

CONTROL COMPLEX
DESCRIPTION
NO. 3 ELECTRONIC SWITCHING SYSTEM

	PAGE		PAGE
1. GENERAL	2	PROCESSOR FRAME	8
PURPOSE	2	A. 3A Central Control	8
CHARACTERISTICS	2	B. Main Store	9
2. PHYSICAL DESCRIPTION	5	MAINTENANCE FRAME	9
PROCESSOR FRAME	5	A. Tape Data Controller (TDC) Units	9
A. 3A Central Control	5	B. E2A Telemetry Unit	10
B. Main Store Controller and Main Store	5	C. System Status Panel and System Status Panel Controller	11
C. Processor Power Unit	6	D. System Status Panel Relay Unit	11
D. Baffles	6	E. Teletypewriter and Teletypewriter Control Units	11
MAINTENANCE FRAME	6	4. POWER	11
A. E2A Telemetry Unit	7	INTRODUCTION	11
B. Tape Data Controller Units	7	A. Processor Frame Power	12
C. System Status Panel and System Status Panel Controller	7	B. Maintenance Frame Power	13
D. Teletypewriter and Teletypewriter Control Units	7	C. Alarms	14
E. System Status Panel Relay Unit	7	5. MAINTENANCE	14
F. Maintenance Frame Power Unit	7	INTRODUCTION	14
3. FUNCTIONAL DESCRIPTION	8	A. Redundancy	14
INTRODUCTION	8	B. Automatic Fault Detection	14
		C. Automatically Initiated Recovery	15

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

CONTENTS	PAGE
D. Diagnostic Tools	15
MAINTENANCE FACILITIES	15
A. System Status Panel	15
B. E2A Telemetry Unit	16
C. Maintenance and Administrative Teletypewriter	16
6. REFERENCES	16
7. GLOSSARY	16

Figures

1. Control Complex	3
2. Typical No. 3 ESS Equipment Floor Plan	4
3. Functional Relationship of Control Complex to No. 3 ESS Office	8
4. Control Units Block Diagram	9
5. Tape Data Controller Units—Block Diagram	10
6. E2A Telemetry Block Diagram—No. 3 ESS to SCC	12
7. System Status and E2A Telemetry Status Reporting Block Diagram	13
8. Teletypewriter Interface Block Diagram	14
9. Teletypewriter Controller 0 and 1 Logic Block Diagram	15

1. GENERAL

1.01 This section describes, in physical and functional terms, the control complex (Fig. 1) as defined by and applied in a No. 3 Electronic Switching System (ESS) office.

1.02 When this section is reissued, the reasons for reissue will be contained in this paragraph.

1.03 The No. 3 ESS is designed to function in a small office environment requiring up to 4500 lines. The equipment floor plan (Fig. 2) depicts the typical floor plan for the 2100-line office (in solid lines), and shows (with dotted lines) the equipment and floor plan expansion required for a maximum 4500-line office. The control complex is indicated in Fig. 2.

PURPOSE

1.04 The control complex consists of the equipment which directs the operations of a No. 3 ESS. This includes not only the processor and its associated memory but also includes some of the equipment which provides an interface between the TELCO personnel and the machine.

1.05 The control complex operations are directed by the generic program for the office. Under this program control, the control complex inaugurates procedures necessary for call processing and monitors routines to ensure timely and accurate operations. Improper operations are detected via automatic trouble detection routines and the control complex initiates automatic recovery actions as required.

CHARACTERISTICS

1.06 The control complex design is based on the *common control* switching philosophy used in predecessor ESSs. New hardware and software techniques are utilized which result in a highly efficient stored program system. The control complex is characterized by the following design techniques:

- Duplication
- Microprogram control
- Time-shared control
- Combined-store system
- Backup storage facility
- Automatic fault detection
- Asynchronous operation of control units
- Asynchronous and serial communication with periphery

