LIMITING CONDUCTOR CONDITIONS NO. 2 AND NO. 2B ESS ARRANGED WITH 2-WIRE FEATURES EQUIPMENT DESIGN REQUIREMENTS ELECTRONIC SWITCHING SYSTEMS

1. GENERAL

SCOPE

1.01 This specification covers the limiting conductor conditions dictated by the various cabling schemes of the No. 2 and 2B Electronic Switching Systems (ESSs).

1.02 This specification is reissued to:

(a) Add No. 2B ESS to title

(b) Add No. 2B ESS information to Sections 1, 2, and 3

(c) Add new paragraphs and figures

(d) Renumber paragraphs and figures

(e) Update lead restrictions in Table A.

DESCRIPTION (NO. 2 ESS)

1.03 The No. 2 ESS is a common control type system using stored program control. As shown in the block diagram (Fig. 1), the system basically consists of a control complex and a number of peripheral units. The switching network is a 2-wire, folded 4-stage ferreed network. Lines, trunks, and service circuits are connected to the same side of the network via the distributing frame (DF). The control complex monitors the status of these lines and circuits via the scanner.

1.04 The No. 2 ESS control complex consists of two control units (CUs) working with a common maintenance center (MC). Each control unit contains a central processor (CP) frame, a +6.7 volt power frame (PWR), from one to four program stores (PSs) and, in larger offices, a supplementary call store frame (SCS). Each CP provides program control, input/output logic, 512 central pulse distributor (CPD) points and a maximum of 8192 words of call storage. This compact arrangement permits much of the interframe ac busing found in the No. 1 ESS to be replaced by intraframe wiring.

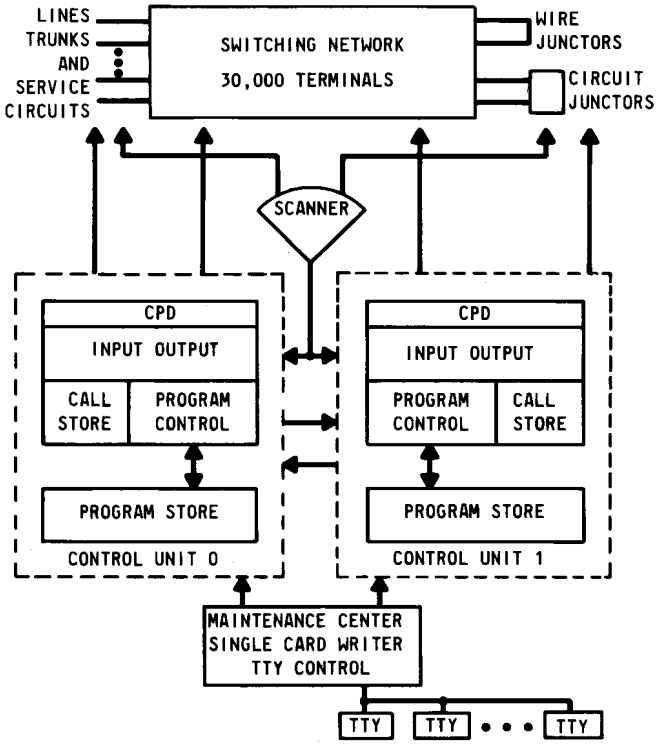

Fig. 1—No. 2 ESS Block Diagram

Control Complex Intraconnections (No. 2 ESS)

1.05 Control complex intraconnections consist of dc cabling between CPs, dc cabling from each CP to the MC, both dc and ac cabling from each CP to its

