MAINTENANCE FRAME
DESCRIPTION AND THEORY OF OPERATION
COMMON SYSTEMS 3A PROCESSOR

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1. GENERAL

INTRODUCTION

1.01 This section describes in physical and functional terms the interfaces and theory of operation of the maintenance frame used in conjunction with the common systems 3A Processor.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

PURPOSE

1.03 The common systems maintenance frame comprises a single bay of equipment which is a part of the common systems 3A Processor. Equipment within this frame provides a man-machine interface as a means of maintaining surveillance and control over the system and displaying general system health.

2. PHYSICAL DESCRIPTION

2.01 The maintenance frame (Fig. 1) is a 7-foot high, 2-foot 2-inch wide, single bay frame. Units mounted in this frame, from top to bottom, are as follows:

- E2A telemetry unit (optional)
- Tape data controller (TDC) 0
- Tape data controller 1
- System status panel/system status panel controller (SSP/SSPC)
- Teletypewriter (TTY)
- Teletypewriter controller (TTYC) unit 0
- Teletypewriter controller unit 1
- System status panel relay (SSPR) unit
- Maintenance frame power unit.

E2A TELEMETRY UNIT

2.02 One E2A telemetry unit is supplied as an option with the common systems maintenance frame, and provides a means for surveillance and control of equipment at remote locations from a switching control center (SCC). Equipment, wiring, and apparatus for the E2A telemetry unit are concentrated on one 8-inch mounting plate located at the top of the maintenance frame. The unit is sectionalized into four modules designated as follows:

- Basic remote module (BRM)
- Expander module 3
- Expander module 4

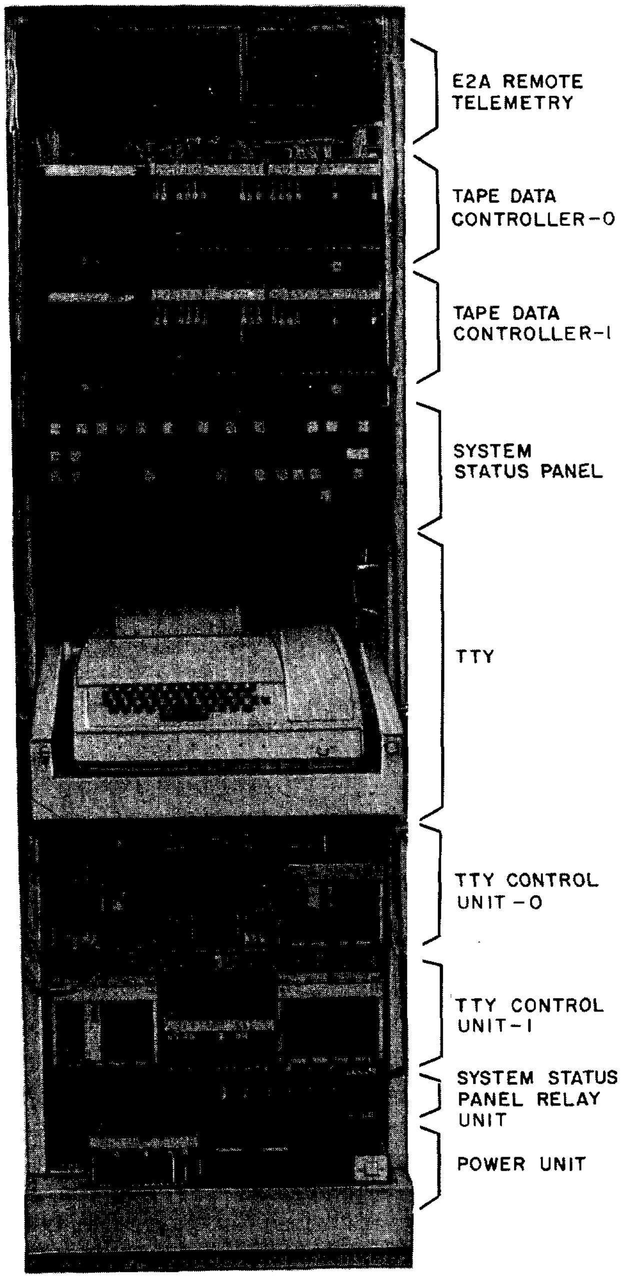

Fig. 1—Common Systems Maintenance Frame

- 202T data set

The BRM and expander modules are equipped with various combinations of plug-in circuit packs, depending on the SCC application.

2.03 For SCC applications, the E2A remote (to the SCC) will always have a BRM and an expander module 3. Each BRM may be equipped with up to 11 circuit packs for various applications. Expander module 3 may be equipped with up to three circuit packs and expander module 4 with up to nine circuit packs. Connectors at the rear of the unit include two No. 600A-10 terminal blocks for power and ground connections and one No. 600A-4 terminal block for office alarm connections. Six type KS-21133 connectors provide signal path connections. The cable interconnecting the E2A unit to the 202T data set terminates in a standard 25-pin connector, type KS-19088, equipped with a KS-19196 hood. The data set is connected to the telephone line via a KS-19087 connector equipped with a KS-19196 hood.

TAPE DATA CONTROLLERS

2.04 Each TDC unit (Fig. 2, Fig. 3) consists of equipment, wiring, and apparatus contained on a single 8-inch mounting plate. TDC 0 and TDC 1 are duplicates, and are located in the common systems maintenance frame as shown in Fig. 1. Each TDC consists of JK-type circuit packs, a KS-21447 cartridge tape transport equipped with a KS-21439 tape cartridge and two J87421A dc-to-dc power converters. Two 87B apparatus mountings house the JK-type circuit packs, which insert into 947A type connectors, and the two power converters, which insert into 947C type connectors. Type 130A designation strips identify each plug-in circuit pack and its location. Circuit packs JK15 and JK14, mounted in positions 24 and 25, respectively, of the TDC (Fig. 2) are optional equipment. These circuit packs are provided only when interfacing to a local synchronous data set (SDS) is required. The local SDS is user supplied and must be connected manually to the TDC unit. The cable stub between the two shall not exceed 50 feet.

See caution, paragraph 3.10.

2.05 A TDC POWER switch is located on the right-hand side of the switch bracket assembly. Two switches, REW and UNLD, appear at the bottom of the tape transport panel on the left-hand side of the unit.

2.06 Two multilayer printed wiring boards at the rear of the TDC connect +5V and ground pins of the 947A connectors and the 347A ground pins of the coaxial terminal field. Backplane cable is connectorized and interconnects the multilayer