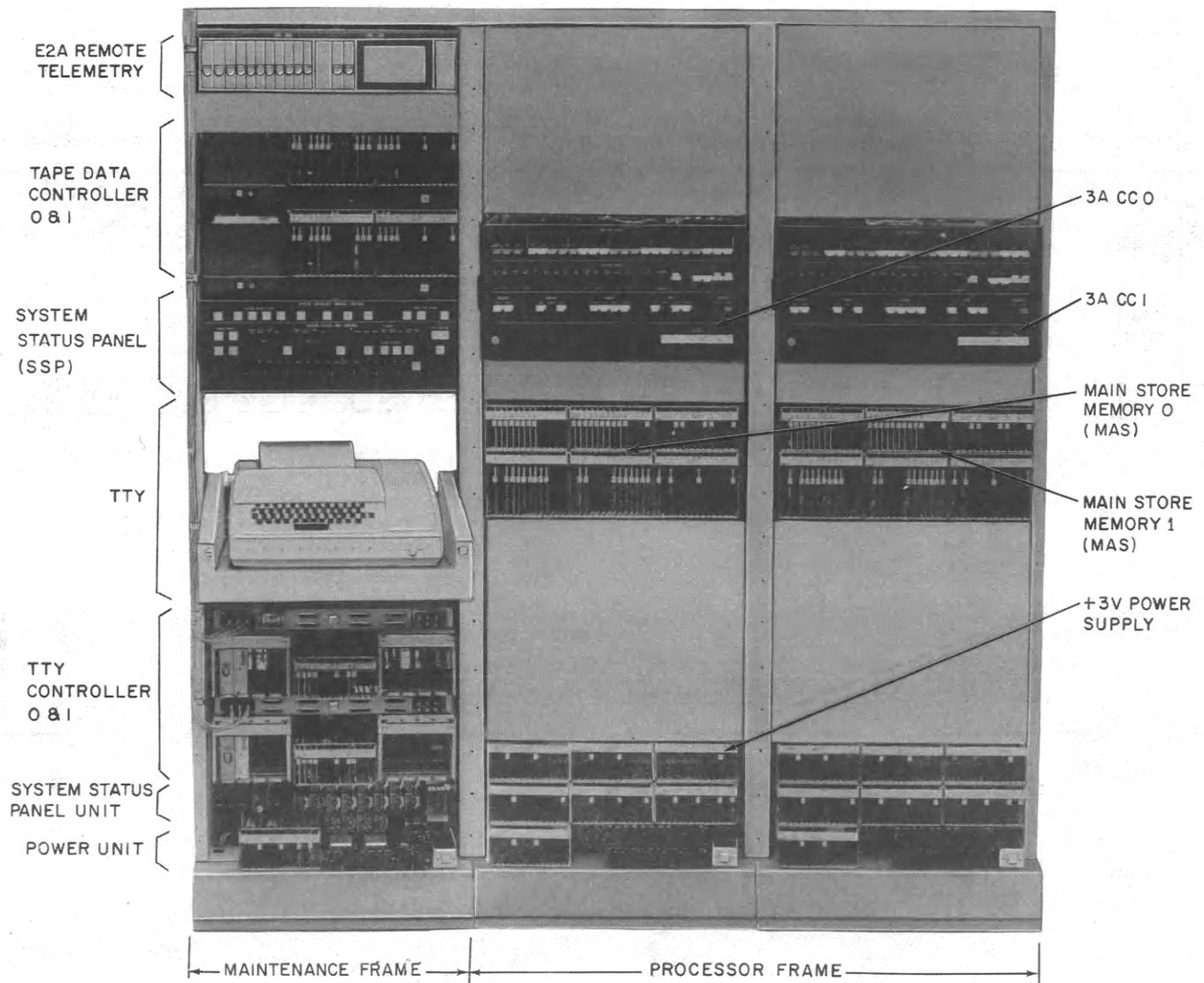


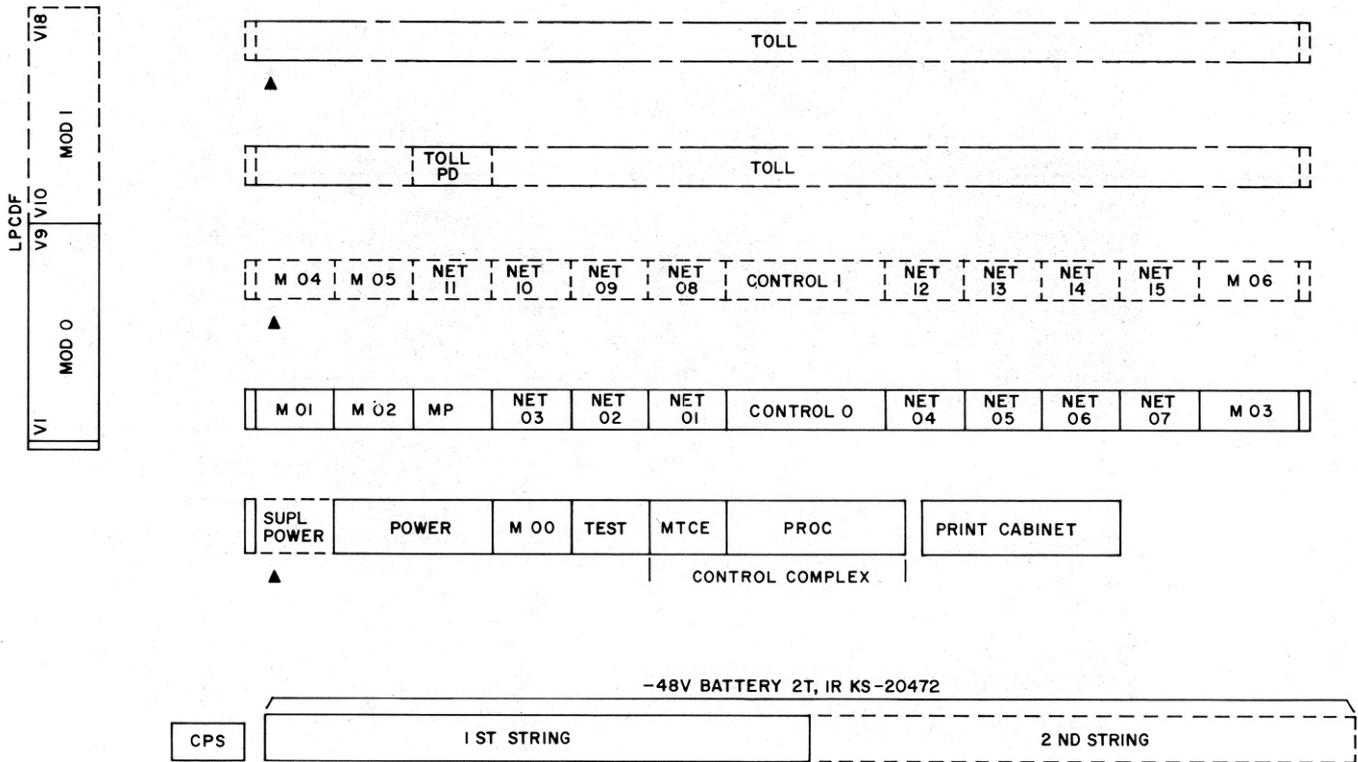
Fig. 1—Control Complex

- Man-machine interface (local and/or remote)
- System status and remote system monitor
- Connectorization.

1.07 Duplication: Continuous operation is assured by providing duplicate units within the control complex which can be switched into operation immediately by the on-line 3A central control (3A CC).

1.08 Microprogram Control: Each 3A CC utilizes a microprogram for control. Microprogram control uses microinstructions which are encoded in the microstore in each 3A CC. The microstore contains sequences of microinstructions to execute each main store instruction.

1.09 Time-Shared Control: Each 3A CC unit, when on-line, executes all program instructions. As a solid state electronic machine, it operates at speeds much faster than the rate at which call processing events require. Consequently, the control equipment is "time-shared" by all of



NOTES:

1. SOLID LINES INDICATE 2100 LINE OFFICE.
2. DASHED LINES INDICATE GROWTH TO A 4500 LINE OFFICE.
3. MINIMUM REQUIRED FLOOR SPACE IS 22 FT. X 41 FT. 8 IN.

LEGEND:

- CPS - CIRCUIT PACK STORAGE FRAME
- LPCDF - LOW PROFILE COMBINED DISTRIBUTING FRAME
- M 00 - 06 MISCELLANEOUS FRAME
- MOD - MODULE
- MP - MISCELLANEOUS POWER FRAME
- MTCE - MAINTENANCE FRAME
- NET (01-15) NETWORK FRAMES
- PD - POWER DISTRIBUTION
- PROC - PROCESSOR FRAME
- SUPL - SUPPLEMENTARY
- V - VERTICAL
- ▲ - DENOTES MAINTENANCE AISLE (FRAME EQUIPMENT FACES THIS AISLE)

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

the calls processed by the system. Call handling is accomplished by subdividing the work required to process a call into small segments interleaved with similar segments of work associated with other calls. Operational steps are, therefore, performed concurrently for a large number of calls.

1.10 Combined-Store System: For each 3A CC unit, the program store, temporary store, and translation store are combined into a single writable storage area called main memory. This

eliminates additional buses, drivers, buffers, and control as used in previous systems to interface the separate program store and call store.

1.11 Backup Storage Facility: A backup of operating and diagnostic program information is maintained on magnetic tape. Therefore, when memory is destroyed, the operating and *bootstrap* programs may be recalled from the tape cartridge associated with the tape data controller (TDC) to restore the memory.

1.12 Automatic Fault Detection: The control complex provides extensive program and hardware facilities to detect system malfunctions. Each unit within the control complex is designed with self-checking circuits which provide immediate detection and location of a fault.

1.13 Asynchronous Operation of Control Units: Asynchronous operation of control units does not require simultaneous operation of units. Under these conditions the 3A CC operates independently of the memory or input/output (I/O) device execution time.

1.14 Asynchronous and Serial Communication With the Periphery: The communications between the control complex and the peripheral controllers are asynchronous in nature; i.e., once the control complex has passed all information to the peripheral controller, it may perform other tasks and later return to the peripheral controllers for their response.

1.15 Man-Machine Interface (Local and/or Remote): The control panel of each 3A CC provides a point of manual control for the control complex. In addition, a maintenance teletypewriter (TTY) channel provides a local and remote communications link between the No. 3 ESS and maintenance personnel. The local and remote TTYs may initiate and receive the same messages from the system. A TTY located in a switching control center (SCC) or technical assistance center (TAC) may monitor, diagnose, and control the system.

1.16 System Status and Remote System Monitor: The E2A status reporting and control telemetry equipment provides a constant flow of information to the SCC which allows it to administer remote operational and maintenance functions for the No. 3 ESS.

1.17 Connectorization: Plug-in circuit packs (based on 1A technology) are used extensively and connect via multipin connectors to wiring and to the multilayer printed wiring boards (MLPWBs). Additionally, the office layout (Fig. 2) facilitates the use of prefabricated, connectorized, interframe cabling. Equipment may be tested as a unit, subsystem, or system at the factory and subsequently installed at the site while the cabling remains intact. Connectorization allows for pretesting of cables

and ease and accuracy of installation of cables at assembly time.

2. PHYSICAL DESCRIPTION

2.01 The physical location of the control complex frames with respect to the rest of the office equipment is shown in Fig. 2. The location of the equipment units which comprise the control complex is shown in Fig. 1. The control complex consists of a double-bay processor frame and a single-bay maintenance frame.