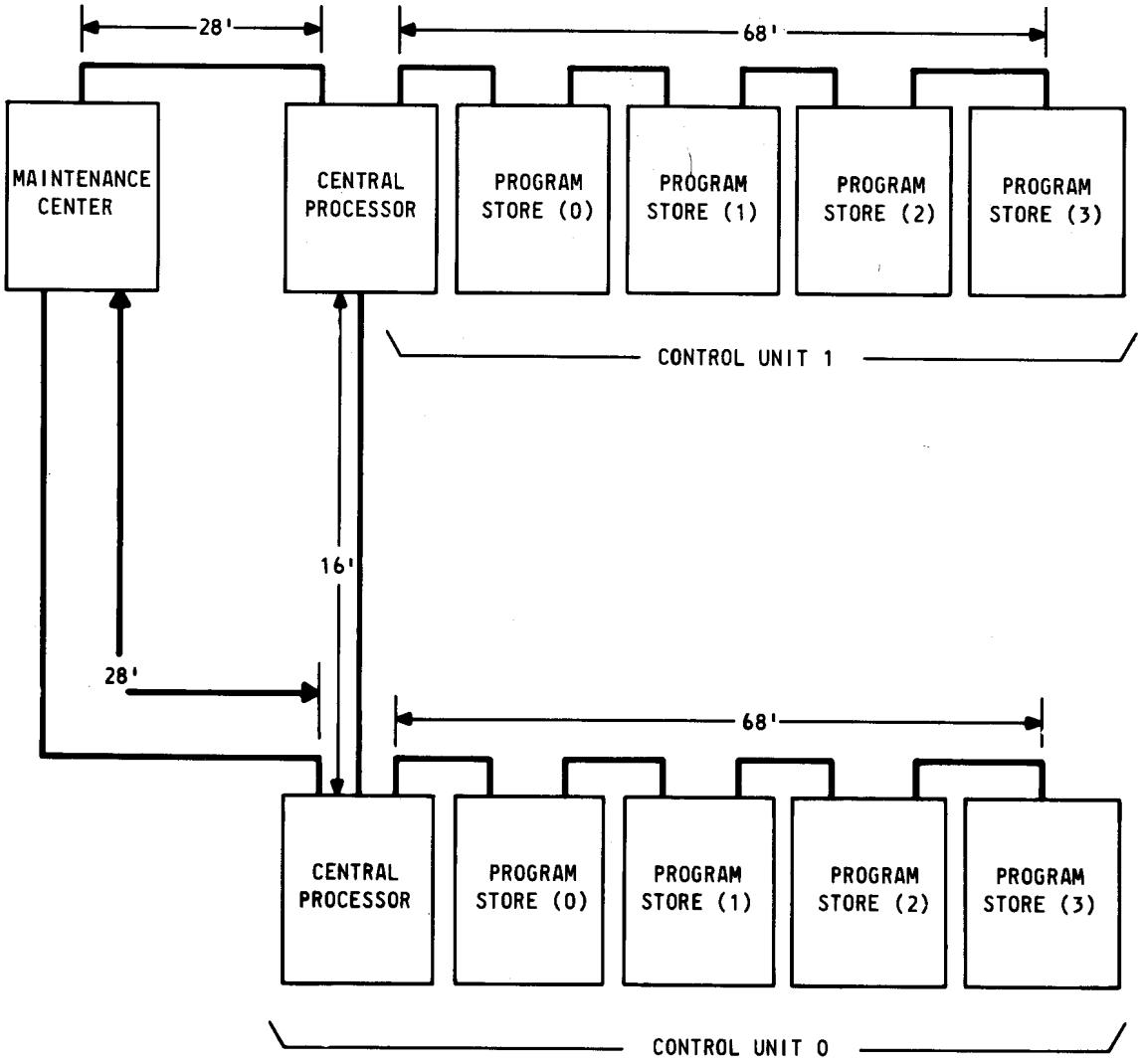

Fig. 2—Control Complex Cable Lengths (No. 2 ESS)

associated PS, and power wiring from each +6.7 volt power frame to its associated control unit frames and the MC. Connectors on a large portion of this interframe wiring allow extensive factory testing and consequently reduce installation effort at the job site.

1.06 To insure a properly functioning system and to simplify the ordering of the interconnecting cables, the locations of the frames in the control complex, the aisle dimension (4 feet 0 inches), and the location of the cross-aisle troughs have been standardized for both left- and right-hand growth as shown in the No. 2 ESS floor plan data sheets, FPD 820-600-150. The intracontrol complex connectorized cables may be specified for these arrangements per H-460-001 (for left to right growth) or H-460-002 (for right to left growth). Deviation from either of these standards is discouraged. However, should local conditions dictate use of a nonstandard arrangement, the length of the connectorized cables must be calculated on an individual basis. The cable lengths chosen should comply with the following conditions (Fig. 2):

(a) Cables connecting either CP and the MC may not exceed 28 cable feet including drop length.

(b) Cables connecting CU0CP and CU1CP may not exceed 16 cable feet including drop length.

(c) To prevent delay in the return of information from the PS to its associated CP, the total length of the ac bus multiple (CP to last PS in con-

trol unit) may not exceed 68 cable feet including drop length.

(d) The dc multiple between the CP and its associated PS may not be more than 20 cable feet longer than the associated ac cable length.

1.07 The +6.7 volt power required by each frame in a control unit is supplied by the -6.7 volt power frame provided with the control unit. The MC obtains +6.7 volt power from both frames. The maximum allowable voltage drop between the +6.7 volt power frame and the equipment frame fuse panel is 0.35 volt. The +6.7 volt feeder sizes for each frame are specified for maximum loop distances in the +6.7 volt power distribution circuit, SD-2H083-01. Deviation from these feeder sizes and loop distance is discouraged; but when local conditions dictate greater loop lengths than shown in SD-2H083-01, the feeder sizes must be recalculated on a job basis.

Control Complex—Peripheral Unit Interconnection (No. 2 ESS)

1.08 Pulses transmitted over groups of leads called buses carry information between the control complex and the peripheral units. Each unit on a particular bus is equipped with a low impedance cable pick-off transformer that is connected in series with the bus cable. A bus pair consists of a balanced-to-ground twisted-wire pair. To minimize reflections that would cause undesirable multiple operations, the twisted pair is terminated at each end with a 100-ohm noninductive resistor. These resistors are supplied on the first and last units of each bus.

1.09 Commands from the CPs are transmitted to the peripheral units over duplicated address buses. The address bus consists of two cable groups. The low bits, AD00 through AD16, and the reset signal AD36 are in one cable group. The high bits, AD17 through AD35, and AD37 are in the other cable group. As shown in Fig. 3, the low-bit cables (one from each CP) are multipled to each peripheral unit, while the high-bit cables (one from each CP) are multipled to each supplementary central pulse distributor frame (SCPD). Each cable group may contain an east and west branch (see SD-2H078-01).

1.10 The control complex transmits the information over the address buses to all units connected to the bus. An enabling pulse is transmitted, via a central pulse distributor, over a private path to the single unit that is to receive the information.

1.11 The answer buses transmit scanner answers, all-seems-well, and enable-verify signals to the central processor. An answer bus cable is multipled from each CP to each peripheral unit. The answer bus may have one or two branches, depending on the size and physical arrangement of an office. In a small office where the answer bus length limitation can be

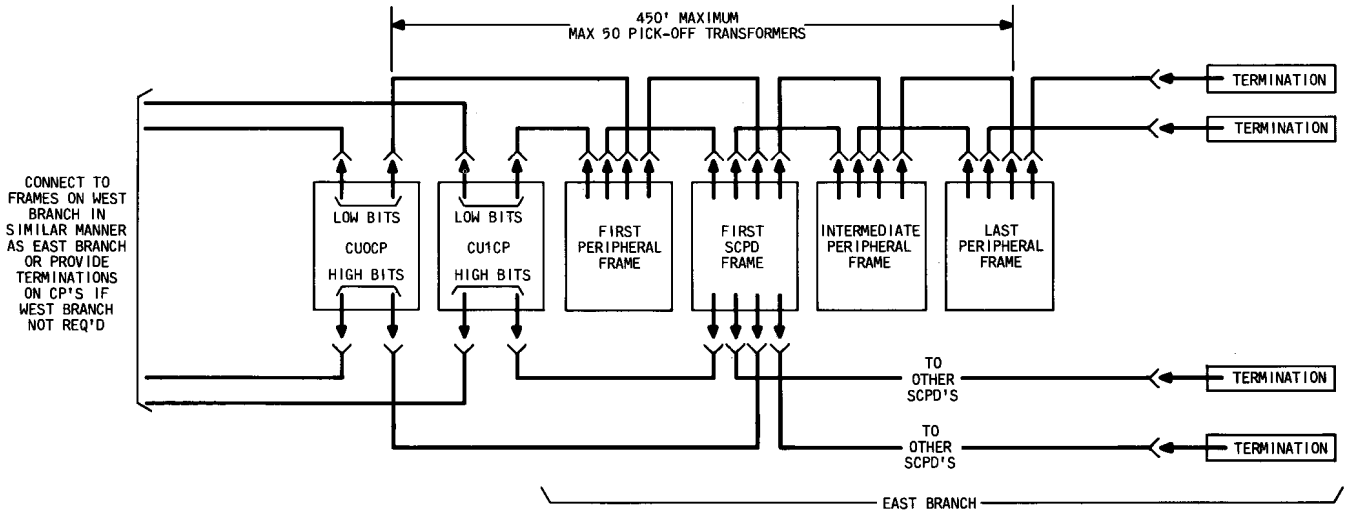

Fig. 3—Address Bus (No. 2 ESS)