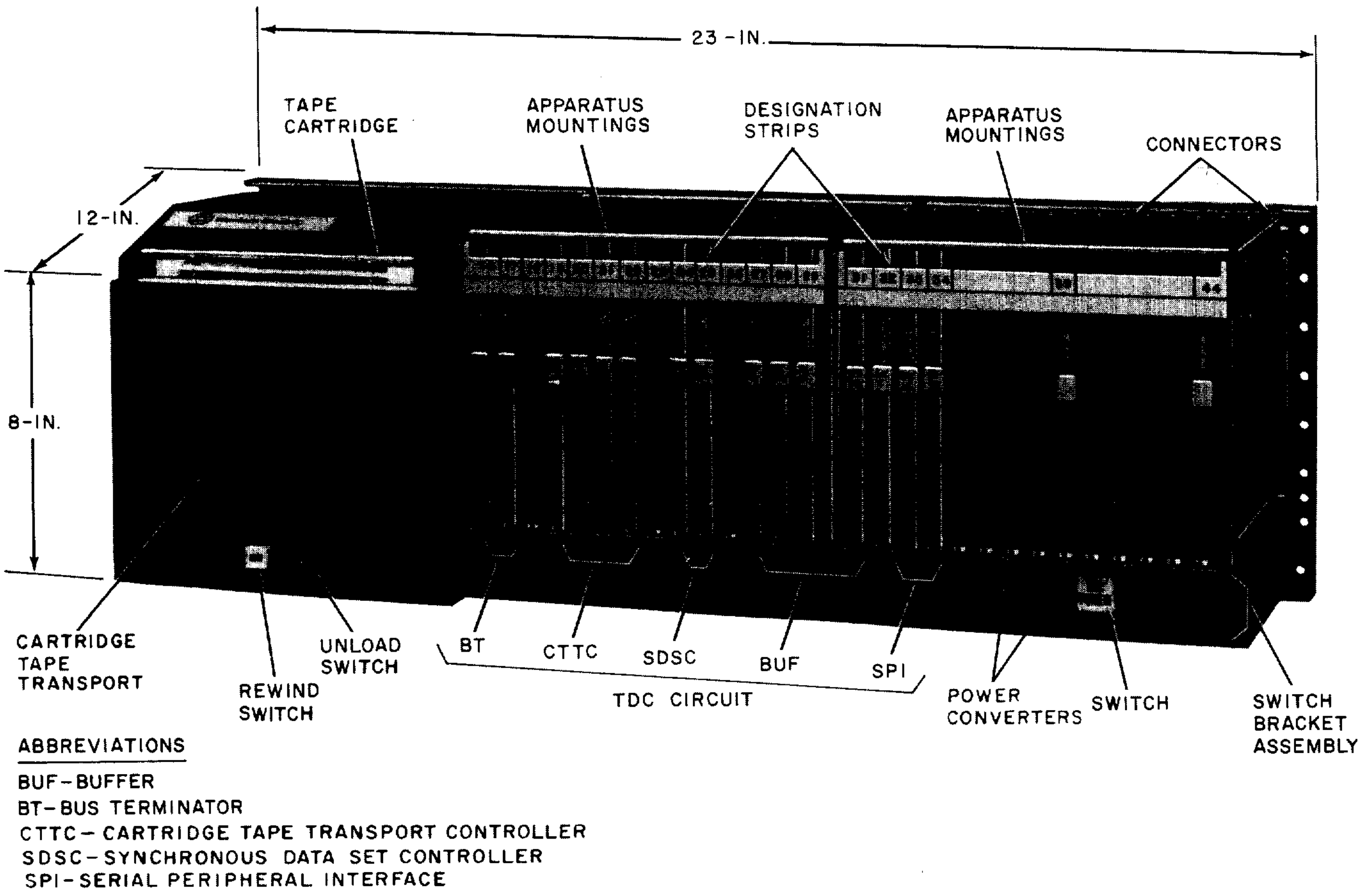

Fig. 2—Tape Data Controller Unit 0 or 1—J1C053A (Front View)

printed wiring board, terminal blocks, and the cartridge tape transport unit.

SYSTEM STATUS PANEL AND SYSTEM STATUS PANEL CONTROLLER

2.07 The SSP is an 8-inch panel (Fig. 4) located in the maintenance frame as shown in Fig. 1. The panel consists of a face plate and a printed wiring board mounted to an aluminum frame, and contains keys, lamps, and light emitting diodes (LEDs). The SSPC is mounted behind the SSP, and the SSP is hinged to the side bracket of the SSPC to provide easy access to the circuit packs of the SSPC. A magnetic latch in the SSP keeps it securely closed.

2.08 The SSPC contains two type 80C apparatus housings, equipped with type FA, FB, and FC circuit packs. The circuit packs plug into 947A and 947C connectors which connect to a multilayer printed wiring board. Type 130A designation strips identify each plug-in circuit pack and its location. Interconnections between the SSP and the SSPC are made with connectorized flat tape cable, twisted pair cable, and coaxial cable.

TELETYPEWRITER AND TELETYPEWRITER CONTROLLERS

2.09 The TTY is a 33- or 35-type (or equivalent) keyboard send-receive, and occupies 16 inches of panel space in the maintenance frame as shown in Fig. 1.

2.10 Equipment, wiring, and apparatus for one teletypewriter control unit are provided on one 8-inch mounting plate (Fig. 5). This unit is duplicated, and two TTY control units (0 and 1) are mounted in the maintenance frame as shown in Fig. 1. Each TTY control unit provides space

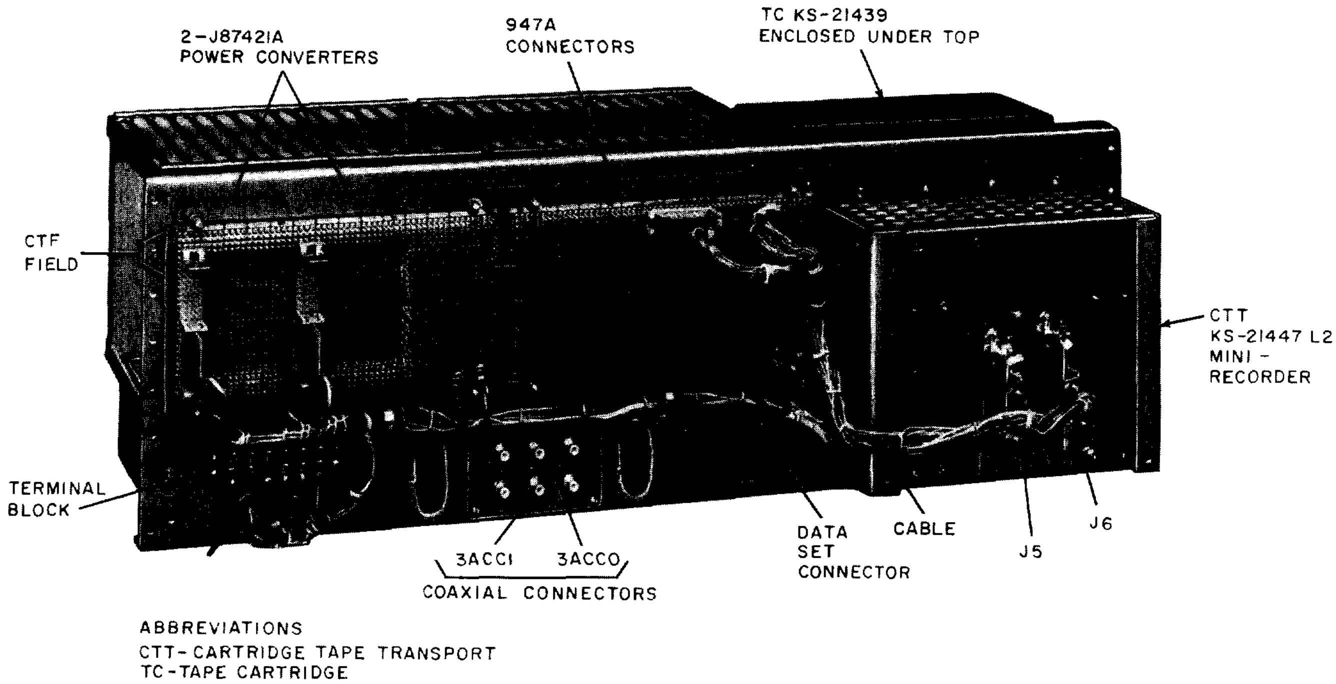

Fig. 3—Tape Data Controller Unit 0 or 1—J1C053A (Rear View)