PROCESSOR FRAME

2.02 The processor frame (Fig. 1) is a double-bay frame 7 feet high by 1 foot 6 inches deep. Each bay is a duplication of the other and consists of the following units:

- (a) 3A central control
- (b) Main store controller (MASC) and main store (MAS)
- (c) Processor power unit
- (d) Baffles.

A. 3A Central Control

2.03 Equipment, wiring, and apparatus for one central control is concentrated on one 12-inch mounting plate located on each frame. An MLPWB is attached to the rear of this mounting plate. Eight 80C apparatus mountings are installed on the front of this plate and house the 3A CC plug-in circuit packs. A 12-inch panel hinged to the side bracket of the 3A CC unit provides access to the circuit packs. Mounted on the front of the panel are status indicator lamps and switches, light-emitting diodes (LEDs), register-select and manual function-select switches. Interconnections between the panel and the 3A CC are made with a connectorized flat tape cable assembly.

B. Main Store Controller and Main Store

2.04 Equipment, wiring, and apparatus for a MASC and one main store memory unit (MASM) equipped with two memory modules (0 and 1) of 32K each (K=1024, 18-bit words) are concentrated on a 10-inch mounting plate. For the MASC a 4- by 23-inch MLPWB is attached to

the rear of the mounting plate, and for the MASM a 6- by 23-inch MLPWB is attached. The 947- and 959-type connectors used for the MASC and the MASM are attached to the front of the mounting plate; they extend through and make contact with their respective terminals on the MLPWBs.

2.05 The MASC consists of three 80C and two 82A apparatus mountings which house 16 FA-type circuit packs, one FC-type circuit pack, and four power converters for the MASC. Designation strips (126A) are mounted on the apparatus mountings to identify the circuit pack located in that position. Terminal strips (347A) are mounted on the MLPWB backplane to interface between the 3A CC and the MASM.

2.06 The MASM consists of three 87A apparatus mountings which house 18 memory and two fan-out circuit packs in both modules 0 and 1. The MASM is also equipped with two power converters. The FC21 +3 volt reference and filter circuit accommodates inputs from two power converters and is located in the MASC unit. A power cable equipped with three plugs connects to the rear of the MASM providing power from the fuse panel at the bottom of the processor frame.

2.07 The MAS is growable by modules (groups of ten plug-in circuit packs 6 by 7-3/4 inches), each having a capacity of 32K. A 6-inch mounting plate provides space for two modules. The capacity required is determined by the number of lines served by each office. A memory of 64K is provided for an office having a capacity of up to 1152 terminals (up to 3 network frames). A 96K memory is provided for an office of greater capacity. The additional 32K of memory is added when customer growth requires four or more network frames. This occurs when the office capacity exceeds 1152 lines. This growth requires the addition of one MASM equipped with one 32K module, and utilizes an additional 6 inches of vertical space.

C. Processor Power Unit

2.08 One processor power unit for each 3A CC is located on each bay as shown in Fig. 1.

2.09 This unit is equipped on one 12-inch mounting plate which consists of three levels: 02, 06, and 10. The back of levels 06 and 10 are equipped with MLPWBs and six 347F terminal strips per

level. The back of level 02 is equipped with terminal punchings, alarm and battery bus bars, a strapping board, resistors, capacitors, and a terminal strip.

2.10 The front of levels 06 and 10 are each equipped with nine 83A apparatus mountings. These mountings may house up to nine dc-to-dc converters which plug into the nine 947C (82-pin) backplane connectors. An FC210 circuit pack is located on level 06, position 44. The front of level 02 is equipped with two 83B apparatus mountings which house two dc-to-dc converters. These plug into two 947C (82-pin) backplane connectors. Also, there are four AK-type relays; 1/2, 1-1/3, and 3 amp fuses; and 72A dummy fuses for the spare positions.

2.11 Connectorized cables from the initial power bay and the miscellaneous power bay pass down through the channel of the frame uprights and through the filter unit located in the base of the frames to provide -48 volts and filtered +24 volts to the processor power unit.

D. Baffles

2.12 A 3-inch baffle (heat dissipator) occupies the space of a 4-inch mounting plate and is mounted between the 3A CC and the MASC (Fig. 1).

MAINTENANCE FRAME

2.13 The maintenance frame (Fig. 1) is a 7-foot high, 2-foot 2-inch wide, single-bay frame. It consists of the following units:

- (a) E2A telemetry unit
- (b) Tape data controller units
- (c) System status panel and system status panel controller
- (d) Teletypewriter and teletypewriter control units
- (e) System status panel relay unit
- (f) Maintenance frame power unit.

A. E2A Telemetry Unit

2.14 Assembly, equipment, wiring, and apparatus for one E2A telemetry unit are concentrated on one 8-inch mounting plate. This unit is located on the top of the maintenance frame as shown in Fig. 1. This mounting plate is equipped with circuit packs and a 202T data set mounted in slots provided on the front right side of the mounting plate. The data set is connected to the E2A unit with connectorized cables. The E2A is required with the No. 3 ESS if it is to be connected to the SCC.

B. Tape Data Controller Units

2.15 Assembly, equipment, wiring, and apparatus for one TDC unit is concentrated on one 8-inch mounting plate. This unit is duplicated and the two units are located on the maintenance frame as shown in Fig. 1.

2.16 The 87B apparatus mountings house the JK-type circuit packs, and the 130A designation strips identify each JK-type circuit pack and its position. The two dc-to-dc power converters plug into the two 947C (82-pin) connectors. The TDC POWER switch is located on the right side of the switch bracket assembly.

C. System Status Panel and System Status Panel Controller

2.17 The system status panel (SSP) is 8 by 23 inches and is located on the maintenance frame as shown in Fig. 1. The panel consists of keys, lamps, and LEDs. The SSP is hinged to side brackets on the frame and opens outward to reveal the system status panel controller (SSPC). A magnetic latch on the panel keeps it securely closed when not in use. Interconnections between the SSP and SSPC are made with connectorized flat tape cable, twisted pair cable, and coaxial cable.

2.18 The SSPC is 4 by 23 inches and is mounted to the frame in back of the SSP. The circuit packs plug into the 947A and 947C connectors which connect to the MLPWB. The 347A CTF interconnects with the SSP, SSP relay unit, E2A telemetry unit, and the maintenance frame power fusing and power alarms.

D. Teletypewriter and Teletypewriter Control Units

2.19 The TTY is a 35-type or equivalent keyboard send-receive (KSR) and occupies 16 inches of vertical space on the maintenance frame as shown in Fig. 1.

2.20 Equipment, wiring, and apparatus for one teletypewriter control (TTYC) unit are provided on one 8-inch mounting plate. This unit is duplicated and the two units (0 and 1) are located on the maintenance frame. Each TTYC unit houses two TTYCs (left and right). The right controller of either unit is normally not equipped on No. 3 ESS, but can be ordered as an optional requirement. The TTYC is equipped with a TTYC POWER-ON button, connector ports 0 through 3 for up to four TTYs, and input or output leads on the coaxial connectors to their associated processor (0 and 1). The left 58C apparatus mounting houses up to four port interface circuit packs (which may be AR17s or 108Ds in any combination). The 80C apparatus mounting houses controller logic and power circuit packs.

E. System Status Panel Relay Unit

2.21 Assembly, equipment, wiring, and apparatus for one SSP relay unit are concentrated on one 4-inch mounting plate located on the maintenance frame. The mounting plate consists of fourteen AF10 relays, one AK30 relay, four 278A terminal strips, and one 288M terminal strip.