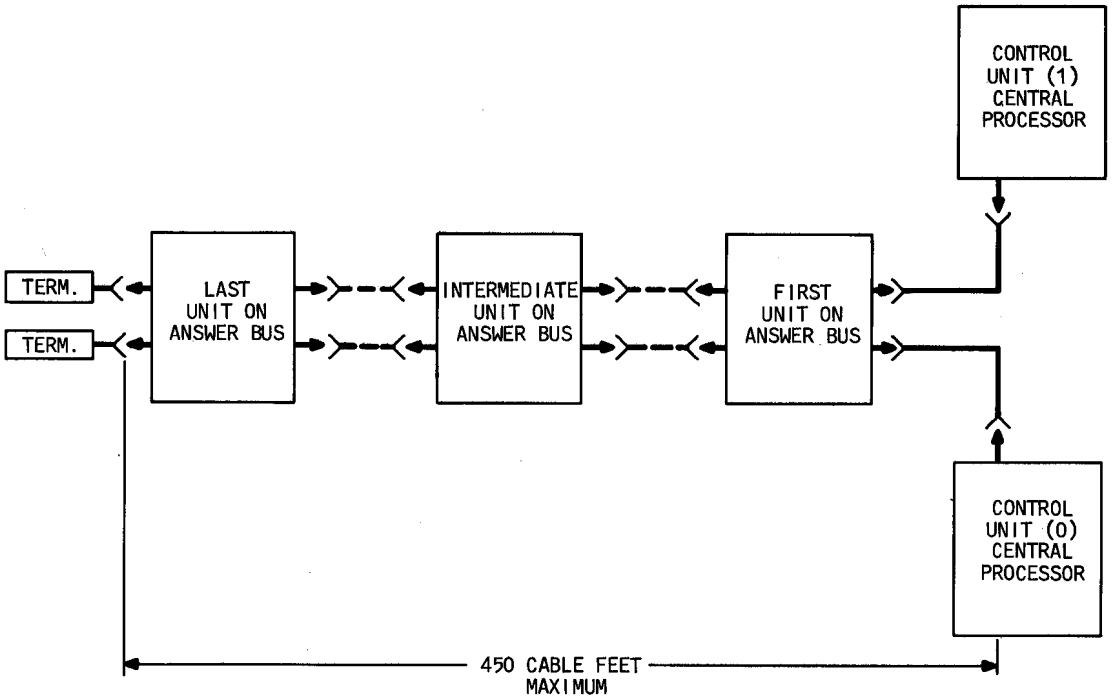

Fig. 4—Answer Bus (West Branch)—No. 2 ESS

met, one branch is used. This is normally the west branch (Fig. 4). In larger offices, or where physical arrangements exceed the limitation of the west branch, an east branch will be necessary to stay within the length limitation. In this case, the two answer bus fan-in circuits are used (see Fig. 5 and SD-2H078-01).

1.12 To simplify installation and growth, the address and answer buses have been connectorized. Each bus cable is made up of an A25L connector cable that is terminated at both ends by KS-20203 L1 plugs. The cable pick-off transformers, cable drivers, and balancing inductors have also been connectorized. Each connectorized unit is arranged to mate with two KS-20203 L1 plugs. The terminating resistors have been mounted in a 525A terminating plug at each end of the bus.

1.13 The No. 2 ESS also requires a dial pulse timing bus. This carries 10-pulse-per-second (PPS) timing signals to the units (if provided) that transmit dial pulses to other offices. This is a nonconnectorized bus made up of standard switchboard cable, 26-gauge twisted pair, 2.5 inches per twist. When this bus is used, termination is provided at the CP and on the last unit of the bus. When it is not required, both terminations are provided at the CP.

1.14 The data-timing bus transmits timing signals to the dial-pulse receiver test circuits. The makeup of this bus is identical to that of the dial-pulse timing bus described in 1.15.

1.15 When the cable length of a bus is terminated, the total length should include the length of cable run in the cable racks plus the drop length (cable rack to point of connection and back to cable rack) at each frame on the bus. The drop lengths to be used are as follows:

NCJS, AMA 4 feet 6 inches
All others 3 feet 3 inches

Note These dimensions are used only to determine the length of a bus run. Installation lengths are specified in the Western Electric Company Installation Handbook.