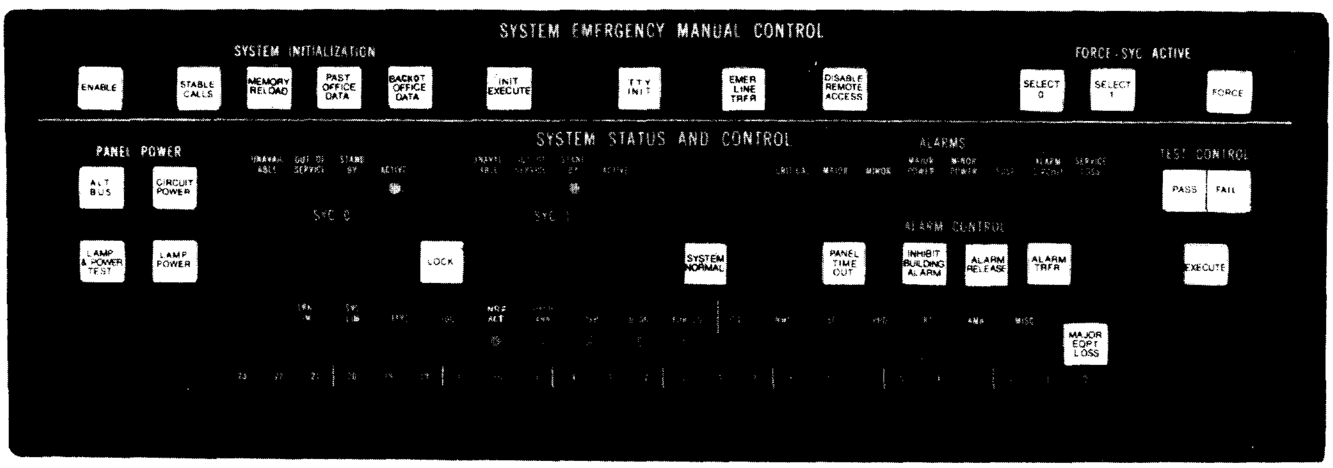

Fig. 4—System Status Panel (Panel for No. 3 ESS Application Shown)

to equip two TTYCs, each having four ports. A 58C apparatus mounting equipped with four 927D connectors is installed at each end of the mounting plate. Each 58C mounting houses up to four 108D data sets, or four AR17 port interface circuit packs, or any combination of the two. An 80C apparatus mounting, located between the two 58C mountings, houses the controller logic, power converter, converter and power alarm, and power reference and filter circuit packs for the two TTYCs. The 80C mounting is equipped with six 947A-, one 947B-, and three 947C-type connectors. A connector plate assembly directly above the apparatus mountings contains eight KS-19038 port connectors, a TTYC POWER switch, and two coaxial terminal fields of six connectors each.

SYSTEM STATUS PANEL RELAY UNIT

2.11 Equipment, wiring, and apparatus for one SSPR unit (Fig. 6) are contained on a 4-inch mounting plate located in the maintenace frame as shown in Fig. 1. This unit consists of two AK30 relays, fourteen AF10 relays, two 278A terminal strips, one 288M terminal strip, and miscellaneous components.

MAINTENANCE FRAME POWER UNIT

2.12 Equipment, wiring, and apparatus for one maintenance frame power unit (Fig. 7) are contained on a 4-inch mounting plate located near the bottom of the maintenance frame. A type 80C apparatus mounting houses two J87389F-2 +3 volt dc-to-dc converters, two FC210 circuit packs and one terminal strip. The FC210 circuit packs and terminal strip insert into 947C connectors equipped with type 82E apparatus mountings. The two converters insert into 947C connectors equipped with type 83B apparatus mountings. A type 130A designation strip identifies each plug-in circuit pack and its location. Also appearing on the mounting plate are four type AK30 relays, two terminal blocks, a power and reset switch, A and B bus bars supplying +24 volts and -48 volts, and four fuse blocks.

3. FUNCTIONAL DESCRIPTION

3.01 The common systems maintenance frame circuit provides the interframe and intraframe connections for all units appearing in the maintenance frame and listed in paragraph 2.01. Operational

