SWITCHING SYSTEMS MANAGEMENT
SYSTEM DESCRIPTION
NO. 1A ELECTRONIC SWITCHING SYSTEM
PROCESSOR COMMUNITY

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1. GENERAL

1.01 This section briefly describes the processor community of the No. 1A Electronic Switching System (ESS). The No. 1A ESS is a stored-program-controlled switching machine which uses the 1A processor to control network and peripheral equipment operation on a time-shared basis. The networks and peripheral units are similar to those used in the No. 1 ESS. It can be used as a replacement unit for existing facilities or as a growth unit. When used as a replacement unit, the transition is without any station modification and with minimum trunking changes at a distant office. The 1A processor provides substantially increased capacity and requires less floor space for equipment arrangements than No. 1 ESS.

1.02 Whenever this section is reissued, the reason will be explained in this paragraph.

1.03 The title for each figure includes a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

1.04 The No. 1A ESS is compatible with all types of existing local, toll, and tandem switching machines. It can be arranged for special services such as Centrex, common control switching arrangements (CCSA), tandem tie trunks, and wide area telephone service (WATS). The No. 1A ESS is capable of serving in excess of 100,000 (dependent on concentration ratio) customer lines. Many variations and changes are accomplished by changing the stored program or data tables rather than by changing apparatus or wired logic.

1.05 Some basic system techniques used in the No. 1A ESS are as follows:

- Stored program control
- Time-shared control
- Modular design
- Plug-in circuit packs
- Duplication
- Automatic fault recognition
- Built-in traffic measurements.

1.06 The system techniques are described below.

(a) ***Stored Program Control:*** The operations performed by the No. 1A ESS are specified by written programs stored in memory. The programs consist of precisely defined instructions which are executed, one at a time, by the 1A processor control circuitry.

(b) ***Time-Shared Control:*** A single control unit directs the operation of all other system units in accordance with program instructions. The control unit can operate at speeds much faster than the rate at which events associated with a single call occur. Consequently, the control equipment is time-shared for all calls handled by the system. This is accomplished by subdividing the work required to process a call into small segments and by interweaving these segments with those associated with other calls.

(c) ***Modular Design:*** Modular growth units, standard floor plans (particularly in the 1A processor area), and connectorized cables minimize the growth and installation intervals. Improvements in the design of a module, such as remreed networks and the miscellaneous trunk frame, do not require redesign or replacement of existing modules.

(d) ***Plug-In Circuit Packs:*** Connectorized plug-in circuit packs combine two of the smallest building blocks of the system: integrated circuit devices and discrete components. The connectorization of these components into a plug-in device allows rapid installation and repair of the 1A ESS equipment.

(e) ***Duplication:*** To insure uninterrupted customer service, equipment whose failure would affect a large number of customers is duplicated. For example, the system contains duplicate central controls. Both units operate

side by side on the same input information, but only one unit is given an active status. If a malfunction occurs in the active unit, the active unit is switched out of service and the duplicate unit is switched to active status with no loss in customer service.

(f) ***Automatic Fault Recognition:*** Maintenance programs monitor the system units to quickly detect equipment failures. A faulty unit is switched out of service automatically so that it will not interfere with the operation of the system. After the unit has been removed from service, maintenance programs initiate diagnostic tests to identify the trouble condition. The results of these tests are printed out through an input/output channel.

(g) ***Built-In Traffic Measurements:*** The ESS machine is always measuring its own performance. Adequate memory must be engineered to store the counts of these measurements. The measurements are always made automatically by the machine. However, printouts of the measurements must be scheduled appropriately by use of the traffic map. When trunks are added to an existing trunk group, peg count and usage measurements are automatically set up for the added trunks without separate administrative or maintenance action.

1.07 The No. 1A ESS (Fig. 1) consists of the control complex and the peripheral complex. These two areas contain the equipment required to perform the call processing necessary for customer service. The control complex includes the equipment units of the 1A processor, the maintenance and administrative control equipment, and the bus system. The peripheral complex consists of the switching network, distribution frames, peripheral monitor and control units, ringing and tone frames, and recorded announcement frames.

1.08 The No. 1A ESS offers a variety of features and services designed to meet various customer needs. (For detailed descriptions of individual operational and service features, refer to other sections of Division H, Section 6). The 1A ESS initially has the feature capabilities of the CC-/SP-CTX-7 generic program. This initial generic is designated 1A2W<G1> 1.

1.09 Service link networks are not supported by the No. 1A ESS. No. 1 ESS offices considering retrofit with the 1A processor must have the service link networks removed.

2. 1A PROCESSOR

GENERAL

2.01 The 1A processor is a self-sufficient hardware-software package that provides stored program control for the No. 1A ESS. It was developed primarily to meet the need for a switching system capable of handling several hundred thousand calls per hour. It offers many improvements over its predecessor used in the No. 1 ESS. These improvements include the following:

- Faster execution of instructions
- More program store capacity
- More call store capacity
- Bulk memory in the form of disk files to reduce storage cost
- Writable program store—memory that can easily be updated or have groups of instructions transferred to it
- Reduced floor space requirement.

2.02 The 1A processor is compatible with the No. 1 ESS program structure so that translation of No. 1 ESS operational programs is semiautomatic. The 1A processor can replace the No. 1 ESS processor in a working office, thus providing more than twice the call processing capacity of a No. 1 ESS with a signal processor. A retrofit candidate must have the No. 1 ESS generic equivalent of the 1A ESS generic program.

2.03 The major structural difference from the No. 1 ESS processor is the addition of an auxiliary unit bus on the central control to accommodate the disk and tape file subsystems. The stored program control can request data transfers between the call stores or program stores and the auxiliary units (disk and tape files); the auxiliary units then perform the operations independently. This convenient transfer allows substantial amounts of the maintenance program to be kept only on disk, with portions moved temporarily into high-speed memory (program stores) as they are needed. This arrangement reduces

the amount of high-speed access memory required. Transfers to and from tape units allow features such as automatic message accounting and reinitialization and updating of memory.

2.04 Improvements in manufacturing and installation costs and intervals have been made possible by extensive connectorization—linking by cables and connectors instead of by hand wiring. Because of connectorization, testing is more efficient. Engineering is simplified by a standard floor plan for most applications. Growth is allowed for in design engineering and is made simpler by connectorization.

2.05 Duplication is used throughout the 1A processor to ensure continuity of service should a unit fail. For example, there are two central control units, each normally performing the same tasks independently and comparing results. This comparison augments more conventional error detection methods, such as parity checks, so that any improper operation can be quickly detected and identified. Should either central control unit fail, the system automatically removes the failing unit from service and continues operation in a noncomparing mode.

2.06 Two spare program stores, called rover stores, are provided for the processor. For example, if eight program stores are required for the generic program, ten are required for service. In case of failure, a spare store is automatically filled with the proper information from file store and substituted for the failed unit. Duplication of the program stores is unnecessary since the generic program is fully duplicated in file store.

2.07 ***Call stores that contain call-related transient information are fully duplicated. However, stores containing relatively constant office-dependent data (parameters and translations) are not duplicated.*** Unduplicated stores rely on backup data in file store and temporary use of one of the duplicate stores. When an unduplicated store fails, one of the duplicated stores is loaded from disk under program control and is used as a replacement for the faulty store until it is repaired.

2.08 Fig. 2 shows a general functional block diagram of the 1A processor divided into its eight functional areas:

- Central control
- Program store
- Call store
- File store
- Auxiliary data system
- Peripheral system interface
- Control panels
- Input/output interface.

EQUIPMENT COMPONENTS

A. Central Control

2.09 The central control (CC) is the main data processor and control unit of the ESS. Under direction of the generic program, the CC performs the major information processing for the system and controls the actions of all system units. It receives input information from lines and trunks via scanners, performs logic operations, establishes network connections, and controls trunks via the signal distributor and central pulse distributor. Through maintenance and diagnostic programs, the CC analyzes troubles and provides printouts of the results.

2.10 Each CC is a word-organized, 24-bit data processor with a cycle time of 700 nanoseconds. (With a cycle time of 700 nanoseconds, CC interprets and executes a 24-bit instruction once every 700 nanoseconds.) The CC units are housed on a double-bay frame. Each bay contains one CC unit as shown in Fig. 3.

B. Program Store

2.11 The program store (PS) is a read/write memory unit containing the generic program which controls the operation of the system. Each program store memory unit provides 65,536 words of memory, with each word organized as 24 data bits and 2 parity bits. Early No. 1A ESS installations are being equipped with a core memory unit. One or two program stores (core) may be mounted on a core store frame. Subsequently, a semiconductor memory unit has been developed which substantially reduces floor space and power requirements. A semiconductor store frame (Fig. 4) may contain six stores. Those offices equipped with core memory

units will be permitted either to grow with semiconductor memory units or to retrofit existing core memory units with semiconductor units. An office may have a maximum of 16 program stores including rover stores.

