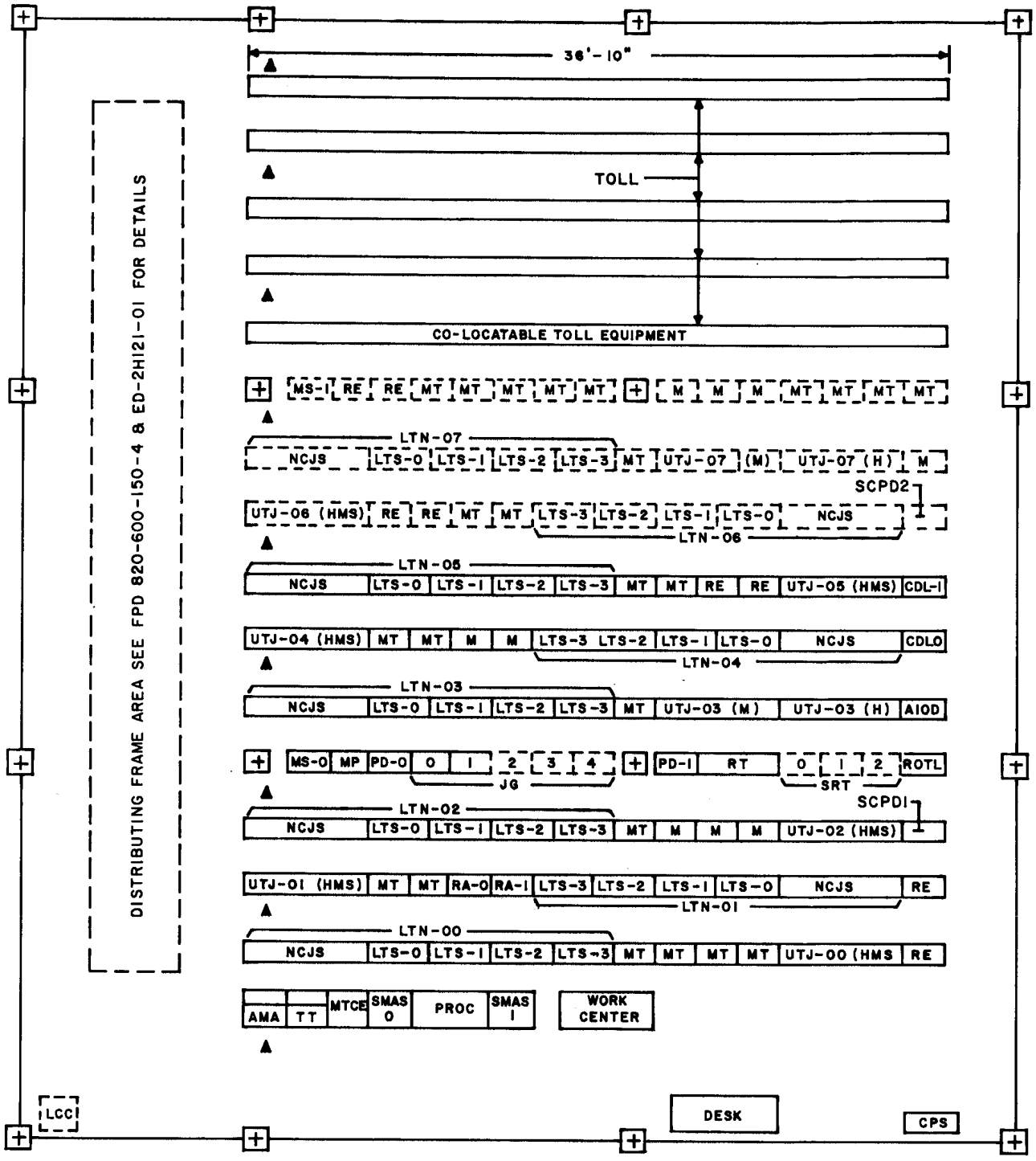

Fig. 4—Typical No. 2B ESS Office Floor Plan

(b) The frame lineups are so arranged that the office can grow approximately one lineup for every network added. However, the standard frame lineup is readily flexible if the limiting conductor lengths are not exceeded. See J2H032 and Section 820-600-151 for limiting conductor requirements.