1.16 To insure a properly functioning bus system and to prevent loss of the necessary coincidence

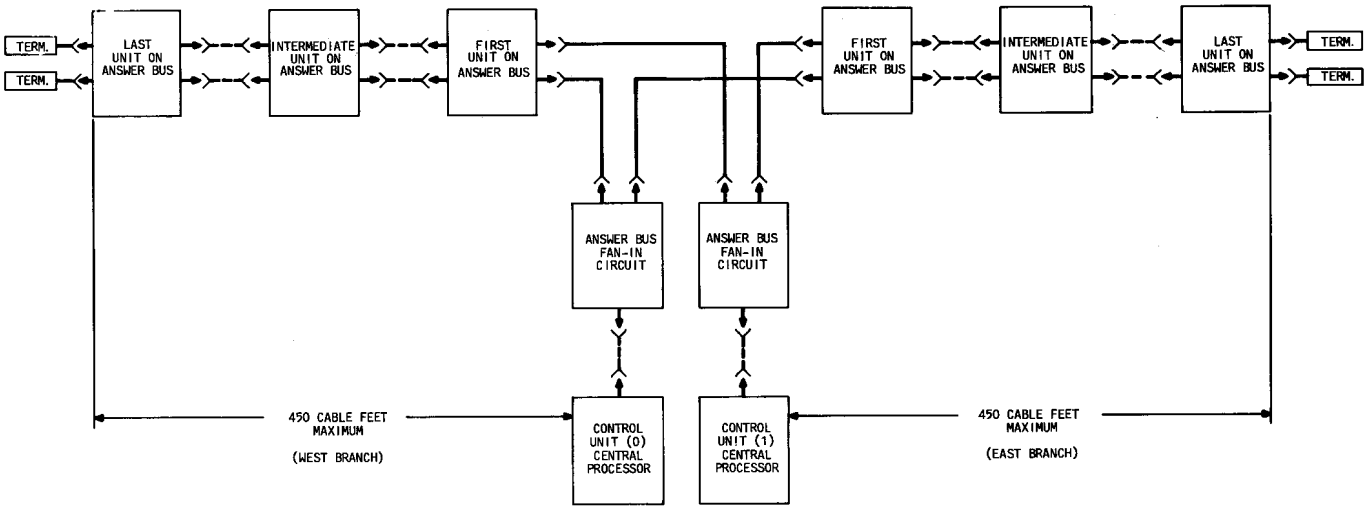

Fig. 5—Answer Bus (East and West Branch)—No. 2 ESS

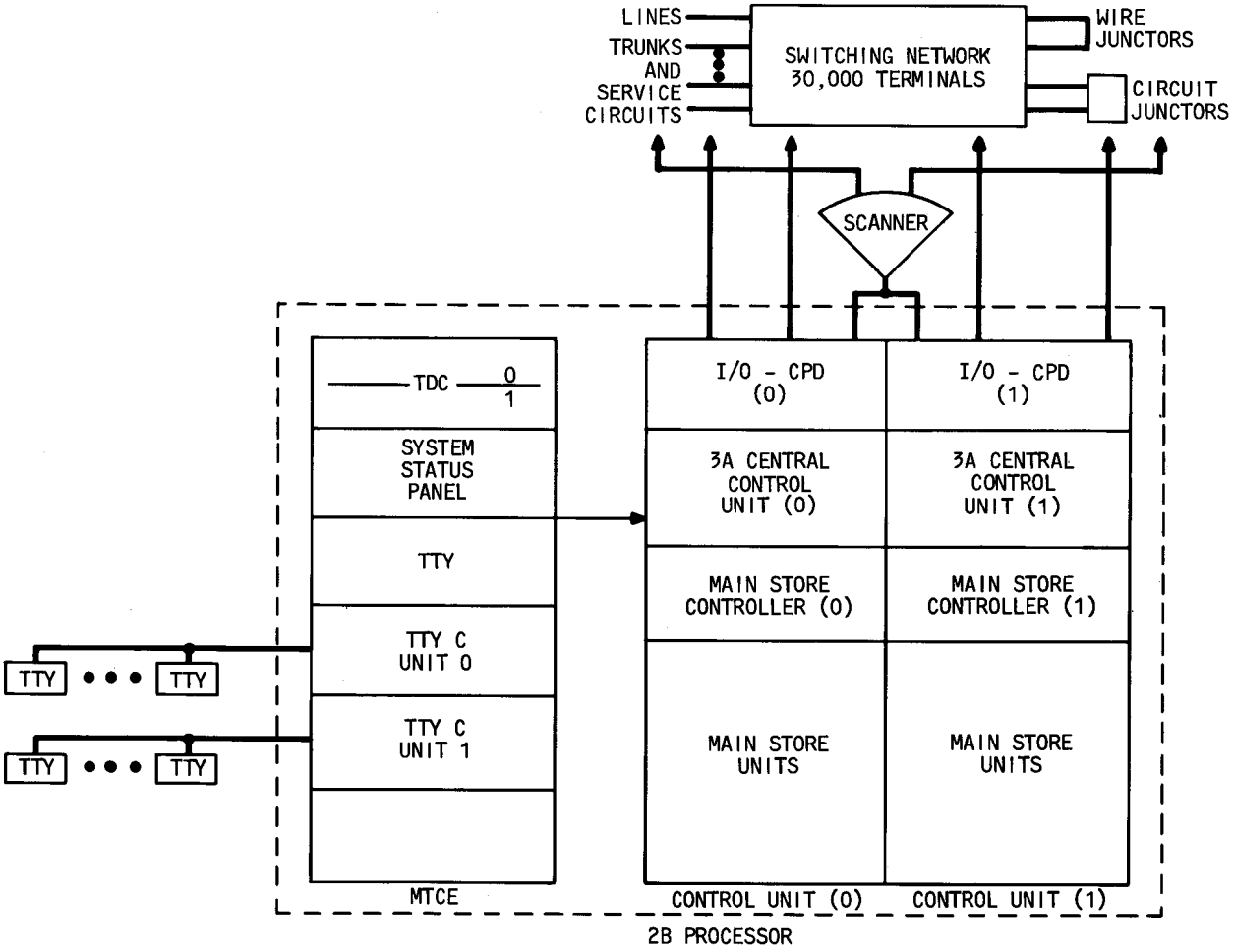

Fig. 6—No. 2B ESS Block Diagram

between the enable leads and the address bus, the following restrictions must be maintained:

(a) The maximum length of any address bus branch (Fig. 3), answer bus branch (Fig. 4), data timing bus, and dial-pulse timing bus is 450 cable feet.

(b) The enable leads must follow the same path as the address bus and the difference in the length of the two shall be no greater than ±105 feet.

(c) The maximum number of pick-off transformers on any address bus, dial-pulse timing, or data-timing bus is limited to 50.

(d) The maximum difference in length of cable 0 and cable 1 of any address bus shall be ±10 feet.

(e) The sum of the length of the enable leads to an SCPD frame and the length of the answer bus from a given CP to that SCPD frame shall be 450 feet maximum.

DESCRIPTION (NO. 2B ESS)

1.17 The No. 2B ESS is a common control type system using stored program control (see Fig. 6). The system basically consists of a 2B Processor and a number of peripheral units. The switching network is a 2-wire, folded 4-stage ferreed network. Lines, trunks, and service circuits are connected to the same side of the network via the distributing frame (DF). The 2B Processor monitors the status of these lines and circuits via the scanner.

1.18 The 2B Processor consists of the Processor frame (PROC), maintenance frame (MTCE), and in larger offices two supplementary main store frames (SMASs). The PROC is a double-bay frame, which contains two control units (CUs). Each unit is equipped as follows:

(a) No. 2B ESS input/output control circuit

(b) 3A central controller (3A CC)

(c) Main store (each fully equipped PROC is equipped with a 256K main store)

(d) Power for these units.

2B Processor Intraconnections (No. 2B ESS)

1.19 The 2B Processor intraconnections consist of coax cabling between the 3A CC subchannel for the I/O main channel and the MTCE. Because the main stores require critical timing, the cabling between the main store controllers on the PROC and the main store controllers on the SMAS (when equipped) must be wired directly across the back of the PROC to the SMAS. The coax cables that connect the 3A CC to teletypewriter control (TTYC) units 2 through 7 (when equipped) cannot exceed a maximum of 60 cable feet including drop lengths (see Fig. 7).