F. Maintenance Frame Power Unit

2.22 Assembly, equipment, wiring, and apparatus for one maintenance frame power unit are concentrated on one 4-inch mounting plate located on the bottom of the maintenance frame as shown in Fig. 1. Two dc-to-dc converters plug into two 947C (82-pin) connectors equipped with two 83B apparatus mountings. The two FC210 circuit packs and one terminal strip plug into three 947C connectors equipped with three 82B apparatus mountings. Also mounted on the front of the mounting plate are four AK30 relays, two terminal blocks, power and reset switch, A and B bus bars supplying +24 volts and -48 volts to 1/2 and 1-1/3 amp 70-type fuses.

2.23 Connectorized cables from the initial power bay and miscellaneous power bay pass down through the channel of the maintenance frame

upright and through the filter unit located in the base of the frame to supply -48 volts and filtered +24 volts to the maintenance frame power unit.

3. FUNCTIONAL DESCRIPTION

INTRODUCTION

3.01 The basic functional relationship of the control complex subsystem to the other areas of a No. 3 ESS is shown in Fig. 3.

3.02 The control complex is made up of the system status panel, system status panel controller, control units, TTY, TTYCs, tape units, and tape data controllers.

3.03 These units interface with the frame input/output controller, scanner controller, network controller, and peripheral pulse distributor to form system control (SYC).

3.04 All of the above units, with the exception of the system status panel and system status panel controller, are duplicated to form a dual control system (SYC 0 and 1). The system status panel and system status panel controller are shared by SYC 0 and 1.

3.05 Either SYC 0 or SYC 1 can assume active office control. The other operates as standby. The active control unit keeps the standby control unit memory updated (Fig. 4) so that an immediate switch of active/standby roles can be accomplished.

PROCESSOR FRAME

A. 3A Central Control

3.06 The main controlling entity is the 3A CC general purpose unit utilizing 16 data bits and two parity bits. It operates in a duplex mode. One 3A CC always has active control over the system while the other operates in a standby mode. Therefore, each 3A CC is a separate complete unit capable of controlling the periphery and system actions.

3.07 Sequencing actions of the 3A CC are controlled by firmware microprogram. Microprogram control is the heart of the 3A CC operation. The microprogram, a series of microinstructions, is stored in a read-only memory (ROM) which is the microstore. The 3A CC is equipped with the storage capacity for 1536 words of 32 bits each. Microstore has a nonvolatile characteristic which

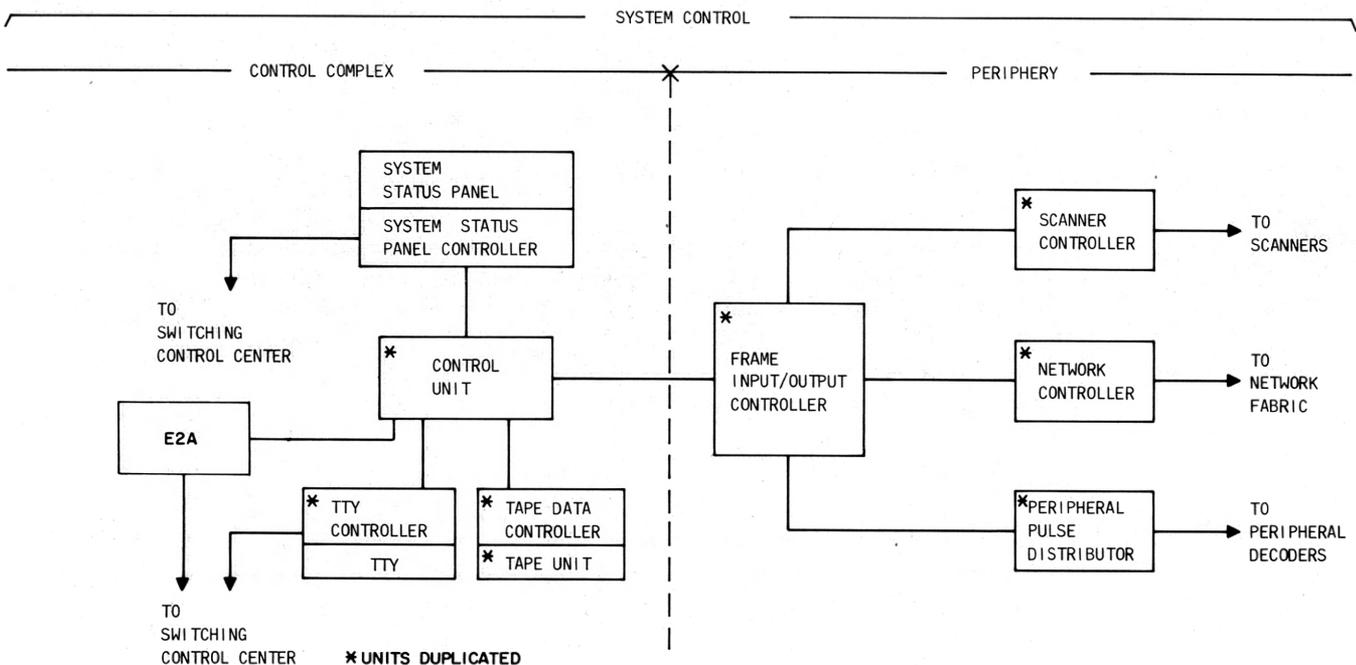


Fig. 3—Functional Relationship of Control Complex to No. 3 ESS Office

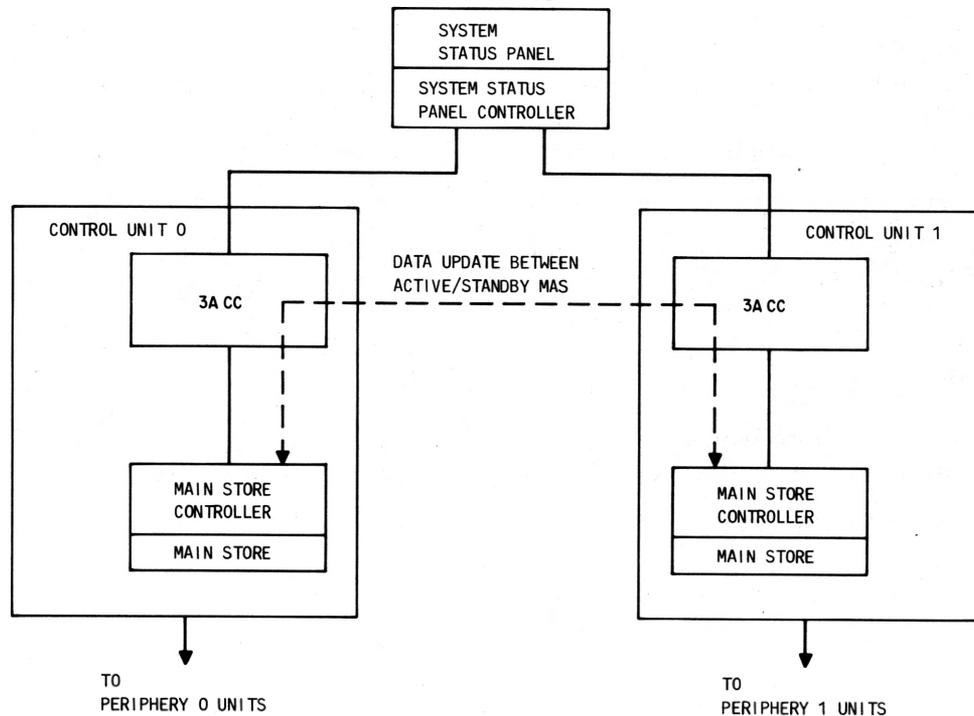


Fig. 4—Control Units Block Diagram

gives the capability of automatic start-up in the event of total power failure.