(c) The distributing frames grow perpendicularly to the frame lineups. These frames are aligned with the associated network frames for orderly growth together in a way that automatically minimizes cable and combined distributing frame jumper lengths.

(d) The floor plan fits standard 20-foot building bays of new buildings and can be readily adapted to existing buildings.

11. DETERMINATION OF QUANTITIES

11.01 Allowable frame requirements for both No. 2 and 2B ESS offices are listed in Table H. Refer to Traffic Facilities Practices, Division D, Section 12 for further information.

12. ASSIGNMENTS AND RECORDS

12.01 Initial office records are generated by WECo when the office data administration (ODA) run for office translations is completed.

(a) The following ESS input forms may be required to provide features described by this document:

- 2100 Series—Terminal equipment number assignments, directory number assignments and CTX group table, etc.
- 2200 Series—Trunk and service circuit assignments
- 2300 Series—Charging and routing information
- 2400 Series—Traffic work tables for traffic measurements
- 2500 Series—General information tables for miscellaneous.

(b) The following R-(record) forms are used for maintenance records:

- 2100-R Series—Terminal equipment number, directory number, and CTX group records
- 2200-R Series—Trunk and service circuit records
- 2300-R Series—Charging and routing records
- 2400-R Series—Traffic work tables and traffic variable assignment record
- 2500-R Series—Miscellaneous records.

12.02 Refer to Translation Guide, TG-2H for details of individual forms.

13. NEW INSTALLATION AND GROWTH

13.01 The No. 2/2B ESS is designed to serve offices for initial installations in the 1000- to 10,000-line range, growing to a total of 10,000 to 20,000 lines depending on traffic. In any particular office, the upper limit on the total number of lines is determined by the traffic characteristics and features provided in that office.

14. TESTING

14.01 The No. 2/2B ESS should be maintained and tested in accordance with the 232 series Bell System Practices. Refer to Equipment Test List (ETL) 232-001-011 for a listing of the specified tests and the frequency they should be performed.

15. MEASUREMENTS

15.01 The No. 2/2B ESS stored program maintains a record of usage of many traffic dependent units or items. These records indicate traffic conditions such as frequency of use of certain circuits, numbers of various types of calls made and services used, and when the office equipment is approaching or exceeeding its engineered loads. Table B summarizes the types of plant and traffic measurements recorded. Refer to Section 232-120-301.

16. CHARGING

16.01 Charging in the No. 2/2B ESS is done via CAMA facilities in another office or via optional AMA facilities in the No. 2/2B ESS office

(LAMA) or via TSPS. Refer to Part 3, SYSTEM PERSPECTIVE for a description of the AMA facilities (also see Sections 232-190-204 and 232-112-101).

SUPPLEMENTARY INFORMATION

17. GLOSSARY

17.01 Refer to Section 232-190-003.

18. REASONS FOR REISSUE

18.01 This is the initial issue of this document.

19. REFERENCES

19.01 For more detail on the No. 2/2B ESS, refer to the following list of documentation sources.

Bell System Practices

19.02 For descriptive, method of operation, and maintenance information on the No. 2/2B ESS, refer to the 232 series BSPs. A detailed listing of the available BSPs may be found in numerical index 232-000-000. Also see Sections 190-110-110, 190-115-110, 680-536-010, 680-536-011, 232-100-100, 232-300-100, 966-202-101, and 999-200-128.

Feature Documents

19.03 For information covering individual features of the No. 2 ESS refer to the 232-190-XXX Feature Documents.

J-Specifications

19.04 The No. 2/2B ESS J-specifications are found in the 820 series BSPs. Refer to numerical index 820-000-000 for a detailed list. Also, refer to J2H031A.

Program Documentation

19.05 For a listing of the programs and associated documentation refer to PG-2H001, 2H002, 2H003, J2H030B, C and J2H101A. Also refer to IM-2H200, OM-2H200, and TLM(s) for No. 2/2B ESS.

Circuit Descriptions and Schematic Diagrams

19.06 For a listing of the available circuits refer to the SD-2H100-01 keysheet.

Other Related Documentation

AT&T Engineering Letters 600-No. 2 ESS, 71-02-181, 73-03-043, 74-01-056, and 75-01-117

Traffic Facilities Practices, Division D, Section 12

Translation Guide, TG-2H

Dial Facilities Management Practices, Division H