1.20 To insure a properly functioning system and to simplify ordering the interconnecting cables, standards have been set as shown in the No. 2 and No. 2B ESS floor plan data sheets (FPD 820-600-150). These standards specify the location of the frames in the 2B Processor, the aisle dimension (4 feet), and the location of the cross-aisle troughs for both left- and right-hand growth. The intra 2B Processor connectorized cables may be specified for these arrangements per ED-4C079-30 for both left- and right-hand growth (see Fig. 8). Deviation from these standards is discouraged.

1.21 The 2B Processor and the peripheral units exchange information by means of pulses transmitted over groups of leads called buses. Each unit on a particular bus is equipped with a low-impedance cable pick-off transformer that is connected in series with the bus cable. A bus pair consists of a balanced-to-ground twisted-wire pair. To minimize reflections that would cause undersirable multiple operations, the twisted pair is terminated at each end with a 100-ohm noninductive resistor. These resistors are supplied on the first and last unit of each bus.

1.22 Commands from the CUs are transmitted to the peripheral units over duplicated address buses. The address bus consists of two cable groups. The low bits, AD00 through AD16, and the reset signal AD36 are in one cable group. The high bits, AD17 through AD35, and AD37 are in the other cable group. As shown in Fig. 8, the low-bit cables (one from each CU) are multipled to each peripheral unit, while the high-bit cables (one from each CU) are multipled to each supplementary central pulse distributor frame (SCPD). Each cable group may contain an east and west branch (see SD-2H078-01).

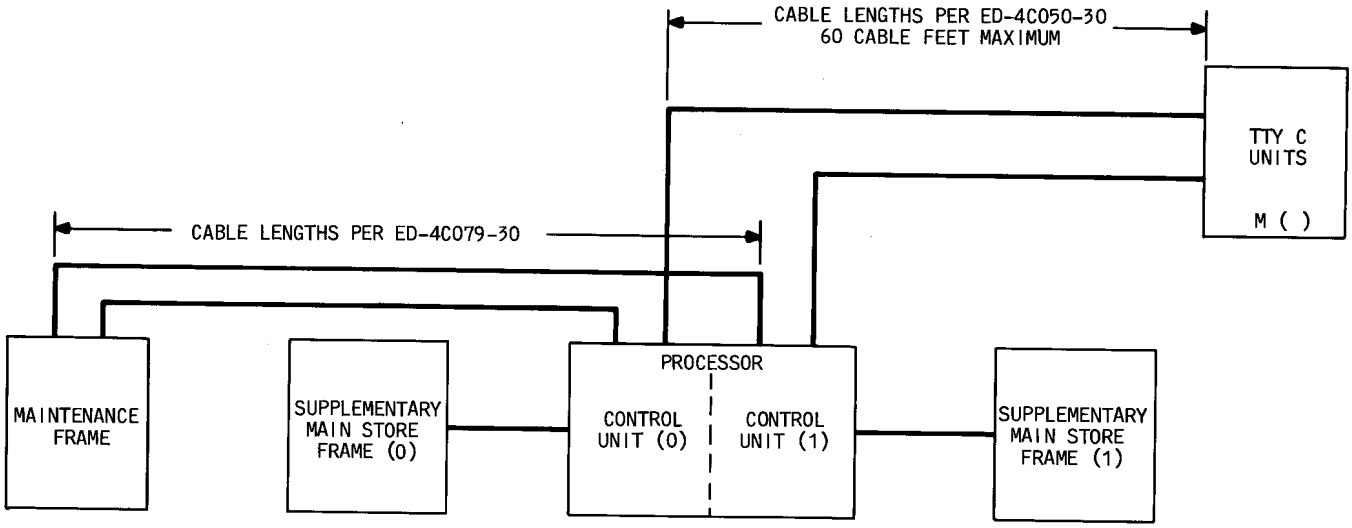

Fig. 7—2B Processor Cable Lengths (No. 2B ESS)

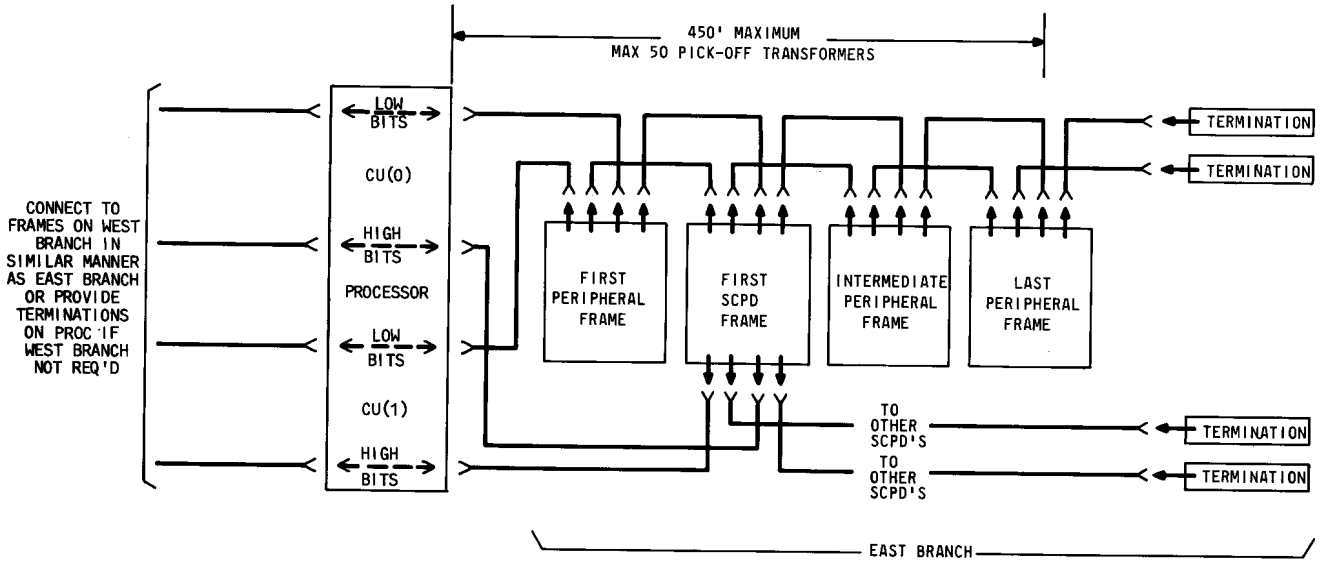

Fig. 8—Address Bus (No. 2B ESS)

1.23 The 2B Processor transmits the information over the address buses to all units connected to the bus. Via a central pulse distributor, an enabling pulse is transmitted over a private path to the single unit that is to receive the information.