2.12 All data stored in the PS are duplicated in the file store, thus eliminating the need to have all PSs duplicated. In addition to those PSs required for the generic program information, two additional PSs called "rover stores" are required. These stores are capable of replacing any of the stores in the event of a failure. When a malfunctioning PS is detected, it is automatically removed from service. Data identical to that contained in the faulty PS are read from the disk files into a rover store; the rover store is assigned to replace the malfunctioning PS until such time as it is returned to service.

2.13 During normal operation, the rover stores duplicate PSs 0 and 1 which contain data that could cause a service interruption if not continuously available in PS. In the event one of these stores malfunctions, the rover store containing the identical information can be assigned without waiting to be filled with the data from a disk file.

C. Call Store

2.14 The call store (CS) uses the same type of memory unit as the PS. Options in frame wiring and circuit pack assignment are exercised to differentiate a CS from a PS. This prevents a CS from being assigned to a PS frame. Each CS has read/write capability and 65,536 words of memory.

2.15 Although the CSs are identical, they are divided into two categories—duplicated and unduplicated. The duplicated CSs are used to store frequently changed or transient data related to call processing. The temporary recent change (RC) and the auxiliary RC areas are located in duplicated CSs. (Hoppers, registers, and buffers are also located in this portion of CS). The unduplicated CSs are used to store PS fault recognition programs, parameter data, and translation data. A backup copy of this data is maintained in the file store for service protection.

2.16 In No. 1A ESS, the memory contents of a store (CS or PS) are identified by K-codes instead of physical frame locations. (A K-code is an octal designation for an address range.) However, K-code assignments are not fixed because memory can be reconfigured by the system. A maximum of 16 K-codes is allotted for No. 1A ESS CSs. There is a maximum of 12 unduplicated CSs in the No. 1A ESS, leaving four K-codes for assignment to the duplicated CSs. Only one K-code is required per pair of duplicated CSs; therefore, eight duplicated CSs are possible for a combined maximum of 20 CSs in the office.

2.17 Since the difference between duplicated and unduplicated CSs is purely functional, if an unduplicated store fails, it can be backed up by assigning one of the duplicated stores to serve its function. During the time that this condition exists, the duplication of one of the normally duplicated stores would be given up. Should one of the duplicated CSs fail, the other duplicated store is used until the faulty store is repaired.

D. File Store

2.18 The file store (FS) is a bulk storage device that provides the 1A processor with a large amount of memory supplemental to that provided by the CS and PS. The FS employs a disk type of memory which must be accessed in a serial, rather than random manner. In comparison with semiconductor memory, which has a random access characteristic, the time needed to retrieve or store information on disk file is generally much longer. For this reason, the FS application is for those situations in which a longer access interval does not adversely affect the high-speed performance of the 1A processor. The advantage of the disk file store as a storage medium is that it provides large storage capacity at a much lower unit cost than semiconductor memory.

2.19 The basic FS frame (Fig. 5) consists of two bays. One bay is 3 feet 3 inches wide and contains either one or two disk file memory units. The other bay is 2 feet 2 inches wide and contains the control and power circuitry. A supplementary FS frame is added when the third and fourth disks are required. This supplementary frame is 3 feet 3 inches wide and uses the control logic provided in the control bay of the basic file store frame.

2.20 A single FS frame contains a disk file controller and from one to four disk storage units. The disk file controller is a wired logic unit capable of receiving and answering requests

for data transfers between the FS communities and the PSs or CSs. The disk storage unit has the capacity for storing 640,000 words of information per disk. The disk store memory contains a single disk that can store information on both faces. Each side of the disk plate consists of 100 tracks with 3200 words per track. The disk plate rotates at a speed of 1745 rpm.

2.21 The 1A processor is capable of accommodating one or two pairs of FS controllers, each pair being referred to as a community. However, it is expected that one community will be sufficent for No. 1A ESS requirements.

2.22 Three basic types of information are stored in the disk files:

(a) Duplication of all programs and data blocks that are stored in PS and unduplicated CS. This duplication provides backup in case of a store failure.

(b) Data tables stored only on disk file for use by various programs during their normal execution.

(c) Programs and data tables that do not normally reside in PS or unduplicated CS but are transferred there whenever needed.

2.23 The following description defines the application of each block of memory that comprises the file store community.

(a) ***Variable Words***—This block of words is used to provide duplication for both PS and unduplicated CS memory.

(b) ***Disk Only Words***—These words are used to store the 1A processor's diagnostic and fault recognition programs.

(c) ***Constant Overhead Words***—This block of words has four distinct functions:

(1) ***Recent Change Rollback Words***—This block of memory is used to store the original data which was modified by a recent change (RC) message. As each RC message updates the data base, the address and original contents of each word that is modified is stored in disk file. In the event of incorrect input data, or for other reasons, a requirement exists to "undo" an RC action, the original information is taken from this disk area and restored to both semiconductor and disk memory, thus rollback. Further, when the memory is filled, the most current data, modified by an RC message, will overwrite data which has been stored the longest.

(2) ***Error Analysis Words***—This block of words is used to record errors detected by the system. Diagnostic programs will utilize this history of errors to determine if a faulty unit exists.

(3) ***Input-Output Save Area Words***—These words are used to protect pending output message information from being lost or multilated prior to certain system reinitialization efforts.

(4) ***Miscellaneous Words***—These words are associated with diagnostic programs for storage of data and results of diagnostics.

E. Auxiliary Data System

2.24 The auxiliary data system (ADS) provides the central control with a magnetic tape storage and data retrieval capability. The auxiliary data system has the following major uses.

- ***Automatic Message Accounting (AMA):*** In general, this data consists of information about each billable call. AMA data is transferred in blocks from duplicated call store to a tape unit. Subsequently, the tape is processed at an accounting center.

- ***System Reinitialization:*** This function involves loading program information into semiconductor memory from an ADS tape unit. System reinitialization provides for recovery of the system when a valid copy of the program information cannot be assembled from information already in the processor.

- ***Program Updating:*** The introduction of a new generic program into a working office will involve the loading of the program, and possibly parameter and/or translation information, from the tape unit into semiconductor memory and then onto disk.

2.25 The ADS of the 1A processor is a versatile, medium-speed data handling system. It is divided into two communities, the same as the file storage system. Each community consists of two data unit selectors. The two data unit selectors provide (a) duplication for reliability and (b) access to a community of from 1 to 16 data unit controllers, each with its individual tape unit. Although a maximum of two communities may be provided, the 1A ESS requirements are expected to be met by one community.

2.26 The data unit controller is a wired logic unit which controls the transfer of data between a data unit selector and the tape transport and also controls the tape transport. The transport is a 9-track device designed to operate with reels up to 10 1/2 inches in diameter and a tape width of 1/2 inch. The data unit selectors are mounted at the top of bay 0 of the FS frame (Fig. 5), while the data unit controllers and associated tape units are located in the tape unit frame (Fig. 6).

F. Peripheral System Interface

2.27 The peripheral system interface serves as a common point of interface between the central control and the peripheral equipment, and between the central control and the 1A processor control and display panels on the control and display frame. (The processor peripheral interface frame contains the logic and access circuitry for the control and display frame.)

2.28 The processor peripheral interface frame is a 2-bay frame 7 feet high, 4 feet 4 inches wide, and 1 foot 6 inches deep. Fig. 7 shows a front view of the frame.

G. Control Panels

2.29 The control panels provide an additional human-machine interface for the 1A processor. These panels contain various keys, switches, and indicator lamps. They are used to monitor 1A processor operation and to exercise manual control over certain 1A processor activities.

2.30 The two control panels provided are (a) the processor display and override panel and (b) the processor A-level program request and system display panel (Fig. 8 and 9, respectively). These panels are mounted on the control and display frame, which is part of the master control center.

H. Input/Output Interface

2.31 The input/output interface provides the interface between central control and input/output terminals. The input/output terminals are controlled by input/output units. The No. 1A ESS input/output frame (Fig. 10) houses two input/output units and supporting circuitry. Two input/output units, each with its own selector, support a maximum of 16 input/output controllers. (An input/output selector provides access for one to eight controllers.)

2.32 Each input/output controller or channel can be utilized for a specific function as defined below. A controller has a maximum of three ports, each connecting to a terminal device of compatible speed. In general, only one port has input/output capability; the other two ports have output capability only.

2.33 The input/output controllers are capable of 100 or 1200 baud data rates, making possible the use of medium speed line printers. Both the DATASPEED® 40, which is required for certain channels, and the Model 35 Teletypewriter are compatible terminal devices.