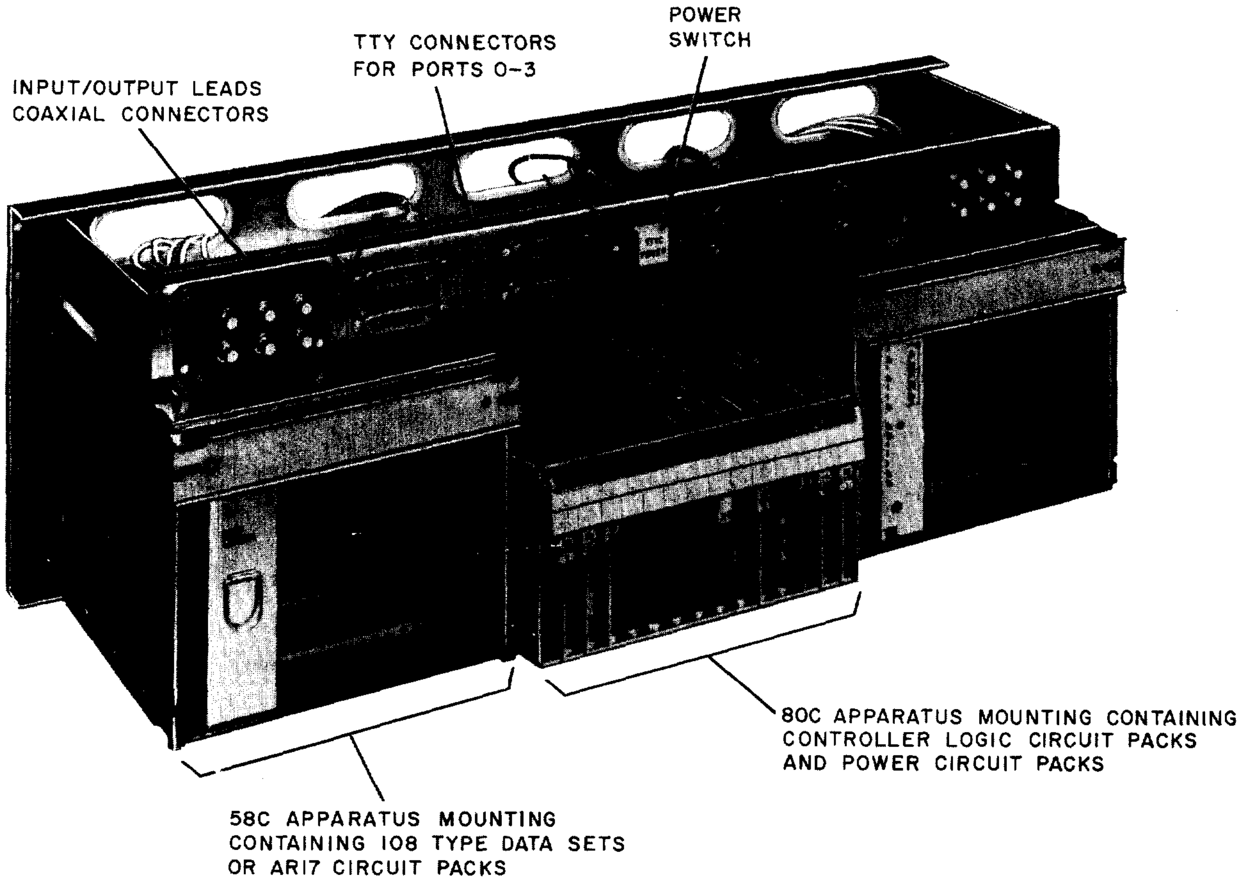

Fig. 5—Teletypewriter Control Unit

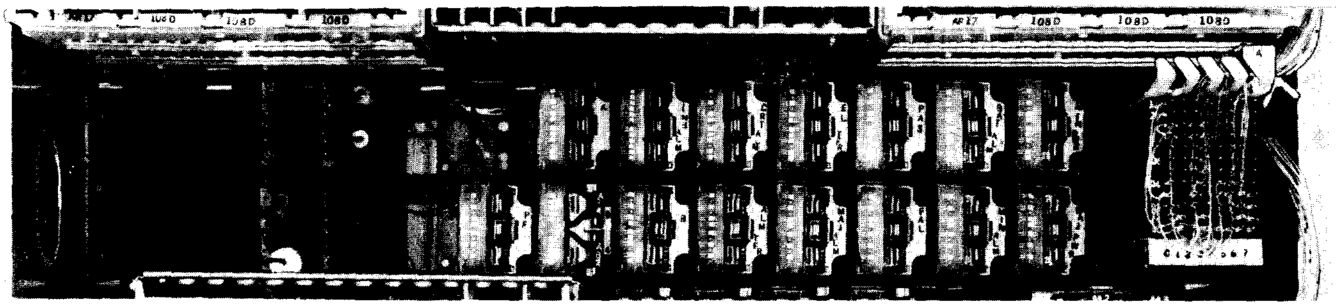

Fig. 6—System Status Panel Relay Unit

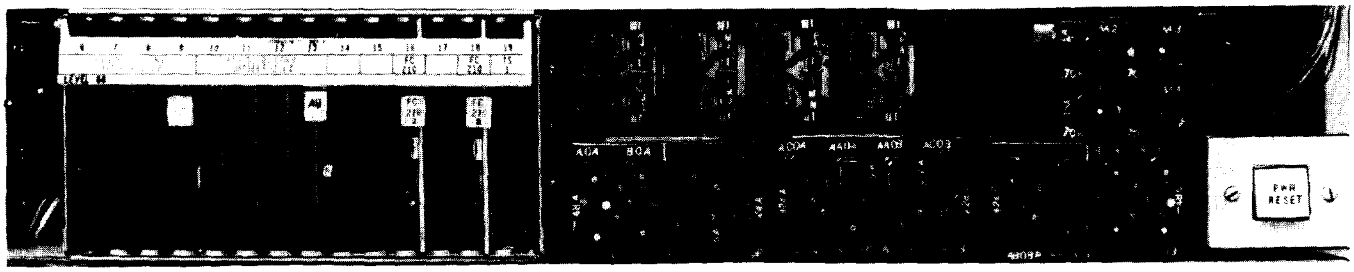

Fig. 7—Maintenance Frame Power Unit

interaction between these units is described in the functional description of the individual units.

E2A TELEMETRY UNIT

3.02 The E2A telemetry provides a communications link between the SSPC and a SCC. It receives command information from, and transmits responses to, the SCC via a private line data facility or the direct distance dialing (DDD) network. The SCC is thus able to monitor system status and execute certain emergency control operations for a specific system. The E2A parallel scans the SSPC on a per-function basis. It also shares control of selected SSPC functions with the SSP switch related to the function on an ORed basis. Control signals from the E2A to the SSPC are transmitted via coaxial cable, and scanned SSPC functions are transmitted to the E2A via twisted pair leads.

TAPE DATA CONTROLLER

3.03 The TDC provides a magnetic tape memory system for the 3A Central Control (3A CC). In various applications, it provides a magnetic tape copy of programs and data files required as backup for the volatile main store memories (resident programs) and various nonresident (paged) routines and diagnostics. It may also be utilized as a semipermanent storage medium onto which miscellaneous office study data may be written for later analysis.

3.04 In addition to two -48 volt to +5 volt dc-to-dc power converters and a power control switch, the TDC circuit contains the following functional units:

- Cartridge tape transport (CTT)
- Serial peripheral interface (SPI)
- Bus terminator (BT)
- Buffer (BUF)
- Cartridge tape transport controller (CTTC)
- Synchronous data set controller (SDSC) (optional).

A. Cartridge Tape Transport

3.05 The CTT is a KS-21447L2 minirecorder used to record and reproduce digital data in a

1600 bit-per-inch phase-encoded format on a 1/4-inch magnetic tape.

B. Serial Peripheral Interface

3.06 Communication between the TDC and the 3A CC is accomplished via a standard 3A CC serial input/output (I/O) channel. The SPI provides serial-to-parallel and parallel-to-serial conversion for all communication between the TDC and 3A CC.

C. Bus Terminator

3.07 The bus terminator performs the following three functions for the TDC:

(1) It provides a proper far end electrical termination for the parallel bus extending from the SPI.

(2) It generates parity on status replies sent to the 3A CC at the request of the selected TDC device.

(3) It provides a 16-bit register into which data can be loaded from the parallel bus and from which the data may subsequently be dumped back to the bus for return to the 3A CC. (This function is provided only for maintenance purposes).

D. Buffer

3.08 The buffer unit is a temporary serial memory device for buffering data transfers between the 3A CC and serial devices on the TDC common parallel bus. It reduces the real time demand on the 3A CC during TDC data transfer. The BUF contains two 1024-bit shift registers (and associated circuitry) which are maintained in opposite but switchable on-line/off-line states and are alternately available to either the 3A CC (via the SPI) or the CTTC or SDSC.

E. Cartridge Tape Transport Controller

3.09 The CTTC accepts commands from the 3A CC via the SPI and parallel bus, decodes the commands, and performs the proper sequencing of control and data lines to the CTT and BUF. It also provides automatic generation of preamble and postamble characters during a write operation and performs a read-after-write check of data written on the magnetic tape.

F. Synchronous Data Set Controller (Optional)

3.10 The SDSC and local SDS are optional equipment to be supplied when system requirements are such that main store (MAS) data may be updated from or transferred to a regional data center. The SDSC circuitry is comprised of two optional circuit packs, types JK15 and JK14, mounted in positions 24 and 25 of the TDC, respectively. Hardware design will permit data set connections to either TDC 0, TDC 1, or to both, when properly equipped. These configurations apply only when required by the using system, and require system software coordination.

Caution: In no case should spare circuit packs be stored in TDC 1 when TDC 0 only is equipped and intended for SDSC operation.

SYSTEM STATUS PANEL AND SYSTEM STATUS PANEL CONTROLLER

3.11 The SSP operates in conjunction with the SSPC and SSPR, and provides a visual display of general system health. It provides local manual switching capability and also forms an integral part of the interface circuitry to the E2A telemetry for SCC applications. The SSP thus provides for the following local and remote maintenance functions:

(a) Remote (SCC) monitoring of SSP.

(b) Emergency manual control by allowing entry of a manual request for a system initialization simultaneously to both 3A CCs.