1.24 The answer buses transmit scanner answers, all-seems-well, and enable-verify signals to the control unit. An answer bus cable is multipled from each CU to each peripheral unit. There are two answer bus cables, an east and west branch (see SD-2H078-01), that form the undirectional answer bus (see Fig. 9).

1.25 To simplify installation and growth, the address and answer buses have been connectorized. Each bus cable is made up of an A25L connector cable, which is terminated at both ends by KS-20203 L1 plugs. The cable pick-off transformers, cable drivers, and balancing inductors have also been connectorized. Each connectorized unit is arranged to mate with two KS-20203 L1 plugs. The terminating resistors have been mounted in the 525A terminating plug at each end of the bus.

1.26 The data-timing bus carries timing signals to the dial-pulse receiver test circuits. The make-up of this bus is identical to that of the dial-pulse timing bus described in 1.27.

1.27 When terminating the cable length of a bus, the total length should include the length of cable run in the cable racks plus the drop length (cable rack to point of connection and back to cable rack) at each frame on the bus. The drop lengths to be used are as follows:

NCJS, AMA 4 feet 6 inches
All others 3 feet 3 inches

Note

These dimensions are used only to determine the length of a bus run. Installation lengths are specified in the Western Electric Company Installation Handbook.

1.28 To insure a properly functioning bus system and to prevent loss of the necessary coincidence between the enable leads and the address bus, the following restrictions must be maintained:

(a) The maximum length of any address bus branch (Fig. 8), answer bus branch (Fig. 9), data-timing bus, and dial-pulse timing bus is 450 cable feet.

(b) The enable leads must follow the same path as the address bus and the difference in the length of the two shall be no greater than ±105 feet.

(c) The maximum number of pick-off transformers on any address bus, dial-pulse timing, or data-timing bus is limited to 50.

(d) The maximum difference in length of cable 0 and cable 1 of any address bus shall be ±10 feet.

(e) The sum of the length of the enable leads to an SCPD frame and the length of the answer bus from a given CU to that SCPD frame shall be a maximum of 450 feet.

Conductor Lengths Resistance Values (No. 2 and No. 2B ESS)

1.29 The logic circuits, which use high-speed transistor-resistor logic (HSTRL) gates, are housed in ESS-type frameworks. The location of these frames within the central office is determined by a floor plan that takes into account the cable restrictions outlined herein. To insure a properly functioning system, the cables interconnecting the various frames must not add any significant delay to the pulses being transmitted and must not reduce a given voltage by a significant amount. To prevent excessive delay, conductor length restrictions are placed on critical leads. Leads that are resistance limited are specified only in terms of conductor resistance. Conversion from conductor resistance to equivalent lead length is based on the following resistance values:

GAUGE OF COPPER WIRE	FEET OF PAIRED WIRE PER OHM	LOOP RESISTANCE-OHMS PER 100 FT OF PAIRED WIRE
22	28.1	3.56
24	17.5	5.72
26	10.5	9.48

1.30 Switchboard cables that interconnect the various frames are divided into four classes. To minimize electrical interference between classes, an

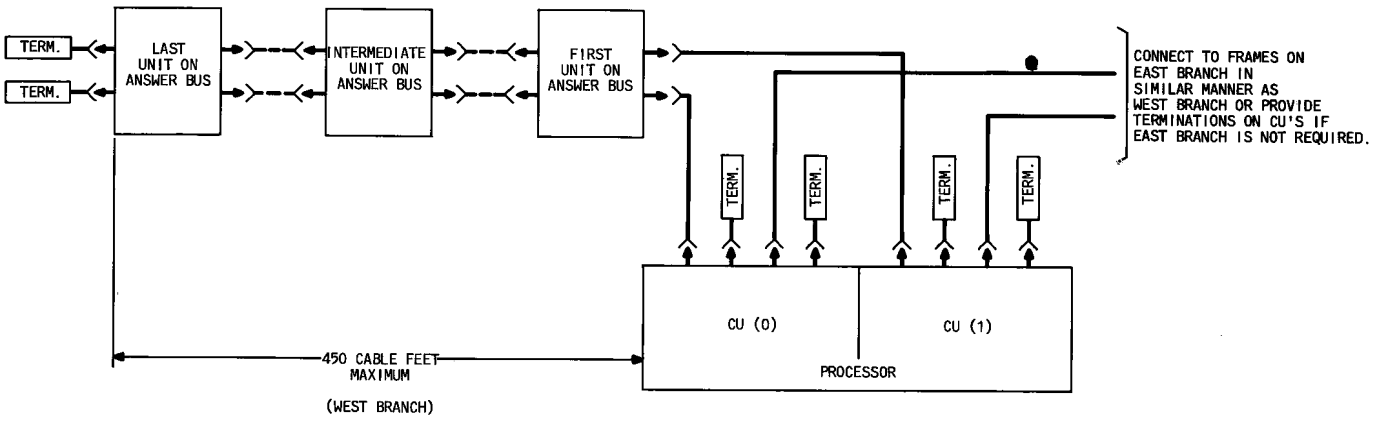

Fig. 9—Answer Bus (2B ESS)

ESS-type cable rack (Fig. 10) is used to shield each class from other classes. Switchboard cables shall be arranged in the cable rack compartments as follows:

SHIELD NO.	CONDUCTORS
1	For bus leads carrying 0.5-μs unipolar and bipolar pulses of control data between CP, PS, or PROC and the peripheral frames.
2	All master scanner leads including those to miscellaneous trunk frames.
3	For all tip and ring leads of the talking path; all relay-control leads; all leads to the tone distribution circuit; all intracontrol complex dc-connectorized cables.
4	For dc power leads, low-voltage control leads for the office lights, all leads from the ringing distribution circuit to the miscellaneous trunk frame designated T( ), R( ), 20, ± 105 volt, ± SUP, ± trip battery, ac-dc, and +130 volt and -130 volt COIN battery leads to the +130 volt and -130 volt distribution circuits.