2.34 The function of each input/output channel and the basis for equippage is as follows:

FUNCTION	REQUIRED	OPTIONAL
Local Maintenance	X*	
Remote Maintenance	X*	
Recent Change Service Order	X	
Administrative Dial Service	X*	
Supplementary Dial Service	X	
Supplementary Remote Maintenance		X*
Switching Control Center (SCC) Maintenance		X*
Supplementary SCC Maintenance		X*
Beltline Maintenance		X†
Plant Service Center (Automatic Line Insulation Test)		X
Network Management		X
Calling Line Identification		X
First Trunk Maintenance		X†
Second Trunk Maintenance		X†
Third Trunk Maintenance		X†
Fourth Trunk Maintenance		X†

* DATASPEED 40 required.

† Model 35 TTY only.

PROGRAM ORGANIZATION

2.35 The stored program which controls the No. 1A ESS is organized as a generic program located in the PS. There is also a data structure in unduplicated CS which consists of parameter and translation information. Parameter information pertains to office equipment quantities and hardware/software options. Translation information pertains to individual lines and trunks.

A. Generic Program

2.36 A generic program is a general purpose switching system control program that is installed in every No. 1A ESS (as opposed to each office having an individually tailored control program). A generic program offers two advantages—a universal remedy for design errors or bugs and the capability of every office to provide any feature and service available with the generic program. The generic program contains the call processing instructions required for the scanning of lines and trunks and for setting up connections and disconnections between lines and trunks. The No. 1A ESS generic program provides the maintenance and administrative programs described below.

- ***Maintenance Programs***

(a) To ensure dependability, the 1A processor employs software and hardware features that detect and resolve problems automatically. A software package is included with the processor to provide for automatic recovery from software and hardware failures and isolation of hardware failures to the circuit pack level.

(b) When a hardware error is detected, the program identifies the hardware unit at fault, removes it from service, and configures the remaining hardware units so that they are capable of supporting call processing. Finally, the program orders a diagnosis of the faulty unit. For the majority of faults, recovery takes place without interfering with call processing.

(c) Diagnostic programs pinpoint the failed circuitry to a few circuit packs, which can be replaced quickly to get the unit back into a working condition. The diagnostics help to achieve the objective of a 2-hour mean time to repair without interfering with call processing.

(d) Software errors, caused by mutilation of the program or data base, trigger a different sequence of events than that for hardware errors. If the mutilation is small enough that the program is still capable of maintaining control, audit programs analyze the data base and correct the affected data on a time-shared basis with call processing. If the program is severely mutilated, it is automatically restored from backup memory devices. Call processing is stopped until the affected information is corrected or restored.

- ***Administrative Programs:*** A number of administrative programs are included with the 1A processor. These programs provide, for example, the ability to function as follows:

(a) Collect data, for later analysis, concerning failures that occur in the system as well as the system's automatic reaction to these failures.

(b) Transfer data to and from disk, tape, and input/output terminals.

(c) Execute a number of utility features which will permit analysis of system operation.

(d) Control the transfer of programs into program store from bulk memory for execution.

(e) Control multiple-task execution of deferred programs that can be interweaved with call processing according to a previously determined priority.

(f) Temporarily allocate memory and provide for the loading and execution of programs which are not an integral part of the system program.

(g) Permit the loading and changeover of either complete or partial updates of the system program or fixed office data.

B. Parameter Data

2.37 The parameter data is office-dependent data of a general nature which do not require changing for day-to-day administration. These data define the services that the office offers to its customers. They also define the CS memory allocations which have been made and the total quantity of equipment, such as peripheral frames and call stores in the office.

2.38 Changes to the parameter data are necessary only when a hardware or software modification of the office occurs. The hardware modifications are typically growth situations where equipment frames are added. The software modifications are usually the result of a reissue of the generic program to improve some segment of the code, to incorporate new capabilities into the program, and to correct program errors which have been detected. When parameter changes are required, the telephone company must place an order with a Western Electric Company Regional Center for a new parameter data assembler run which generates the new parameter data for the ESS.

C. Translation Data

2.39 The translation data contain specific information about lines, directory numbers, service circuits, trunks, and routing for a particular office. For the customer line, this information includes the services to which the customer subscribes, the type of equipment on the customer's premises, the relationship of the customer's directory number to the line equipment number, and the billing treatment the customer should receive. The trunk and service circuit translation data include identification of the trunks that are associated with each trunk group, etc. The translation data also contains the information used to translate office codes and to determine routing and charging information for interoffice calls, as well as other information such as routing of irregular calls (e.g., partially dialed numbers or misdialed numbers).

2.40 The line translation data are subject to continuous changes since new customers are added daily and old customers are moving or changing the services to which they subscribe.

The trunk translations are similarly changed to maintain efficient trunk group sizes, to modify routing and alternate routing plans, and to change charging information when rates change.

2.41 To accomplish these changes, the generic program provides the ability to input the required modifications to the translation data. The data can be changed as required via teletypewriter input messages into the recent change area of duplicated call store or the file store in the case of delayed recent changes. Since this is a continuing process, it is the telephone company's responsibility to manage and update the translation data. The Network Administrative Organization is generally responsible for managing line and number translation data.

3. BUS SYSTEM

3.01 Four internal bus systems are provided for CC to communicate with the PSs, CSs, auxiliary units, and peripheral units. These bus systems (see Fig. 11) are duplicated to ensure a high level of processor reliability.

3.02 Under normal operating conditions, one bus of a duplicate pair is designated as the active bus and the other is designated as the standby bus. These buses are assigned to the active and standby CCs, respectively. In the event of failure of a bus, processor unit, or a peripheral unit, the CC makes appropriate CC and bus reconfiguration changes to maintain system operation.

3.03 When either data or instructions are transferred from the CC to other units of the 1A processor, the units are enabled via the coded enable method. With coded enabling, a sync pulse followed by an address is sent to every unit on a bus. Only the unit whose internal address matches the one sent over the bus will process the information. When the processing is complete, an all-seems-well (ASW) signal is sent by the addressed unit to indicate the successful completion of the operation.

3.04 Data or instruction transfers between the CC and the switching system are performed via the peripheral unit bus. Units of the switching network are enabled by the central pulse distributor (CPD). A CPD unit within the switching network provides this enabling. Upon receiving an order from CC, the CPD pulses the enable line associated with the desired unit. The CC places data on the peripheral unit bus and only the unit receiving the CPD data is able to accept and act on it. When the unit receives an enable pulse from the CPD, it returns a verify signal to the CC. The verify signal is used by the CC to determine if the correct unit was enabled. As additional frames are required, most interconnecting buses are extended to accommodate the new frame(s).

4. ADMINISTRATIVE AND MAINTENANCE CONTROL

A. Input/Output Facilities

4.01 The master control center (MCC) and multiple input/output channels with associated terminals are provided for control of the system by operating personnel. The MCC consists of a control and display frame, a trunk and line test panel, and an input/output terminal. Input/output terminals are used as the primary interface for the administrative and maintenance control of the No. 1A ESS. The administrative and maintenance channels are described below.

4.02 ***Administrative Dial Service Channel:*** This channel, formerly referred to as the traffic channel, reports traffic load conditions, overload conditions, and traffic data accumulated by the system. In addition, it serves as backup for the supplementary dial service channel and the network management channel, if provided. The administrative channel is also used to verify translations and to implement line load control. Traffic data is printed according to a schedule (map) input by the network administrator. Terminals on this channel can be either locally or remotely located. A DATASPEED 40 terminal is required for this channel.

4.03 ***Supplementary Dial Service Channel:*** This channel should be used as a receive-only channel. The supplementary channel is used in conjunction with the primary channel to separate traffic data and administrative messages. Traffic data (H, C, W and TC24A and B), scheduled to print, is directed to this channel while administrative information is transmitted over the primary administrative dial service channel. This channel should be used for interface with the Engineering and Administrative Data Acquisition System (EADAS) and other data collection and processing programs. The supplementary dial service channel in No. 1A ESS is a machine-machine channel and

can be optionally equipped with a DATASPEED 40 or a Model 35 teletypewriter (TTY).

4.04 ***Maintenance Channels:*** A minimum of two maintenance channels are always included in a No. 1A ESS office. These channels are the local and remote maintenance channels. Two other channels, the supplementary remote maintenance channel and the belt line maintenance channel, are provided on an optional basis. The terminals report the status of the system to maintenance personnel and are used by them to request a variety of system actions. The local maintenance channel is always located at the MCC while the remote channel may be located in the same building or at another location. Both of these channels use a DATASPEED 40 as the associated input/output terminal. The supplementary remote maintenance channel, which requires a DATASPEED 40, is provided for Technical Assistance Center (TAC) or Maintenance Assistance Center (MAC) usage. The belt-line maintenance channel utilizes a mobile Model 35 TTY. The mobile TTY is plugged into a belt-line jack (wired in parallel on all frames throughout the office).

4.05 ***Switching Control Center Channels:*** Two maintenance channels are available for switching control center (SCC) usage. These channels have the same capabilities and receive as a minimum the same outputs as the local and remote maintenance channels. Both channels must be equipped with DATASPEED 40 terminals.