(c) A means of forcing a 3A CC on-line or off-line.

(d) Local control of other switching functions through switches that are interrogated via program initiated I/O messages to the SSPC.

3.12 The SSPC contains the interlock and control logic and display buffers required for operation of the SSP. It provides the I/O circuitry for communication between a 3A CC and the SSP, pulse driver circuits for the system initialization function, and timing functions. The SSPC also contains buffering circuitry required for communication between the SSP and the E2A telemetry unit.

TELETYPEWRITER AND TELETYPEWRITER CONTROLLERS

3.13 The TTY facilities (TTYs plus TTY control units) provide the primary means of communication between operating personnel and the system. Operating personnel may request, via TTY input messages, specific actions to be performed by the system. The TTY output messages provide system response to such requests, as well as periodic printouts of system status and error conditions.

3.14 Each TTY control unit (0 and 1, Fig. 1) in the maintenance frame provides mounting facilities and power conversion for two TTYC circuits. Each circuit has four ports, with each port capable of controlling one TTY. The TTYC circuits (Fig. 8) are numbered 0 through 3, with even-numbered circuits (0 and 2) appearing in TTY control unit 0 and odd-numbered circuits (1 and 3) appearing in TTY control unit 1. The TTYCs are also called ***left*** and ***right,*** as viewed from the rear of the TTY control unit (Fig. 8).

3.15 Each TTYC provides the interface between the 3A CC and up to four TTY ports. The four TTY ports associated with each TTYC comprise a hub arrangement, whereby signals from any one are seen by the others. Ports 0 through 3 are associated with TTYC circuits 0 and 1 (***right***) and ports 4 through 7 are associated with TTYC circuits 2 and 3 (***left***). The local maintenance TTY (contained in the maintenance frame) is usually assigned to port 0 of TTYC 0. The remote maintenance channel and other port assignments may vary with equipment usage. Appropriate system application documentation should be consulted for TTY port assignments.

SYSTEM STATUS PANEL RELAY UNIT

3.16 The SSPR unit provides a relay interface between the SSPC and office alarms or various system peripheral frames as required. The circuit also contains power sequencing relay logic and alternate bus switching relays pertaining to the SSPC and SSP power supply.

MAINTENANCE FRAME POWER UNIT

3.17 The maintenance frame power unit provides the power fusing and distribution for all units appearing in the maintenance frame. It includes circuits that detect fuse failures and other power problems within the maintenance frame. On-unit visual indications and relay interfacing to off-unit office alarm circuits for these failures are provided. Also included is a power alarm test feature for testing portions of the minor alarm circuit of all dc-to-dc converters within the frame.

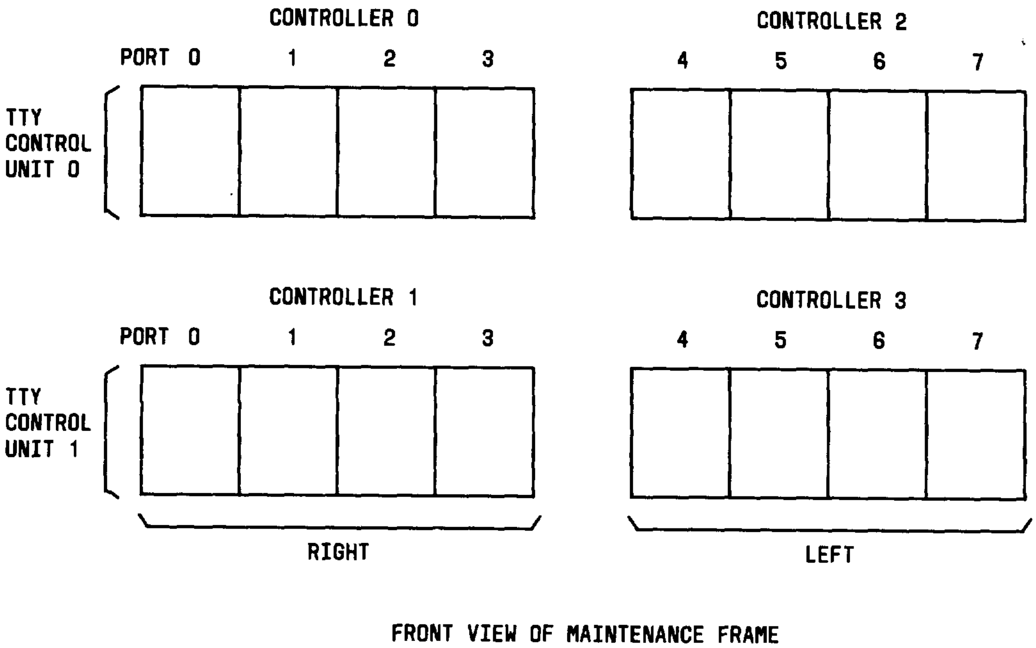

Fig. 8—TTY Controller Configuration

4. THEORY OF OPERATION

INTRODUCTION

4.01 Units within the maintenance frame combine functions and interact, either directly or indirectly, to provide the man-machine interface as a means of surveillance and control over the system. Maintenance of the system relies on a communication link between operating personnel and the processor hardware/software. As such, the maintenance frame provides:

(a) Local and remote visual display and manual (switching) intervention capability

(b) Local and remote communication with the system via teletypewriter

(c) A magnetic tape storage system for the 3A CC as backup for the volatile MAS (resident programs) and various nonresident (paged) routines and diagnostics

(d) Power alarms and power alarm test facilities.

LOCAL DISPLAY AND MANUAL SWITCHING

4.02 The SSP, SSPC, and SSPR combine functions to form a visual reporting system to display system status via the SSP, a control and interface unit, and a relay power sequencing and buffer unit.

4.03 Lamp and LED indicators on the SSP are activated by I/O messages from the 3A CC via the SSPC to indicate various system status functions. Lamp drivers on the SSP contain a transistor switch which turns the lamp on or off. The lamp drivers and LED indicators are controlled via flip-flop memory elements in the SSPC.

4.04 Manual inputs to the system are made through mechanical switches on the SSP, and are transmitted to the 3A CC via the SSPC. Software control of the system may be overridden to provide emergency manual control. Manual requests for force active and lock functions and the 3A CC initialization signal are entered into the system from SSP switches via pulse driver circuits in the SSPC. Other manual switching functions are controlled via key memory elements (flip-flops) in the SSPC. These flip-flops reflect the state of the SSP switches and are interrogated by the 3A CC via program initiated I/O messages to the SSPC.

4.05 The SSPC is accessed via a serial 21-bit data message from the 3A CC which is transmitted in bipolar form (Fig. 9). Each bipolar pulse is decoded into a data one or zero. The total bipolar pulse period is used to form a shift pulse for moving the data stream into a shift register. Figure 10 shows the I/O message format. Detection by the SSPC of bad parity or an illegal start code (other than binary 011) in the I/O message results in the transmission of a maintenance start code (binary 101) with all-zero data bits back to the 3A CC. A 2-bit code specifies a write-read operation (01) or a read only operation (other than 01). A 3-out-of-6 address code determines the key memory data group that is selected. A 3-out-of-6 code is defined as a group of six bits containing three, and only three, ones.