Maximum Conductor Length For Power and Ground Leads No. 2 and No. 2B ESS

1.31 ESS-type power distributing frames are used to distribute the +24 and −48 volt power to the equipment frames. Feeder distribution and sizes are specified in SD-1A148-01 for J1AXXX coded frames, in SD-2H083-01 and SD-2H084-01 for J2HXXX coded frames, and in SD-2H091-01 for No. 2 or 2B ESS circuits requiring +48 volts. In general, the power distributing frames should be located in the area of the frames they serve. The feeder sizes shown in the respective distribution circuits are based on a maximum 1-volt drop between the power distributing frame and the associated equipment frame fuse panel. These sizes should be used in all cases except where the loop length exceeds 175 cable feet. For loop lengths greater than 175 cable feet, the feeder size must be calculated as specified in the respective distribution circuits.

1.32 Power distributing frames should be located to provide the shortest convenient cable runs to the power board. The recommended maximum distance from the power board to the power distributing frame is 200 cable feet.

1.33 Power feeders between the power plant discharge fuses and each PD frame shall be sized to insure a voltage range of +21.75 to +26.25 and -43.75 to -52.5 at each PD frame. Voltage ranges of the various potentials supplied to the equipment are as follows:

NOMINAL	MAXIMUM RANGE
+24 V	+20.75 V to +26.25V
−48 V	−42.75 V to −52.5 V
+130 V	+125 V to +135 V

NOMINAL	MAXIMUM RANGE
−130 V	−125 V to −135 V
115 V, 60 Hz	130 V to 125 V, 59 V to 61 Hz

1.34 To prevent spurious signals from adversely affecting the operation of the No. 2 or 2B ESS, a single-point central office ground (ground window) is employed. This type of ground system requires the isolation of all ESS equipment from building ground. The power room equipment is connected to building ground and, therefore, must be isolated from the equipment frames in the ESS switchroom. The central office ground is generally located nearest to the lowest-numbered PD frame and is then multipled to all other PD frames and +6.7 volt power frames via 750 MCM cable. Details and variations of the single-point ground system are specified in SD-2H083-01, SD-2H084-01, SD-1A148-01 and ED-1A200-10. Except as indicated in these documents, the grounding requirements specified in SD-81891-01 and Section 802-001-180 will be observed.

1.35 ESS and non-ESS systems may be served by a common power plant; however, the ESS single-point ground concept must be maintained. Circuit compatibility and the restrictions that apply to power sharing are specified in J2H031 (Section 820-600-152). It is recommended that non-ESS equipment be mounted in 7-foot, single- and double-bay frameworks such as ED-97162-51 and ED-97163-51. These frames should be kept separate from ESS equipment and should be powered by a PD frame (ESS or non-ESS type) containing an ESS-type filter. This PD frame should be located in the non-ESS (Fig. 11) areas and shall be connected to the single-point ground.

1.36 In those offices that require high bay (9 feet 0 inch or 11 feet 6 inches) frames that are connected to building ground, precautions must be taken to isolate these frames and associated cable racks from the equipment frames in the ESS switchroom (Fig. 12). As indicated in 1.35, the PD frame serving this equipment must use an ESS-type filter unit.

Limiting Conductor Conditions For Shield 2 and 3 Cables

1.37 The maximum 1000-Hz loss through a No. 2 or No. 2B ESS office shall not exceed an average value of 0.5 dB and a maximum value of 0.8 dB when measured using a 900-ohm termination transmission test facility. These values represent the total loss through the office and include the loss in junctor or trunk circuits as well as the loss in office cabling between the various frames in the network. The maximum 0.8-dB loss is 0.3 dB for junctor or trunk circuits and 0.5 dB for office cabling.

1.38 The 0.3-dB loss for junctor or trunk circuits is dependent on floor plan layout. Floor plan layouts and cabling paths through the office must be chosen to satisfy the 0.5-dB loss as specified above. Since the 0.5-dB loss in office cabling is practically all copper loss, it is more conveniently specified in terms of either dc conductor resistance or conductor length as follows:

(a) In terms of dc conductor resistance: dc conductor resistance of the tip plus ring leads in the maximum cable path through the office must not exceed 100 ohms. This cable path is to be measured from the DF associated with the ESS equipment through the office and back to the DF. The path should represent the maximum path a call would take through the office.

(b) In terms of cable length for 26-gauge conductors: the length of the maximum cable path of the tip and ring (pair feet) conductor through the office must not exceed 1050 cable feet.

1.39 Office layouts which cannot be engineered to satisfy this requirement using 26-gauge cable should be referred to Bell Telephone Laboratories, Incorporated, for recommendations.

1.40 Outgoing trunk transmission tests are made by establishing a path between the trunk-test panel and the trunk being tested. Incoming trunk tests require a path between the trunk being tested and the combined milliwatt balance termination and loop-around test circuit (Fig. 13). Variations in cable length could adversely affect these measurements. To reduce any error in these measurements, a reference point is established for each type of trunk. The reference point for outgoing trunks is at their network appearance. The reference point for incoming trunks is the "reference network." The reference network is assigned on a job basis in the following manner:

(a) The path lengths between each network and the junctor grouping frame are determined and the average length is calculated.