4.06 ***Service Order Channel:*** This channel, which can be equipped with either a DATASPEED 40 or a Model 35 TTY, is provided for service order and translation information. One service order terminal is typically located in a plant assignment bureau. Another terminal is located within the No. 1A ESS office. These terminals use special formatted paper forms to facilitate the typing of messages. They can also be used off-line to produce a magnetic tape that contains information for subsequent transmission into the system.

4.07 ***Automatic Line Insulation Test Channel:*** The automatic line insulation test (ALIT) channel is also referred to as either the plant service center (PSC) or the local test desk (LTD). It is equipped with either a DATASPEED 40 or a Model 35 TTY. It is used for recording information at a local or remote test bureau. This information consists of a list of permanent signals on lines, results of ALITs, and results of tests peformed on pressurized cable connector pairs.

4.08 ***Supplementary Trunk Test Position Channels:*** These channels, to a maximum of four, are used to direct messages to designated sets of supplementary TTYs. The messages consist of trunk diagnostic results and responses to Maintenance personnel actions at the supplementary TTYs. These channels are equipped with Model 35 TTYs.

4.09 ***Calling Line Identification Channel:*** The calling line identification (CLID) channel records information that has been requested as a result of initiating CLID procedures (call tracing). This information includes the calling and called directory numbers and the time that the call was placed. This channel can be equipped with either a DATASPEED 40 or a Model 35 TTY.

4.10 ***Network Management Channel:*** This channel provides the primary interface between the network manager and the switching system. Through this channel, the network manager can activate network management controls and receive traffic and status information associated with the network management function. This channel can be equipped with either a DATASPEED 40 or a Model 35 TTY. However, a channel need not be dedicated for this function. If one is not dedicated, the administrative traffic channel, by default, serves as the network management facility.

B. Line Load Control

4.11 Line load control (LLC) is a possible response of the network administrator to an office overload. LLC is a means by which lines considered essential to national defense and public welfare can be given preferential service during overload periods. This is accomplished by selectively denying originating service to some or all lines not considered essential. The initiation of LLC does not affect calls already established, nor does it prevent calls from being completed to lines temporarily denied originating service. Thus, essential calls are allowed to reach any telephone at any time.

4.12 LLC can be activated manually by using an input message or can be activated by the ESS after being placed in the automatic or ON mode by another input message. Both messages can be entered via the maintenance or administrative

dial service input/output channels. Refer to DFMP Division H, Section 6d(1) for additional information on LLC.

5. REFERENCES

5.01 Additional information on the No. 1A ESS is available from the following sources.

Bell System Practices

951-600-105, 1A Processor—General Description

966-120-100, No. 1A ESS—General Description

Dial Facilities Management Practices

Division H, All Section 6 Practices

Traffic Facilities Practices

Division D, Section 11a(2), No. 1A ESS—System Description

Other References

TG-1A, Translation Guide

PA-6A001, Office Parameter Specification

PA-6A002, Translation Output Configurations

IM-6A001, Input Message Manual

OM-6A001, Output Message Manual

6. GLOSSARY

6.01 The following is a glossary defining terms used in No. 1A ESS.

Address: A combination of bits that identifies a location in a storage device or equipment unit.

Bit (Binary Digit): A binary unit of information. It is represented by one of two possible conditions, such as, the character 0 or 1, on or off, high potential or low potential, conducting or not conducting, magnetized or demagnetized.

Bus: A group of leads providing time-shared communication paths over which information is transmitted from any one of several sources to any of several destinations as governed by gates.

Decode: To translate input information into a form recognizable by the unit receiving the information.

Duplicated Call Store: Memory units containing transient information pertaining to call processing (set card defined in unduplicated CS).

Enable Pulse: A pulse that permits a unit or circuit to become operative.

Encode: To code information into a form suitable for transmission from one unit to another.

Error: A malfunction, the symptoms of which ***cannot*** be reproduced under program control.

Fault: A malfunction, the symptoms of which ***can*** be reproduced under program control.

File Store: A bulk memory device which contains backup of all programs and data blocks in unduplicated call store and program store in addition to programs and data tables that do not normally reside in other memory units.

Instruction: A binary word which directs central control to perform a particular function.

Memory: A unit into which information can be placed to be extracted at a later time. The ability to retain information for later use.

Memory Circuit: A circuit which, having been put in some state by an input signal, will remain in that state after the removal of the input.

Nonresident Program: Portion of generic program that is maintained in FS and brought to the PS only when needed.

Parameter Information: Information contained in the FS and unduplicated CS pertaining to office equipment and certain hardware and software options.

Parity Bit: A bit attached to a word to make the total number of ones, including the parity bit, odd or even.

Parity Check: A check on the validity of a binary word by determining whether the number of ones in the word is odd or even.

Program: An organized set of instructions used to control system functions.

Program Store: A memory unit that stores the resident generic program.

Read: To retrieve information from a memory device.

Real Time: Actual time of event occurrence. A real-time control system is one in which information related to a physical process is converted by the control equipment quickly enough so that the outputs obtained are useful in controlling that process.

Redundancy: The use of equipment and facility duplication to make possible continuity of service in the presence of troubles.

Resident Program: That portion of the generic program that is maintained continuously in PS.

Subroutine: A sequence of programmed instructions to perform a particular function which is common to several programs.

Temporary Memory: A read and write memory which contains information that can be changed by the internal circuitry of the system.

Translation Information: Information contained in the FS and unduplicated CS pertaining to the individual lines or trunks. It may be used, for instance, to convert a directory number into an equipment location, to derive the class of service, etc.

Trouble: A fault that causes a deviation from normal system operation.

Unduplicated Call Store: Memory units used to contain office data, both parameter data and translation data.

Word: A set of characters associated to express system information. (The term ***word*** may be prefixed by an adjective describing the nature of the characters, such as binary word.)

Write: To insert information into a memory device.

7. ABBREVIATIONS AND ACRONYMS

ADS	Auxiliary Data System
ALIT	Automatic Line Insulation Test
ASW	All-Seems-Well
AU	Auxiliary Unit
AUB	Auxiliary Unit Bus
CC	Central Control
CCSA	Common Control Switching Arrangement
CD	Control and Display Panel
CLID	Calling Line Identification
CPD	Central Pulse Distributor
CS	Call Store
EADAS	Engineering and Administrative Data Acquisition System
FS	File Store
LLC	Line Load Control
LTD	Local Test Desk
MAC	Maintenance Assistance Center
MCC	Master Control Center
PS	Program Store
PSC	Plant Service Center
PUB	Peripheral Unit Bus
SCC	Switching Control Center
SD	Signal Distributor
TAC	Technical Assistance Center
TTY	Teletypewriter
WATS	Wide Area Telephone Service