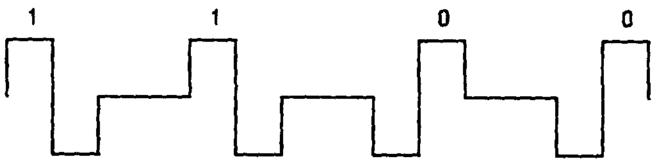

Fig. 9—Bipolar Pulse Pattern

REMOTE DISPLAY AND MANUAL SWITCHING

4.06 The system may be unattended in some applications. The SSP functions must therefore be available to maintenance personnel at a remote location (SCC). Remote maintenance capability is provided via the E2A telemetry unit. The E2A interface within the SSPC provides buffering between the panel interface and the E2A telemetry unit. Both the E2A telemetry unit and interface circuits are optional.

4.07 Three circuit packs make up the maintenance interface that is used to buffer the E2A telemetry inputs from the SSPC flip-flop outputs. Inputs from the E2A telemetry are zero-active to the SSPC, and the SSPC provides one-active signals to the E2A telemetry.

4.08 The E2A provides for status reporting and relay outputting upon command from the SCC. Status reporting involves the scanning of a

PH	DATA BITS								PL	3/6 ADDRESS CODE						OP CODE		START CODE		
20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Fig. 10—I/O Message Format

group of input signals. The scanning function is initiated by a group report command from the SCC that specifies which of four groups should be scanned. Upon completion of the status report, the E2A will return to its quiescent state. A maximum of 1024 inputs can be scanned by the E2A.

4.09 The relay output function is initiated by a relay output command from the SCC that specifies the relay which is to be operated or released. Upon completion of the command, the E2A will reply with a verification transmission to the SCC.

4.10 The BRM provides a maximum capability of 64 status inputs and 32 relay outputs. It includes the common control and up to four combined I/O circuit packs. Each combined I/O circuit pack provides for 16 nonisolated status inputs and eight relay contact outputs. For applications which require isolated status inputs, or which require more than 64 nonisolated status inputs or more than 32 relay outputs, one or more expander modules are required. Use of an expander module requires an additional circuit pack in the BRM to provide expander common control.

TELETYPEWRITER FACILITIES

4.11 Interfacing between the 3A CC and the system TTYs is provided by the TTYCs. A TTYC connects the 3A CC with up to four TTY ports. Communication between the 3A CC and the TTYC is over a 6.67 megabit serial I/O channel. A connection to the 3A CC interrupt bus is also provided so that the TTYs can be serviced on a demand, rather than a scheduled, basis.

4.12 The character exchange between the TTYC and the TTY is based on the American Standard Code for Information Interchange (ASCII) approved by the American Standards Association. The exchange is made in an asynchronous, 100 word-per-minute (110 baud) serial format. This exchange rate may also be optionally specified at 150, 300, 600, or 1200 baud. Each port can accommodate, in any combination, a local Electronic Industries Association (EIA) compatible TTY, a 20-mA current loop TTY, or a remote TTY via a 108-type data set private line arrangement.

4.13 Each TTYC has a ***receive, send,*** and ***interrupt*** connector assigned to each of two 3A CCs. The receive and send connectors are connected to a 3A CC serial I/O channel via coaxial cables. The coaxial cable shields are grounded at the 3A CC and floating at the TTYC to achieve dc isolation. The interrupt signal is a 1-microsecond pulse sent by the TTYC when a TTY character becomes available to the 3A CC. It connects to the 3A CC interrupt circuits when the TTY is serviced in a demand mode.

4.14 The serial data exchange between the TTYC and the 3A CC is a 21-bit format (Fig. 11) transmitted in bipolar pulse form. Data messages from the 3A CC to the TTYC are either character messages or control messages. A character message contains an ASCII encoded character to be printed on the TTY. A control message contains information which is used to enable or disable the TTYC ports or to perform a port alarm test. A message transmission from the 3A CC is followed by an all-zero bit stream until the TTYC responds with a return message or until a timeout occurs. The continuing bit stream is used by the TTYC to generate bipolar data for the return message. Thus, data is sent from the TTYC to the 3A CC when, and only when, the 3A CC sends to the TTYC. The 3A CC can communicate with the TTYC either on a scheduled basis or when an interrupt signal is received from the TTYC.

4.15 Data messages from the TTYC to the 3A CC are either character messages or status messages. A character message contains an ASCII encoded character being entered from the TTY. A status message contains the present status of each port.

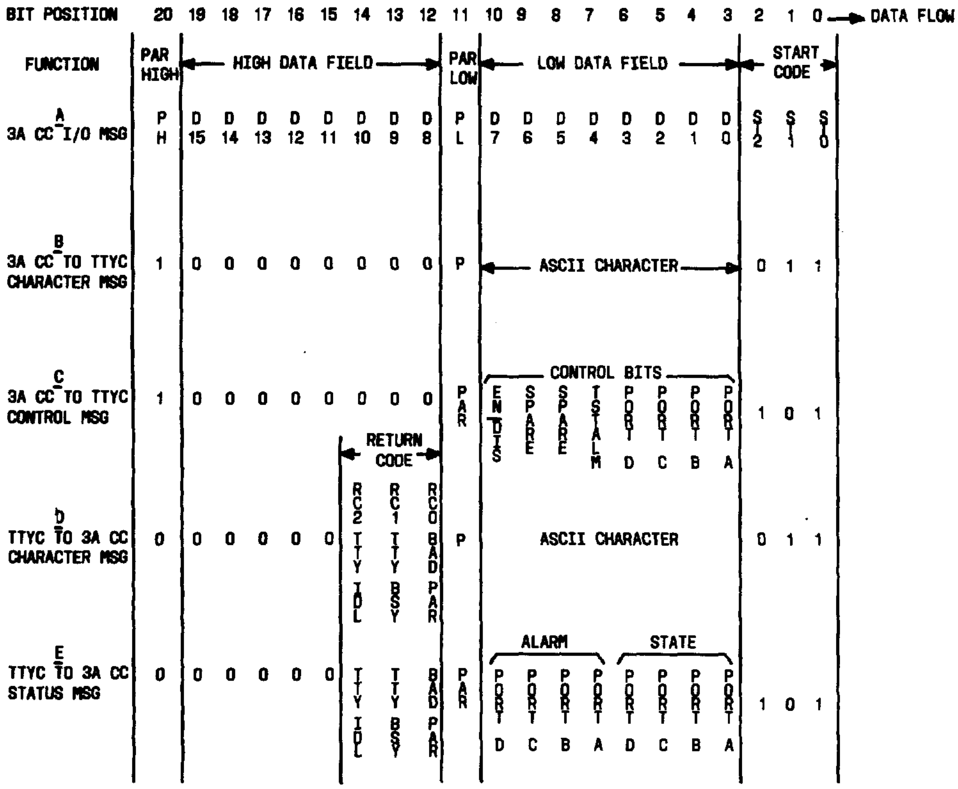

Fig. 11—TTYC Message Format

MAGNETIC TAPE STORAGE SYSTEM

4.16 The 3A CC communicates with the TDC via a serial I/O channel. The SPI functional unit performs serial-to-parallel and parallel-to-serial conversion for all communications between the 3A CC and the TDC. A serial input port to the SPI is provided from both 3A CCs, and a serial output port from the SPI is provided to both 3A CCs. Serial messages from the 3A CC are 21 bits in length and are encoded to contain both data and a clock component.

4.17 The two inputs from the 3A CCs are logically ORed together and connected to a single data and clock recovery circuit. The clock component shifts the data into a 21-bit register. A parallel bus interfaces the SPI to other logical devices of the TDC.