B. Main Store

3.08 The main store (MAS) provides the means for storing program instructions and data used by the 3A CC to direct and control the system. A main store consists of a main store controller (MASC) and one or more main store memory modules. Each module has a storage capacity of 32,768 18-bit words. The MASC serves as the interface between the 3A CC and the MAS.

3.09 The MAS is divided functionally into temporary store or call store, program store, and translation store. The temporary store is used by the 3A CC to store transitory data; the program store contains the generic program; and the translation store provides access to all line, trunk class, and peripheral equipment information. The MAS is electrically alterable (except blocks that are write-protected) and the contents of the memory can be changed by accessing it with the TTY via the 3A CC.

3.10 The MAS is a dynamic, volatile, semiconductor type of storage. Dynamic means that the memory is not permanent and must be refreshed at defined intervals or else the stored information will be lost. Volatile means that if power is lost the stored information is destroyed. When a total power failure occurs, a *bootstrap* operation is performed which includes the reloading or rewriting of the information into the memory from the backup tape system. Reloading occurs automatically to the point at which translation data is required. This requires manual initiation from either the affected office or the SCC.

MAINTENANCE FRAME

A. Tape Data Controller (TDC) Units

3.11 The TDC unit combines four categories of equipment: TDC circuit, cartridge tape transport, tape cartridge, and power to provide a backup facility for the MAS data. Each 3A CC has its own dedicated tape cartridge system and may also access the other tape cartridge system. Figure 5 is a functional block diagram of the TDC unit. Each tape cartridge contains all the program

and translation data which reside in the MAS. It also contains other programs vital to No. 3 ESS which are only used periodically. These programs are referred to as nonresident (since they are stored external to the MAS) and include system diagnostics, maintenance utilities, and administrative and recent change programs.

3.12 The TDC circuit is the interface between the 3A CC, the cartridge tape transport, and the administrative data link facility.

B. E2A Telemetry Unit

3.13 The E2A is an interface between the No. 3 ESS and the SCC.

3.14 The function of the status reporting and control telemetry equipment (E2A) is to communicate with the SCC. The SCC is a centrally located control center capable of providing administrative, operational, and maintenance functions of up to 16 switching system central offices or small offices.

3.15 The E2A equipment provides a means of transferring control and status information between the SCC and each No. 3 ESS office. (Figure 6 contains a block diagram of each.) The E2A may have up to 96 single-ended scanner inputs and up to 24 control points. Of the 96 scanner inputs, 16 represent the overall condition of the CDO and are known as critical indicators. The

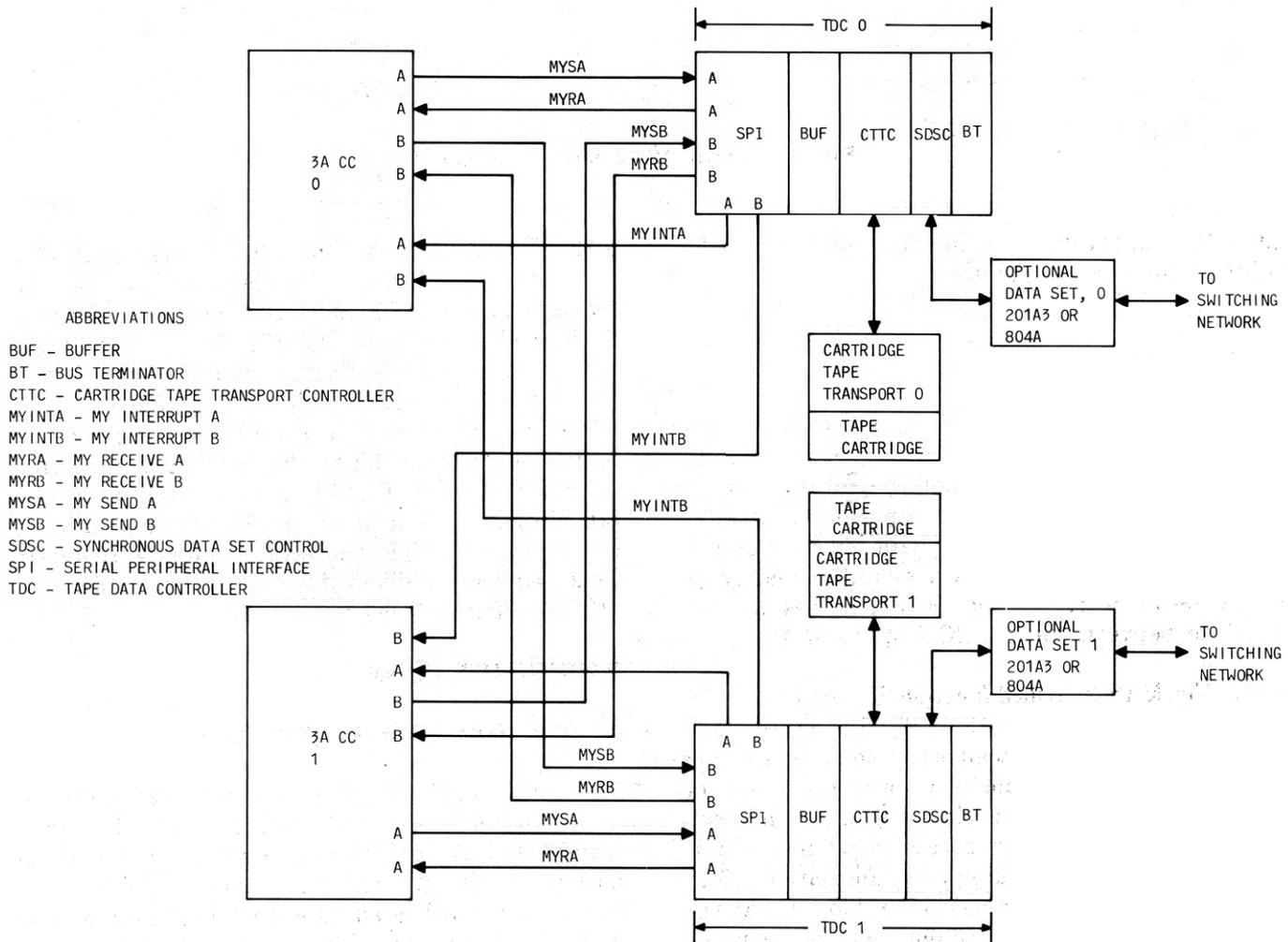


Fig. 5—Tape Data Controller Units—Block Diagram

critical indicators are constantly monitored and the status of each is reported to the SCC via the E2A. When an alarm condition occurs on the critical indicators, the SCC may request that all 96 status points be monitored and all status inputs displayed at the command and display (C&D) console on the display and command keys for analysis by SCC personnel. The C&D console transmits group report commands to the E2A on a continuous basis to update the lamps on the display and command keys. The C&D console has 48 command keys which can order locking and nonlocking relay contact operation at the CDO E2A telemetry unit. Figure 7 is a functional block diagram of how the E2A telemetry unit interfaces with the system status panel controller to provide the SCC with control of the No. 3 ESS.

C. System Status Panel and System Status Panel Controller

3.16 The SSP and SSPC are part of the Control Unit (CU) and provide visual indications of normal and/or emergency conditions and control of central office alarm circuit interface relays. The SSP provides designated keys which permit operating personnel control of the No. 3 ESS. The SSPC provides the required circuitry to interface the SSP to the 3A CC (Fig. 7).

D. System Status Panel Relay Unit

3.17 The system status panel relay (SSPR) unit provides a relay interface between the SSPC, office alarm circuits, and system peripheral frames. These relays are provided with plastic windows through which their operation or release may be verified.