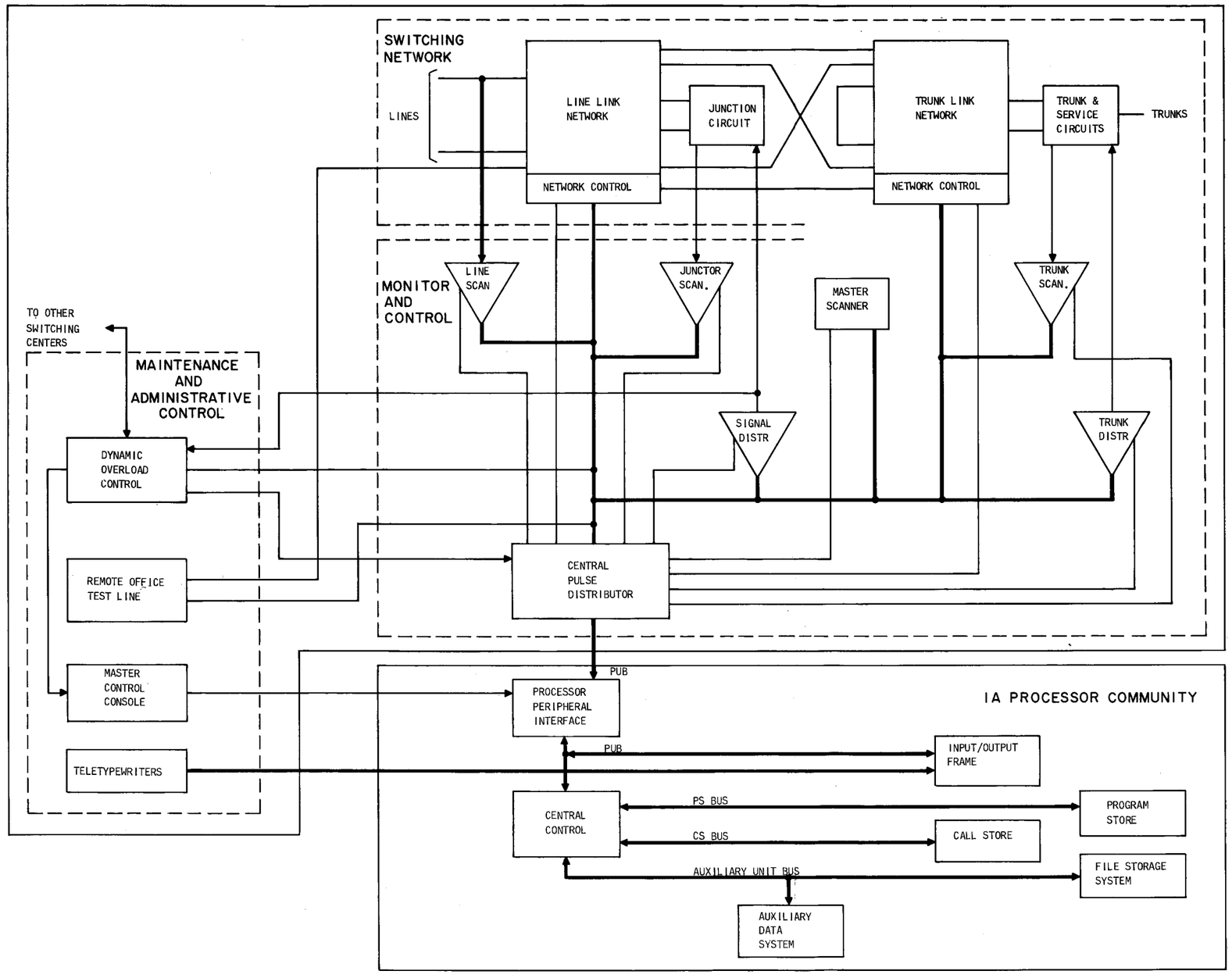


Fig. 1—No. 1A ESS Functional Schematic (1.07)

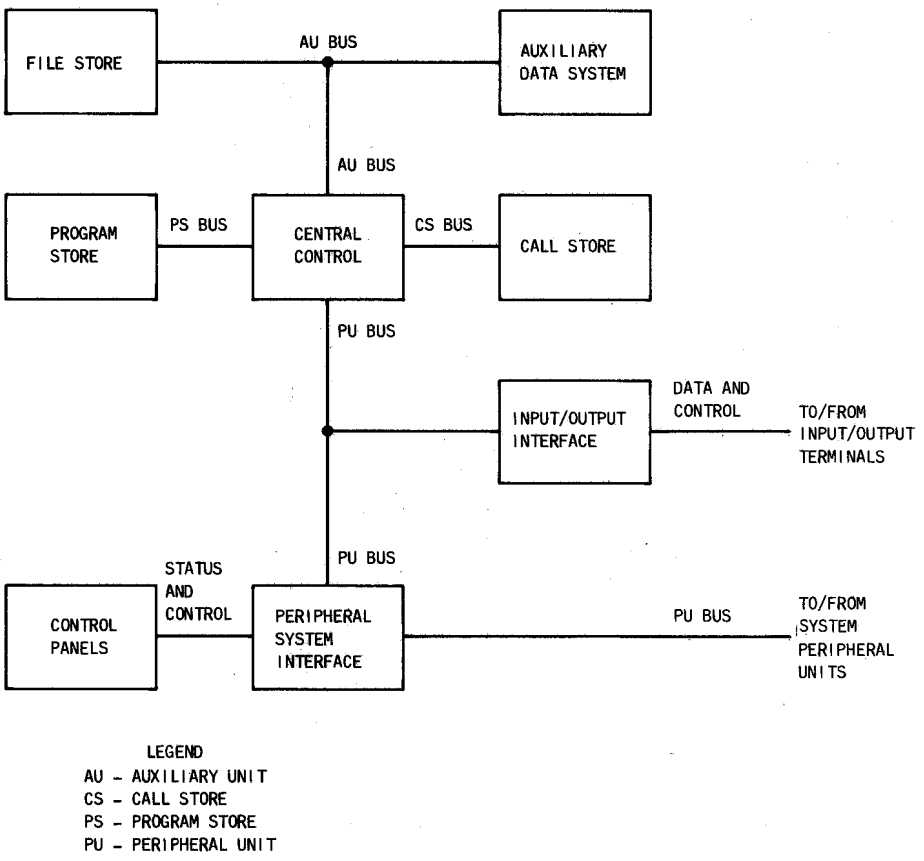


Fig. 2—1A Processor Functional Block Diagram (2.08)

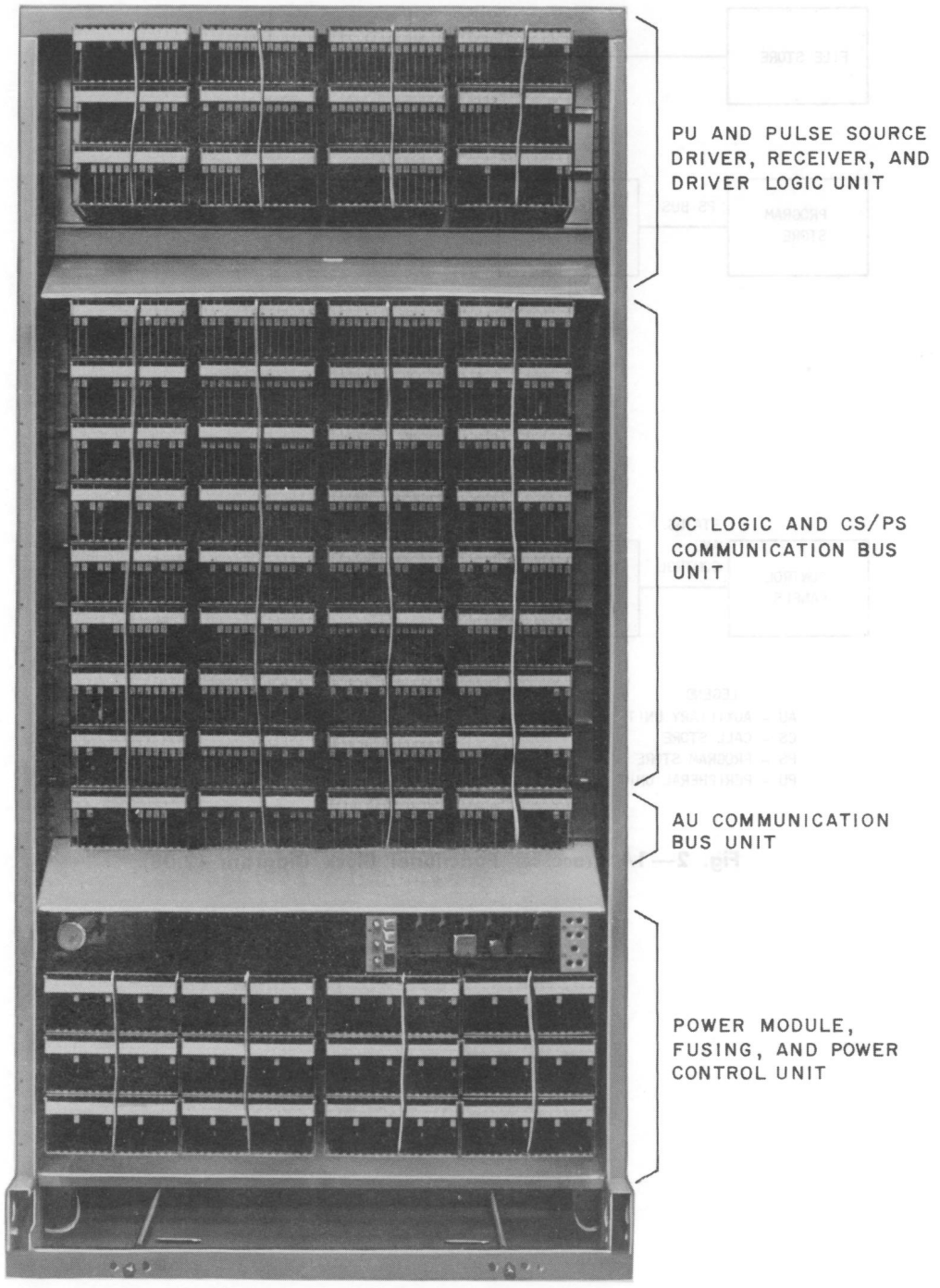


Fig. 3—Central Control Frame (2.10)