4.18 The parallel bus contains 16 information plus 2 associated parity leads, 6 control leads, a clock lead, and 4 device response leads. All command messages to the TDC contain a device address code on the six low-order bus information leads. Only the device with a matching address code will accept the command message. A reply message from the selected unit is then gated back onto the parallel bus and to the SPI to be shifted serially over the output port to the 3A CC.

4.19 The SPI also checks each incoming 3A CC message for serial parity errors. Detection of a parity error will prevent the message from being gated onto the parallel bus, and will cause a special serial parity error reply to be returned to the originating 3A CC.

4.20 A buffer unit provides a temporary serial store for data moving to or from the tape or synchronous data set. The two 1024-bit shift registers and associated circuitry are alternately available to, and under the control of, the 3A CC (off-line) and the CTTC or SDSC (on-line). The dual buffer structure allows the 3A CC to service the off-line buffer at its convenience while a serial data exchange between the on-line buffer progresses at the CTTC or SDSC data rate. The on-line/off-line status of the buffer memories switches at the completion of each 1024-bit data transfer on the serial bus. When the switch occurs, a status bit is set to inform the 3A CC that the off-line buffer memory requires servicing. Optionally this buffer ready state can be used to generate an interrupt to the 3A CC via the interrupt coax.

4.21 The CTTC receives and decodes commands from the 3A CC via the SPI and parallel bus. It performs proper sequencing of control and data lines to the CTT and BUF for data transfers. All data transfers to and from the magnetic tape involve the BUF circuit. The data transfer rate during read and write operations is 48,000 bits per second.

4.22 Information is stored serially on the magnetic tape using a phase encoded format at a data density of 1600 bits per inch on four independent data tracks. The four tracks are identified by number. Track number one is unique in that it is write protected by the CTTC to prevent overwriting or inadvertent mutilation of program data. Information is grouped on each track in blocks. Adjacent blocks are separated by interblock gaps, nominally 1.55 inches in length. Each information block contains a 16-bit data preamble, a string of 16-bit data words, a 16-bit cyclic redundancy check character, and a 16-bit data postamble. The CTTC automatically adds the preamble and postamble to the data blocks during write operations and strips them from the data blocks during read operations.

4.23 The optional SDSC, when used, provides interfacing between the TDC circuit and the SDS at EIA RS-232C standard signal levels. It decodes commands from the 3A CC and initiates proper sequencing of control leads to the SDS and BUF to effect a proper data transfer between the regional data center and the processor main store.

5. THEORY OF OPERATION—POWER AND ALARM CIRCUITS

POWER DISTRIBUTION

5.01 The -48 volt dc power and +24 volt dc power from central office power distribution circuits are supplied to the maintenance frame via four ED-5A079-10 connectors (Fig. 12). These connectors provide both A bus (-48BA, +24AA) and B bus (-48BB, +24AB) power connections. Resistance-capacitance (RC) filtering is provided for the +24 volt power circuits. The -48 volt dc power and +24 volt dc power are then distributed to appropriate fuse blocks for further distribution via the maintenance frame power unit.

5.02 Fuses in the maintenance frame power unit are generally Western Electric 70-type fuses. In some instances, however, a Bussman type GBB fast-blowing fuse is used. The Bussman fuses are used where a 70-type fuse, rated at 2 amperes or higher, cannot be guaranteed to blow more quickly than the main supply fuse used in some applications. Since the Bussman fuses have no alarm arrangement compatible with the fuse blocks provided, each is paralleled by a low-amperage 70-type fuse to provide a fuse alarm source.

POWER AND ALARM CONTROL

5.03 The power and alarm control circuits for units appearing in the maintenance frame are located in the maintenance frame power unit. Alarm control flip-flops, located on two FC210 circuit packs in this unit, are buffered from system monitors and central office alarm circuits by five alarm relays. These alarm relays are designated MN, MJ0, MJ1, MJ2, and MJ3, and are normally operated. When an alarm condition occurs, the associated alarm control flip-flop is set, thereby releasing the relay to indicate the alarmed condition. After the trouble has been corrected, the alarm control flip-flops may be reset by momentarily depressing the PWR RESET switch located on the maintenance frame power unit.

5.04 The MN relay flip-flop monitors a power alarm (PA) lead that is connected to every dc-to-dc converter appearing in the maintenance frame. The PA lead is activated when the output voltage of a converter drifts out of tolerance, thereby causing the MN relay to release. Release of the MN relay results in a minor alarm to the 3A CC.

5.05 The MJ0 relay monitors the fuse alarm (FA) lead associated with the SSPC, and the MJ1 relay monitors all fuses associated with the SSP related circuits. An alarm condition in either of the two dc-to-dc converters that supply +3 volts dc to the SSPC activates the FA lead, thus causing MJ0 relay to release. Release of the MJ0 relay removes the +24 volt dc start voltage from both converters, thereby removing the +3 volts dc