E. Teletypewriter and Teletypewriter Control Units

3.18 The KSR TTY is a bidirectional means of communication between operating personnel and the 3A CC. (Figure 8 is a functional block diagram of the TTY interface.) Operating personnel, via TTY input messages, request that specific actions be performed by the system. Operating system software or call processing software initiates the required actions and provides the data in response to these messages. Status information on related internal conditions and actions completed is provided

in typewritten (hand copy) reports from the TTY. The TTY also provides periodic printouts of system status. When trouble occurs, it prints out the results of manually initiated programmed diagnostic tests. By using the trouble locating manual (TLM), the printout can be translated into a probable circuit failure and its physical location. In addition to trouble locating, administrative changes can be made on translation data via the TTY.

3.19 The TTYC (Fig. 9) serves as a transmit/receive buffer between the TTY and the 3A CC. There are two TTYC units, 0 and 1. Each TTYC unit contains space to equip two independent TTYCs. Each controller provides four ports. The No. 3 ESS normally utilizes one teletypewriter controller in each TTYC unit. TTYC 0 serves as the maintenance channel, and under emergency conditions, TTYC 1 provides a backup to the maintenance channel. Normally, TTYC 1 (called miscellaneous channel) provides the administrative TTY channel on an autoconnect (dial-up) basis from a remote location (SCC) if required (Fig. 8). The maintenance channel (TTYC 0) may serve a local or remote TTY or both (each receives the same message) as shown in Fig. 8. Teletypewriter information can be distributed to each port independently or to any combination of ports, including all four in parallel. For example, an incoming message to the 3A CC from any port of a TTYC is also repeated on all other active TTY ports of that TTYC.

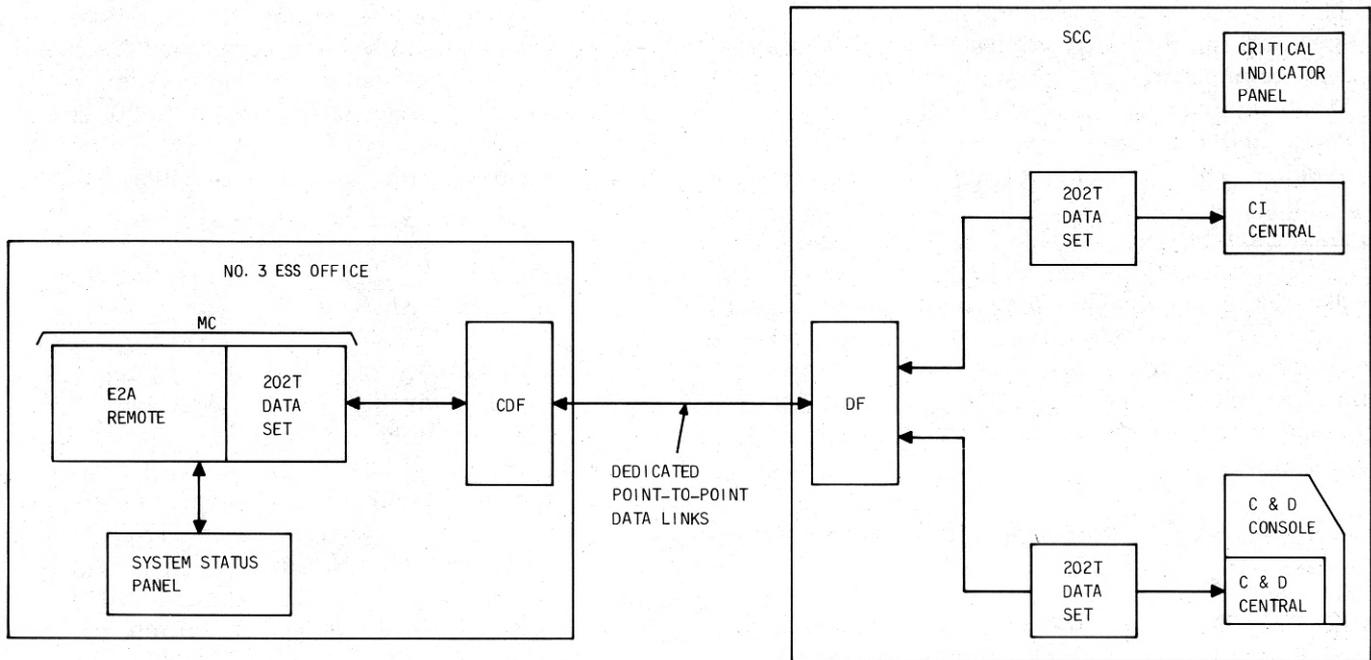
4. POWER

INTRODUCTION

4.01 Power is supplied to the control complex via -48 volt buses and +24 volt converters. The -48 volt source is located in the power frame and the +24 volt converters are located in the miscellaneous power frame.

4.02 Two -48 volt buses (A and B) provide power to the control complex. Bus A is associated with SYC 0 and Bus B is associated with SYC 1.

4.03 The two +24 volt converters, located in the miscellaneous power frame, supply power to the processor frame and the maintenance



ABBREVIATIONS
 CDF - COMBINATION DISTRIBUTING FRAME
 CI - CRITICAL INDICATOR
 C & D - COMMAND AND DISPLAY
 DF - DISTRIBUTION FRAME
 MC - MAINTENANCE FRAME
 SCC - SWITCHING CONTROL CENTER

Fig. 6—E2A Telemetry Block Diagram—No. 3 ESS to SCC

frame. The +24 volt converter 0 supplies SYC 0 and the +24 volt converter 1 supplies SYC 1.

4.04 A description of power, as it pertains to each individual unit of the control complex, is given in 2.08 through 2.11.

4.05 The functional description of power and alarms is as follows:

- (a) Processor frame power
- (b) Maintenance frame power
- (c) Alarms.

A. Processor Frame Power

Note: The following functional description applies to each bay of the processor.

4.06 The +24 volts, filtered at the base of the frame and -48 volts are distributed to the power converters in the MASC, the MASM, and the processor power unit.

4.07 The MASC power converters convert -48 volts to +3 volts which is distributed over the MLPWB to power the individual circuit packs in the MASC.

4.08 The MASM derives its power from dc-to-dc converters which convert -48 volts to +3 volts, +5 volts, +12 volts, and -5 volts.

4.09 The processor power unit consists of power converters which convert -48 volts to +3 volts. The +3 volts is used by the individual circuit packs of the 3A CC units. The clock, microstore, and 3A CC panel LEDs require +5 volts; the panel lamps require +24 volts. The