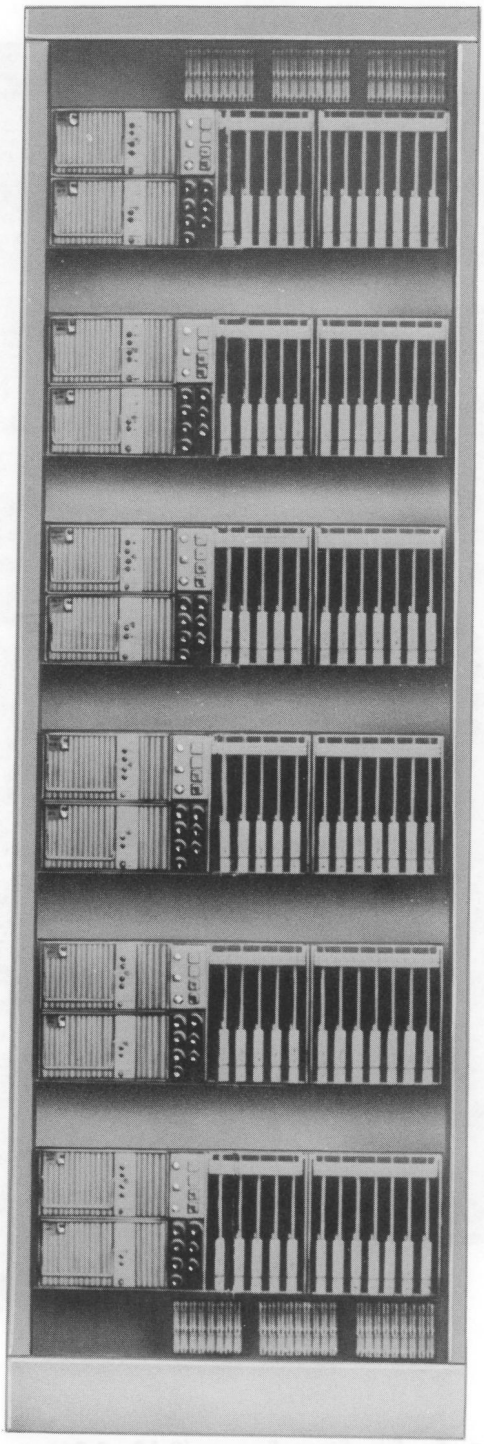


Fig. 4—Semiconductor Store Frame (2.11)

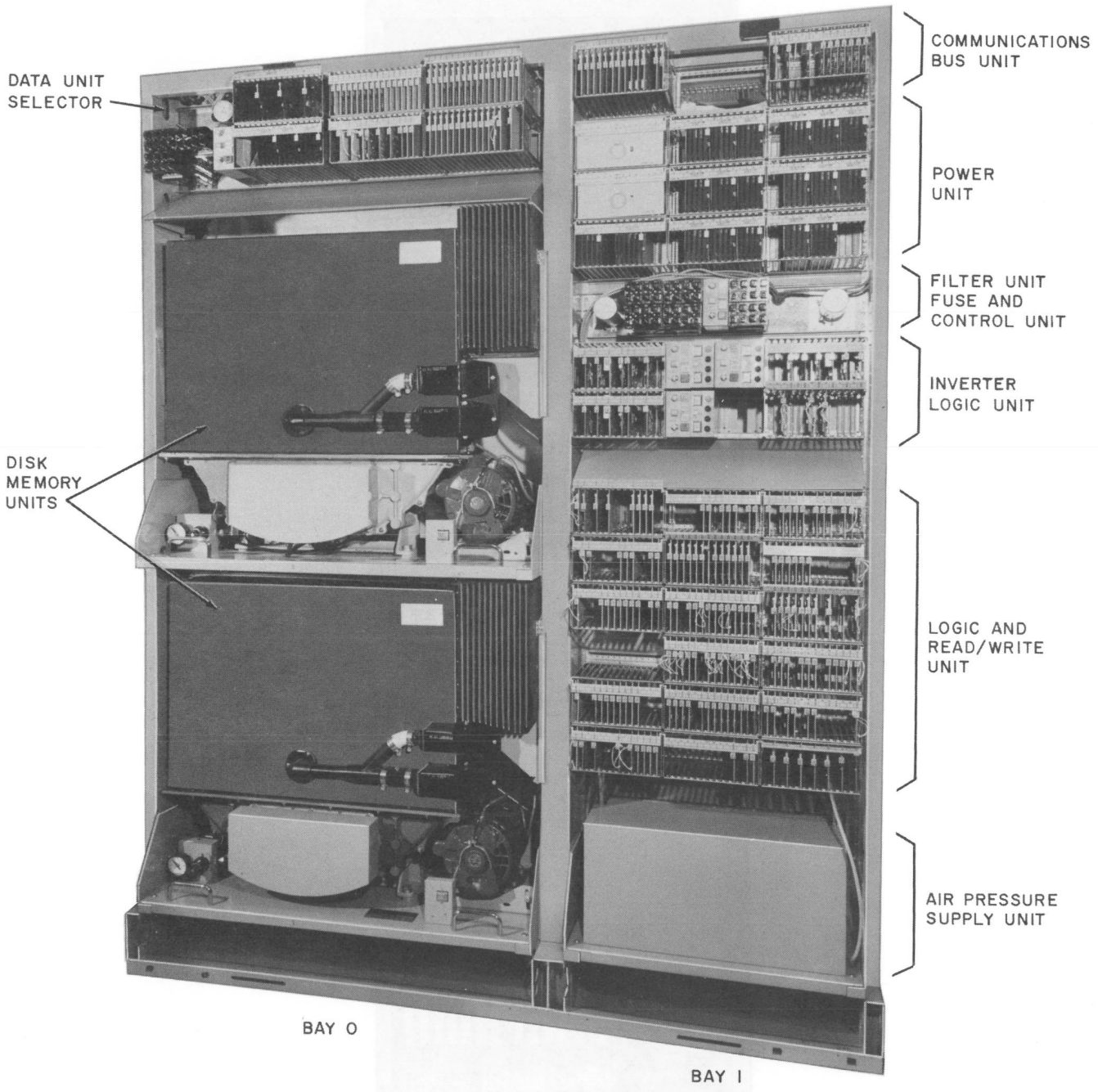


Fig. 5—File Store Frame (2.19, 2.26)