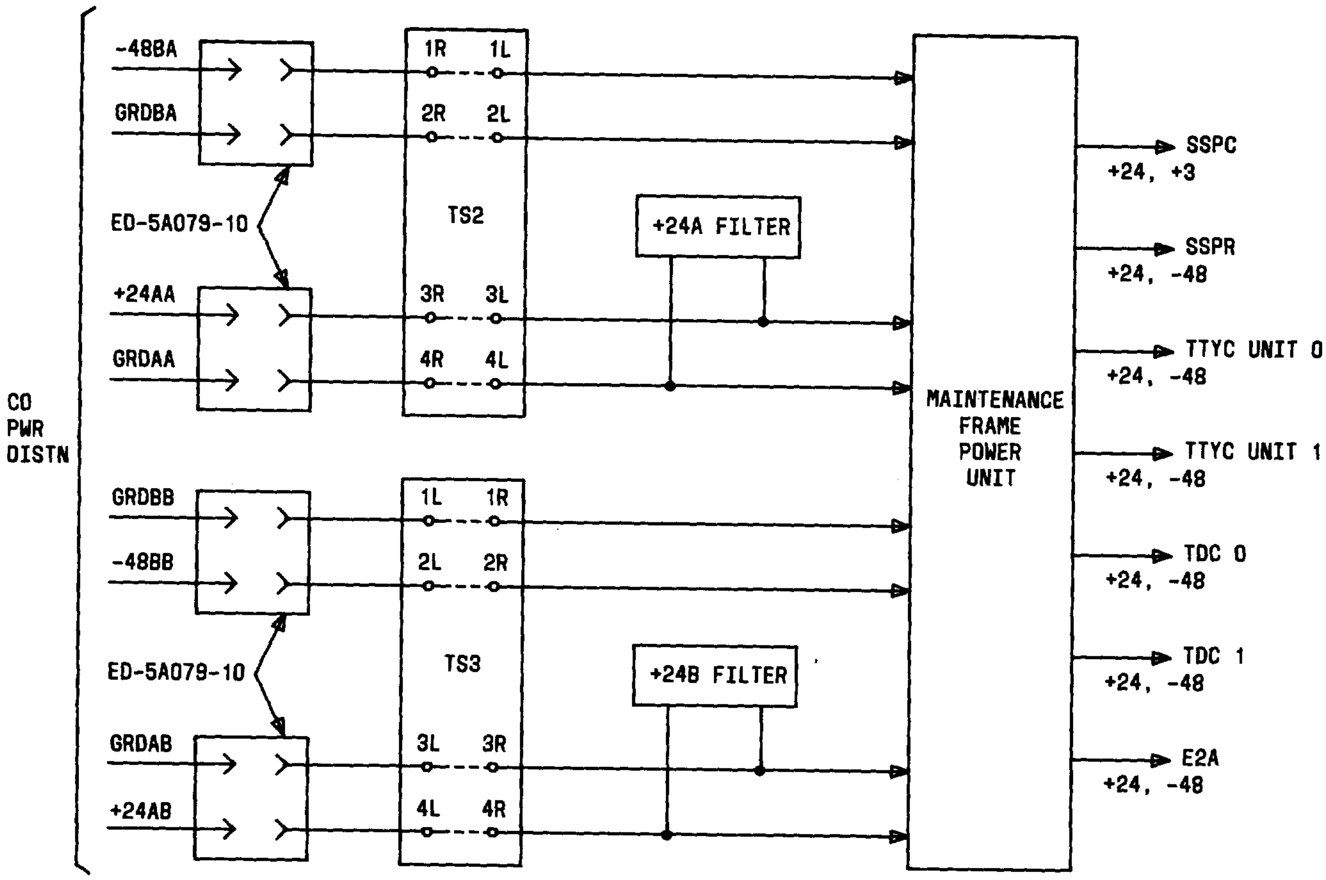

Fig. 12—Maintenance Frame Power Distribution—Simplified Schematic

power from the SSPC circuit. Since SSPC related power is connected in an alternate bus switching arrangement, any fault capable of blowing one fuse in the alternate bus arrangement is likely to blow the alternate fuse after the bus transfer is made. When a fuse associated with the SSP related circuits blows, the MJ1 relay releases. The MJ2 relay monitors fuse alarms and the converter fuse alarm lead associated with the TTYC circuits appearing in the maintenance frame. The MJ3 relay monitors fuse alarms and the converter fuse alarm lead associated with the TDC circuits.

POWER ALARM TEST

5.06 The power alarm (PA) circuits appearing in the maintenance frame may be tested on a limited basis by a series loop connection between all dc-to-dc converters and voltage reference circuits contained in the frame. This connection provides the ability to test the minor alarm indicator circuits and the integrity of the series-connected PA loop. The test is initiated either by operating the LAMP & POWER TEST key on the SSP, or by system software.

POWER SEQUENCING

5.07 Power sequencing relay logic is provided in the SSPR to control the dc-to-dc power converters located in the maintenance frame power unit. A finite time interval is required for the +3 volt converter output to stabilize after application of the converter start voltage. Power sequencing provides a time delay following converter start-up to ensure a known initial state of the SSPC circuits when the +3 volt converter power is applied. A power sequence occurs either when the SSP CIRCUIT POWER key is operated or when an alternate bus switch has occurred.

ALTERNATE BUS SWITCHING

5.08 An alternate bus switching arrangement is provided which automatically attempts to switch from the primary A power buses to alternate

B power buses when loss of bus power occurs. Two alternate bus switching relays for the SSP and SSPC are contained in the SSPR. These relays monitor, and are powered by, the +24 volt dc A bus and -48 volt dc A bus, respectively, via fusing in the maintenance frame power unit. Both relays are held normally operated. Release of either relay will result in a transfer of its associated power source from the primary A bus to the secondary B bus.

5.09 Loss of +24 volt A bus power, or of the ground path to its relay monitor, releases the relay and transfers the +24 volt power source to the secondary B bus. Similarly, loss of -48 volt A bus power, or of the ground path to its relay monitor, releases the relay and transfers the -48 volt power source to the secondary B bus. Release of the -48 volt bus switching relay also forces release of the +24 volt bus switching relay, thereby switching both power sources. Release of the +24 volt bus switching relay, however, does not have a similar effect on the -48 volt relay. The reason for this difference is that the momentary loss of either the +24 volt or -48 volt source to a dc-to-dc converter can cause a converter shutdown. Removal and reapplication of the +24 volt start input to the converter will initialize the converter to a power-on state. Switching of the +24 volt source from one bus to the other provides the required power sequencing to the converter start input.

5.10 The maintenance frame power circuit is designed for operation from the +24 volt dc B power bus. The B bus power is supplied through contacts of a bus switching relay which is powered from the +24 volt B bus. The relay is held normally operated via a ground path through normally closed contacts on ALT BUS key at the SSP. If the B bus power fails, the relay will release, thus transferring to the standby +24 volt A power bus. Restoration of the B bus power source will automatically operate the relay to transfer the maintenance frame power unit to the B bus power source.

6. MAINTENANCE

INTRODUCTION

6.01 The objective of the overall maintenance plan is to maintain and repair or replace faulty equipment as quickly and as efficiently as possible. In general, a failure can occur in one of the units appearing in the maintenance frame without affecting the service provided by the office. However, an out-of-service unit in the maintenance frame results in the loss of control and monitoring capabilities provided by that unit. For this reason, repairs should be effected as soon as possible.

MAINTENANCE FEATURES

6.02 Features included in the maintenance frame which provide additional maintainability are equipment redundancy and fault detection and recovery. There are two TDC units, each powered by separate buses, and the information on each tape cartridge is identical. Each tape cartridge provides a backup copy of write protected main store programs in addition to infrequently used diagnostic programs and other data. There are also four TTYCs, two on each power bus. If a failure occurs in a TTY channel, that channel can be removed from service without affecting service provided by the office. If the maintenance TTY channel is removed from service, a backup channel is used until repairs are effected. These features are normally controlled by software.

6.03 Built-in character and parity checks and start code checks are provided to ensure the integrity of data exchanges between the 3A CC and the TDCs or TTYCs. Each 3A CC has the facilities to switch duplicated units in or out of service upon request, or when an emergency condition exists.

7. REFERENCES

7.01 Additional information on the units appearing in the maintenance frame is available from the documents listed below. Applications documents for the specific user system should also be consulted.

- Section 254-300-110—3A Central Control Description, Common Systems
- Section 254-300-120—3A Central Control Theory of Operation, Common Systems
- Section 254-300-140—3A Processor Power System, Common Systems
- Section 254-300-170—Tape Data Controller Description and Theory, Common Systems

- Section 254-300-180—System Status Panel, System Status Panel Controller, and System Status Panel Relay Unit, Description and Theory of Operation, Common Systems 3A Processor

- Section 254-300-190—Teletypewriter and Teletypewriter Controller, Description and Theory of Operation, Common Systems.

8. GLOSSARY

8.01 The following terms and definitions are used in this section.

ASCII—American Standard Code for Information Interchange

Baud—A unit of signaling speed. For binary elements, the signaling rate in bits per second is the speed in bauds.

BRM—Basic remote module (E2A telemetry)

BT—Bus terminator

BUF—Buffer

CC—Central control

CTT—Cartridge tape transport

CTTC—Cartridge tape transport controller

DDD—Direct distance dialing

EIA—Electronic Industries Association

FA—Fuse alarm

I/O—Input/output

LED—Light emitting diode

MAS—Main store

MRF—Maintenance reset function

PA—Power alarm

RC—Resistance-capacitance

SCC—Switching control center

SDS—Synchronous data set

SDSC—Synchronous data set controller

SPI—Serial peripheral interface

SSP—System status panel

SSPC—System status panel controller

SSPR—System status panel relay unit

TTY—Teletypewriter

TTYC—Teletypewriter controller