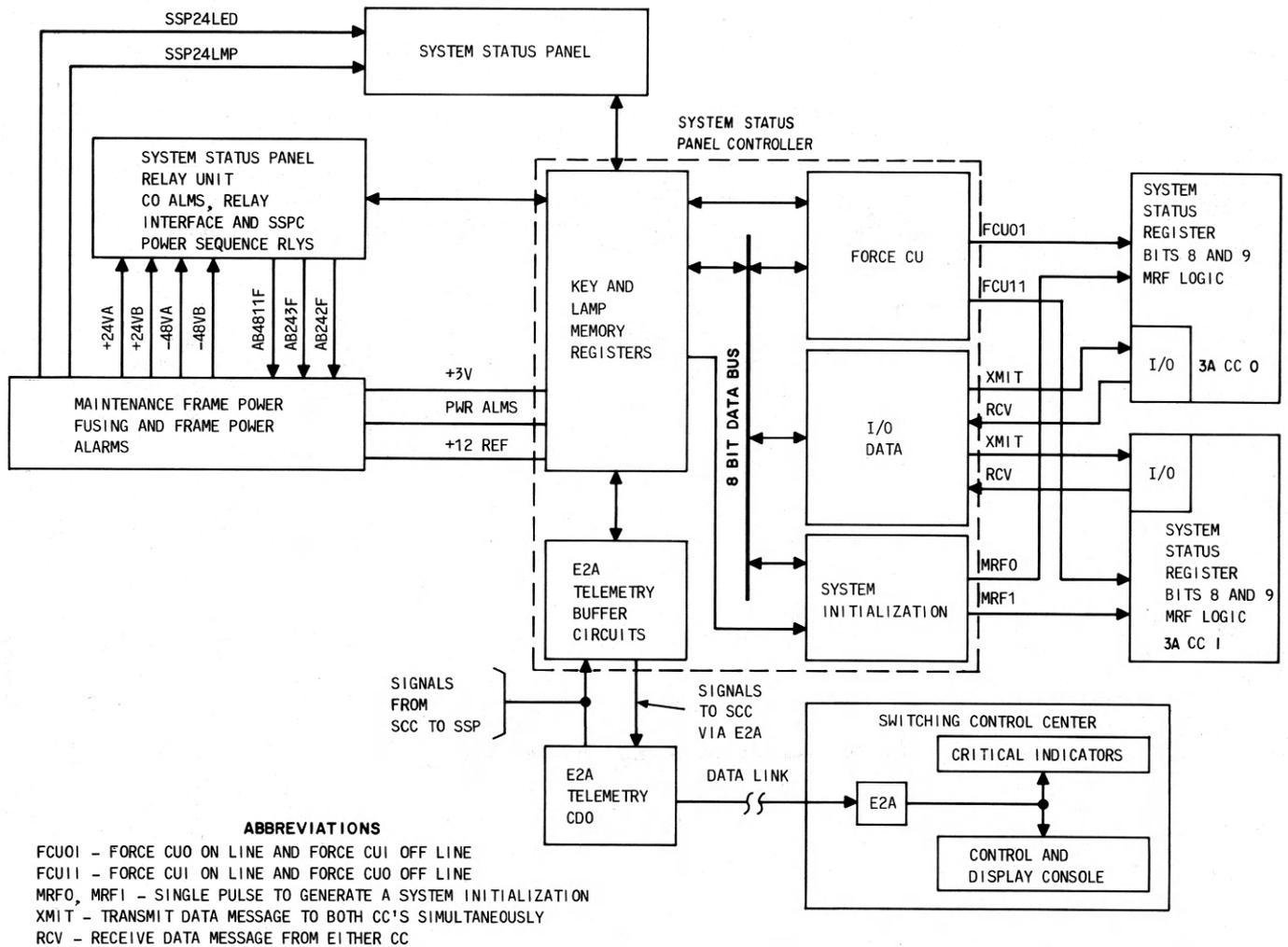


Fig. 7—System Status and E2A Telemetry Status Reporting Block Diagram

unit is equipped with AK-type relays, some of which function to initiate major or minor power related alarms. Others function to start the power converters in the proper sequence.

B. Maintenance Frame Power

4.10 The +24 volts, filtered at the base of the frame, and -48 volts are distributed to power converters located in the E2A telemetry unit, TDCs 0 and 1, TTYCs 0 and 1, and the maintenance frame power unit.

4.11 E2A power converters supply required voltages to the 202T data set and individual circuit packs.

4.12 TDC 0 and 1 converters convert -48 volts to +5 volts to supply the individual JK-type circuit packs.

4.13 Each TTYC 0 and 1 is equipped with one converter which converts -48 volts to +5 volts for the logic circuit packs. The +24 volt regulator supplies voltage to the 108D data sets and AR17 circuit packs.

4.14 The maintenance frame power unit is equipped with two converters which supply +3 volts and +12 volts to the circuit packs mounted on the SSPC. This unit also supplies +24 volts to the SSP for lamps and LEDs. The unit monitors its own voltage and current and that of the power

NO. 3 ESS STANDARD TTY ARRANGEMENT

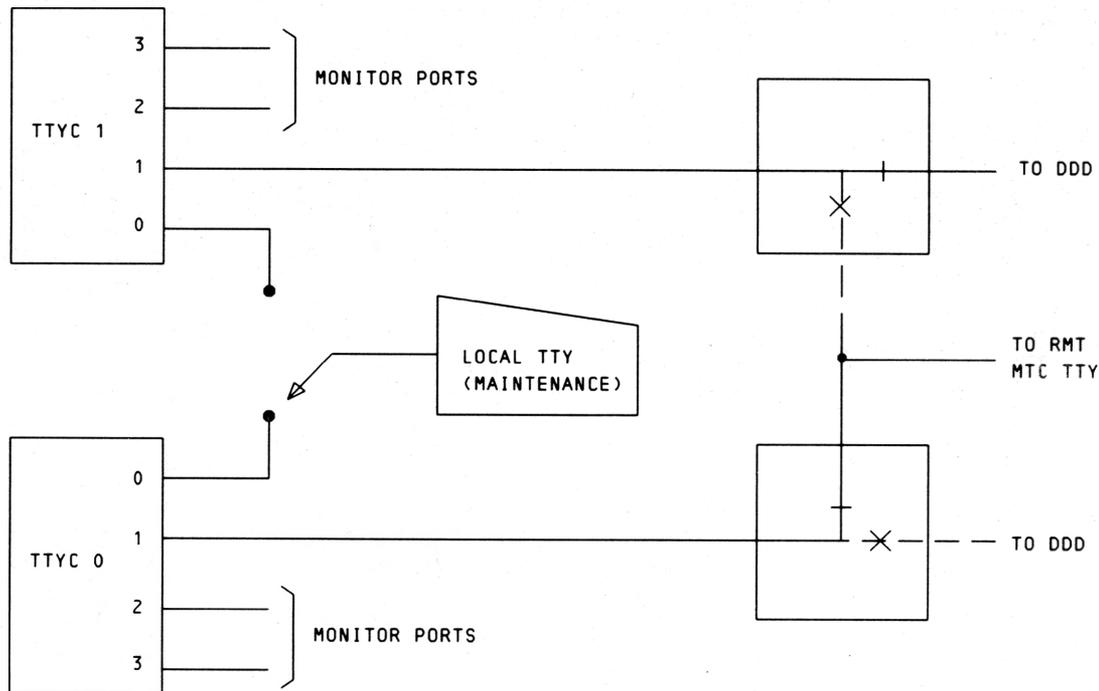


Fig. 8—Teletypewriter Interface Block Diagram

converters for the TDCs and TTYCs, thus providing the facility for visual and audible indications under normal or fault conditions.

C. Alarms

4.15 In the normal operating condition (no fault) the audible alarm is off and alarm indications on the SSP are extinguished. In the event of a power source or circuit path failure, the following occurs:

- The corresponding indicator lights on the SSP
- An alarm sounds to indicate the severity of the fault
- A message giving definition of the fault is printed on the maintenance TTY.

5. MAINTENANCE

INTRODUCTION

5.01 The objective of the maintenance system is to provide continuous service. The primary functions of the maintenance design to meet this objective are automatic fault detection, automatically initiated recovery, and effective diagnostic capability.

A. Redundancy

5.02 Duplication of equipment in the control complex provides two sets of equipment, either of which is capable of controlling the office. The active 3A CC keeps the standby memory up-to-date and prepared for a rapid switch. Units duplicated are 3A CC, MAS, TDC, and TTYC.