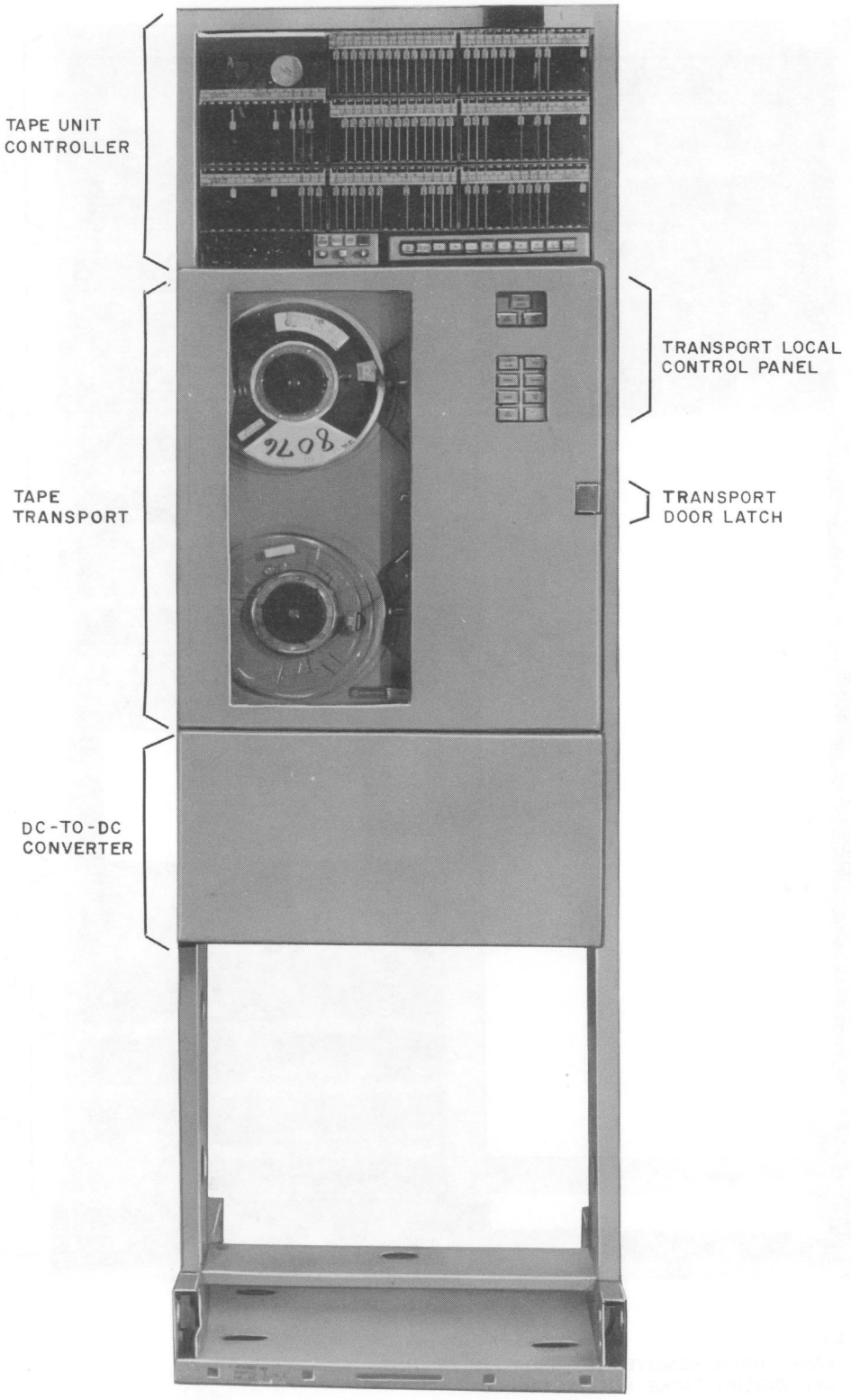
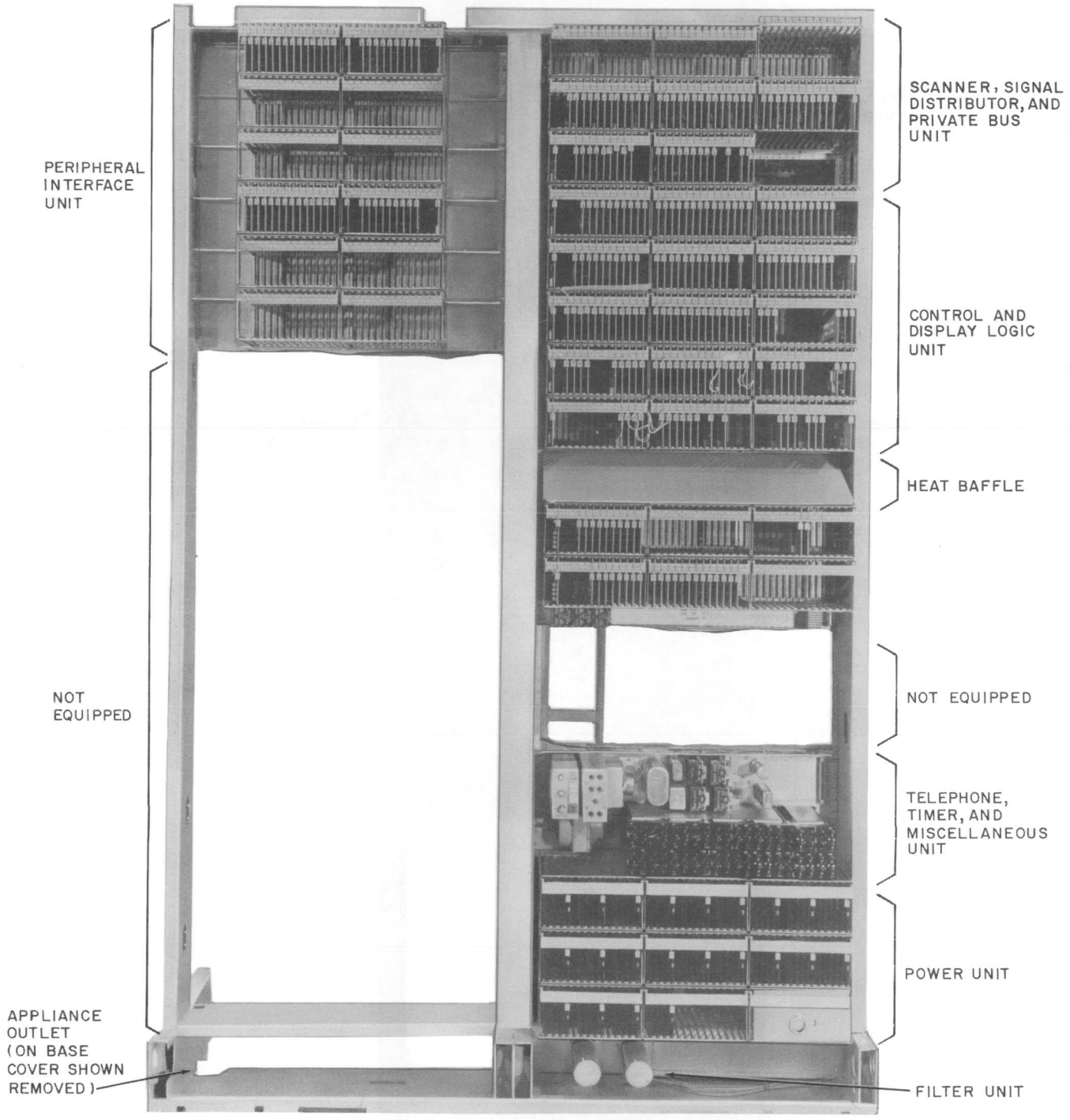


Fig. 6—Tape Unit Frame (2.26)



NOTES:
1. BASE COVER REMOVED TO SHOW FILTER UNIT
2. ALL CIRCUIT PACKS NOT INSTALLED

Fig. 7—Processor Peripheral Interface Frame (2.28)

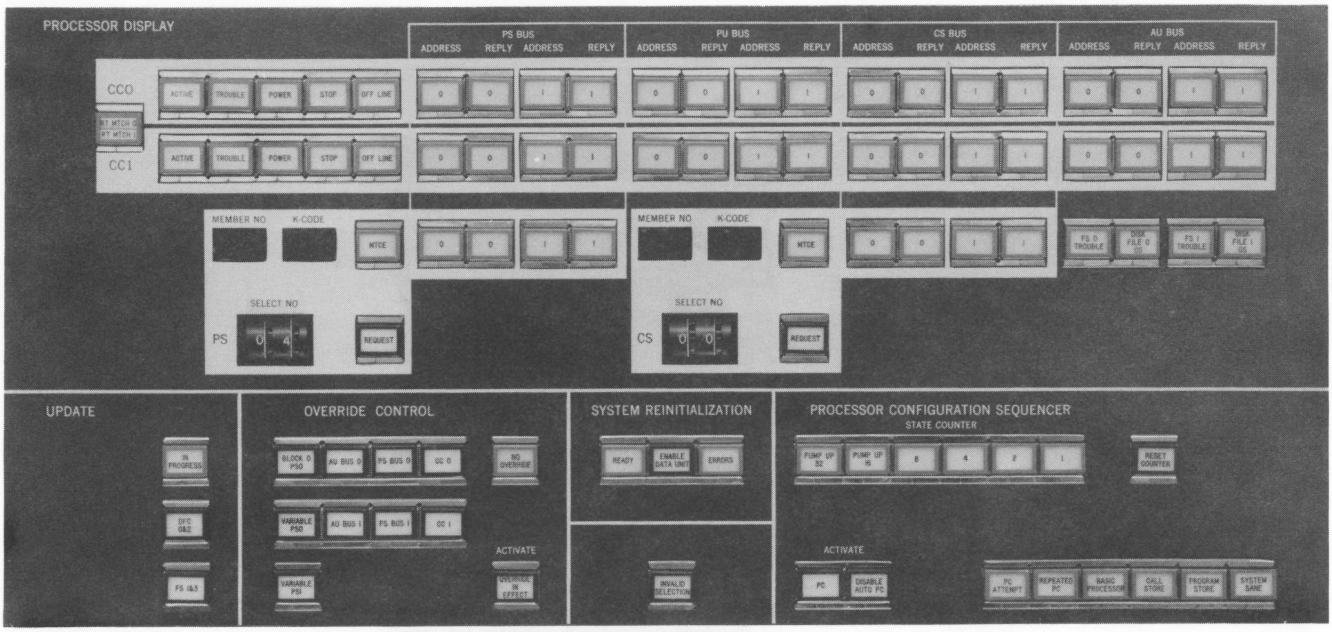


Fig. 8—Processor Display and Override Panel—Front View (2.30)

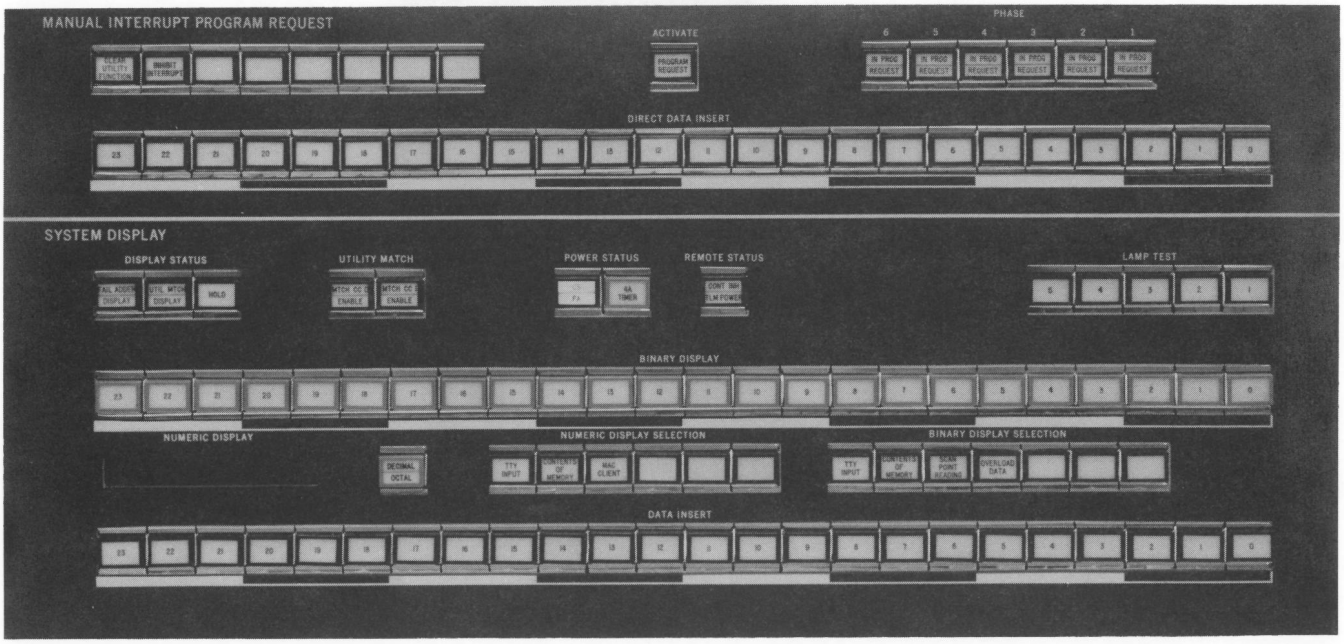


Fig. 9—Processor A-Level Request and System Display Panel—Front View (2.30)

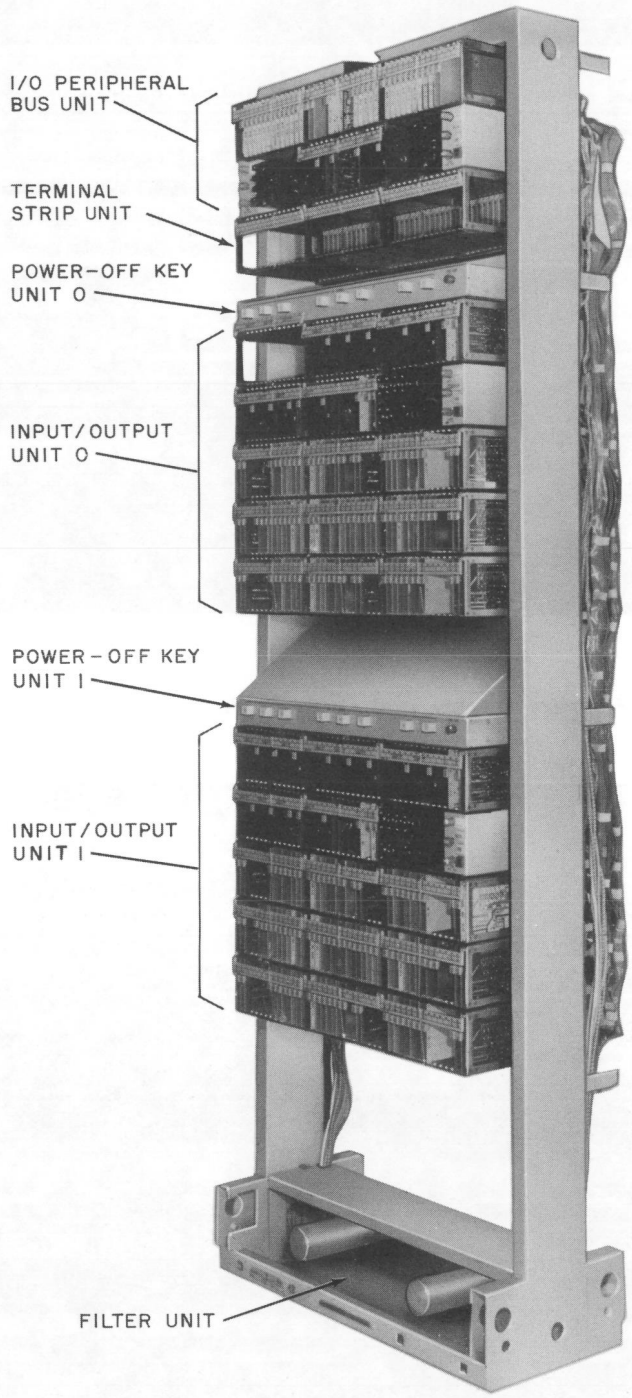
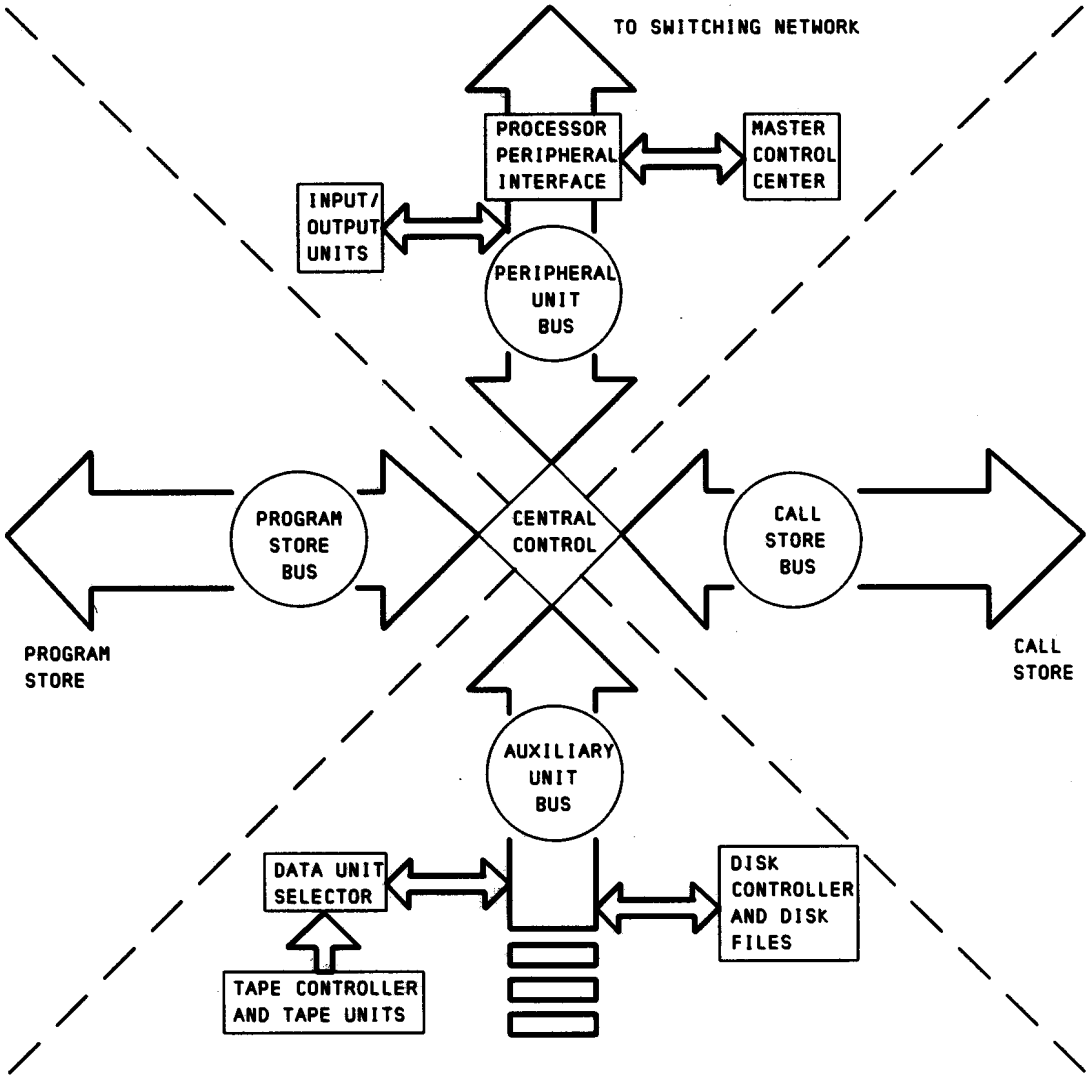


Fig. 10—Input/Output Frame (2.31)



THE MAJOR STRUCTURAL DIFFERENCE BETWEEN THE 1A PROCESSOR AND ITS PREDECESSOR IS AN AUXILIARY UNIT BUS.

Fig. 11—1A Bus System (3.01)