B. Automatic Fault Detection

5.03 Continuously operating self-checking circuits within the 3A CC and the MASC provide immediate automatic detection of faults. This eliminates the need for operating match comparisons

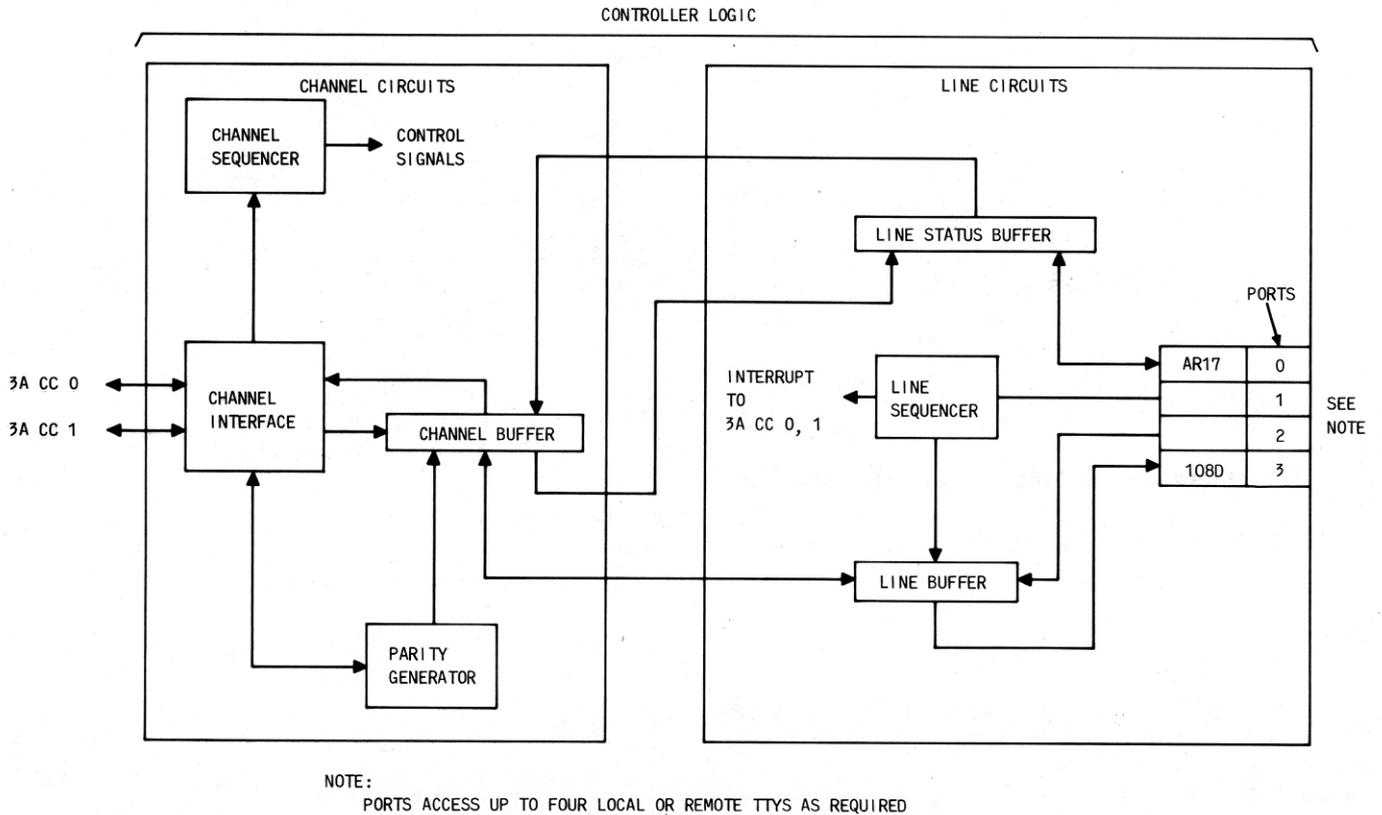


Fig. 9—Teletypewriter Controller 0 and 1 Logic Block Diagram

between the active and standby equipment. Programmed diagnostics are also available and used for detection of faults.

C. Automatically Initiated Recovery

5.04 For duplicated units, the system will retry, if possible, the activity which failed first. If still unsuccessful, it will switch to the redundant standby unit to continue service.

5.05 Unduplicated units are subject to programmed error analysis and/or quick checks, to verify their condition prior to removal from service.

D. Diagnostic Tools

5.06 Nonresident diagnostics can be initiated manually via the maintenance TTY. Isolating the fault to a specific item of hardware is accomplished by correlating the TTY printout with the TLM.

MAINTENANCE FACILITIES

5.07 The maintenance facilities which pertain to the control complex are the SSP, E2A telemetry unit, and the maintenance and administrative TTY.

A. System Status Panel

5.08 The SSP provides the following features:

- System initialization
- Force and lock
- Alarms (visual)
- Alarm control
- System status
- Critical indicators to SCC

SECTION 233-110-000

- Test control (step and repeat functions)
- Display buffer.

B. E2A Telemetry Unit

5.09 The E2A telemetry unit provides the following features:

- Critical indicators to SCC
- System scan points to SCC
- Control points to SCC.

C. Maintenance and Administrative Teletypewriter

5.10 TTYC 0 provides the maintenance channel for local or remote TTYs.

5.11 Under normal conditions TTYC 1 miscellaneous channel provides the administrative channel on an autoconnect (dial-up) basis for the SCC or the TAC. If the maintenance channel fails, the miscellaneous channel takes over the maintenance channel functions on a priority basis.

6. REFERENCES

6.01 Reference documents pertinent to this section are listed below.

SECTION	TITLE
233-000-000	No. 3 ESS Documentation Index
966-210-100	General Description No. 3 ESS
233-110-200	Control Complex Theory
233-110-100	3A Central Control Description
233-110-201	3A Central Control Theory
233-110-105	Main Store Description
233-110-205	Main Store Theory
233-110-120	System Status Panel and Controller
233-110-115	Teletypewriter and Teletypewriter Controller
233-110-110	Tape Data Controller

SECTION	TITLE
233-130-100	Power Equipment Description
233-140-100	Office Maintenance Description
233-141-100	Centralized Office Maintenance
233-142-100	Task Oriented Procedures

7. GLOSSARY

7.01 A glossary of terms is provided to aid in understanding this section.

Bootstrap—A program in microstore which, in the event of main store memory loss, calls up the initialization program from tape

Data Link—A frequency-signaling path for transmitting and receiving data messages

Diagnostic—A program to generate test data to isolate a fault within the unit being diagnosed to a small number of circuit packs

Fault—The failure of an electronic circuit to perform a function for which it was designed and can be reproduced by the system

Frame input/output controller (FIOC)—An interface between the 3A CC and the peripheral controllers. It converts the information between serial and parallel forms (depending upon the direction of flow) and gates the data to and from the peripheral controllers

Initialization (also referred to as maintenance reset function [MRF])—Restart of the 3A CC at a known location and condition. The two basic types are system generated and manually generated

Light emitting diodes—LEDs convert direct current into a visible light output without benefit of energy-consuming filaments

Line—Anything that connects to a network terminal which is not classified as a trunk or service circuit. Usually a pair of wires which serves to connect a customer telephone to a terminal on the network

Network controller (NWC)—That part of a system control which receives orders from the CU (via

the FIOC) and establishes paths in the network. A system control may contain two network controllers

Peripheral pulse distributor (PPD)—That part of a system control which receives orders from the control unit (via the FIOC) and sends bipolar pulses to peripheral decoders. A system control may contain two PPDs

Scanner controller (SC)—That part of a system control which receives orders from the CU (via the FIOC) and replies with the scan results of a row of 16 scan points. A system control may contain two scanner controllers

Scan point—A location at which a ferrod is connected in order to determine the status of a customer line, trunk, or test point.