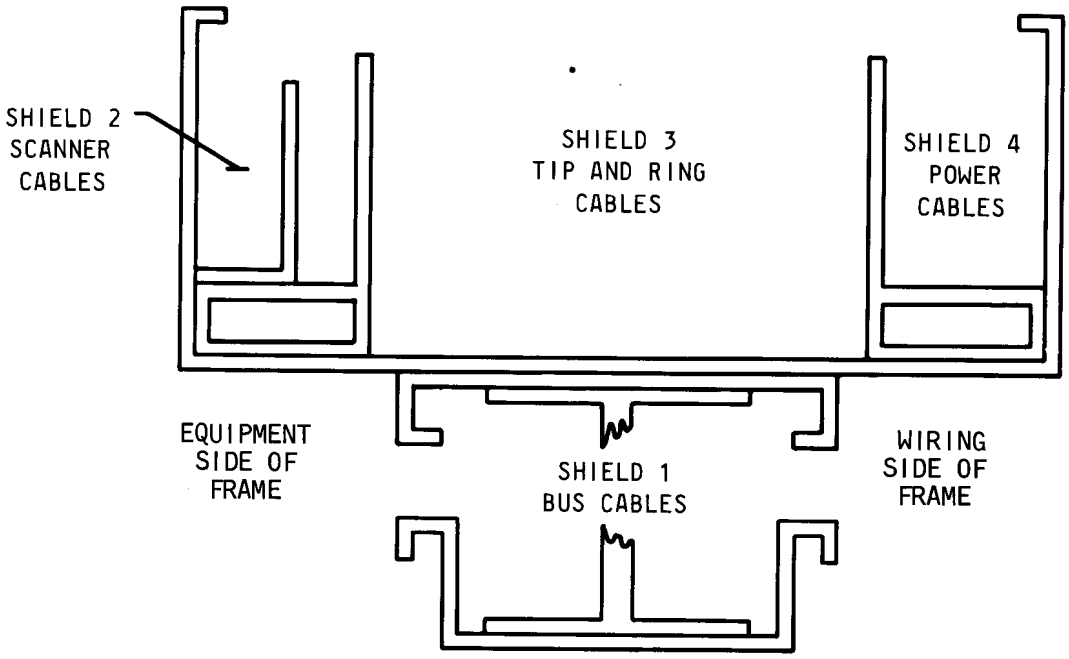

Fig. 10—ESS Cable Rack

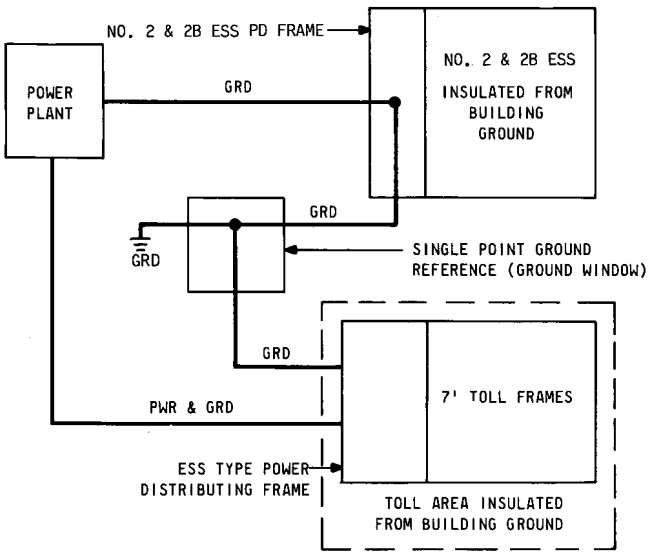

Fig. 11—PD Frame

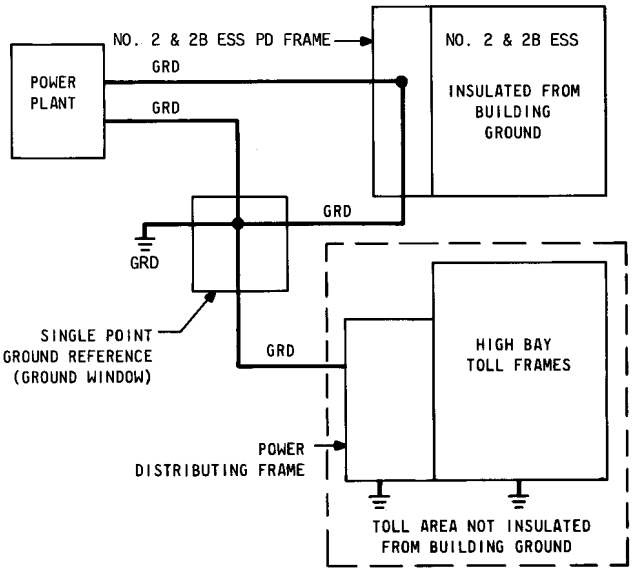

Fig.12—Equipment Frames in the ESS Switchroom

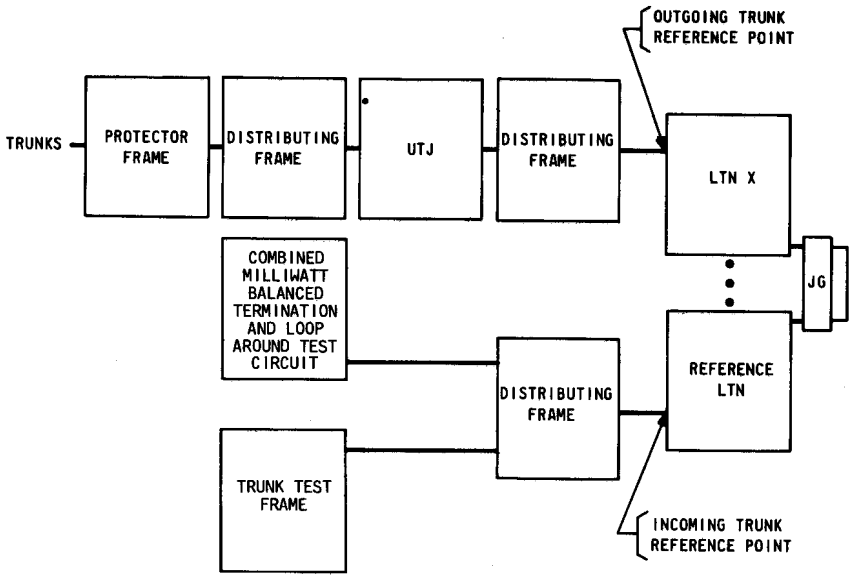

Fig. 13—Connecting Path of Trunk Test Panel to Trunks

(b) The network that has a cable length closest to this average is designated the "reference network."

1.41 The trunk-test panel (SD-2H075-01) and the combined milliwatt balance termination and loop-around test circuit (SD-2H136-02) must be connected to the reference network.

1.42 Since the trunk test panel is connected to the reference network, an additional error is introduced when measuring loss on outgoing trunks. This error is caused by the path length between the incoming and outgoing reference points through the switching network. The maximum loss between these reference points should not exceed 0.07 dB. To meet this requirement, cable lengths within the office are limited to 175 feet between incoming and outgoing trunk reference points and to 250 feet between the trunk test frame and the outgoing trunk reference point.

1.43 Restrictions on certain specific critical leads are listed in Table A.

Limitations on Equipment Arrangement

1.44 To prevent electrical interference with the ESS equipment, equipment frames in an ESS office shall be at least 5 feet from any heavy-duty electrical motors.

1.45 Recorded announcement frames shall not be located adjacent to ringing and tone frames. Any other standard equipment arrangement is permissible.

2. SUPPLEMENTARY INFORMATION

800-600-100—List of General Equipment Requirements
802-001-180—Protective Grounding Systems
820-000-000—No. 1, No. 1A, No. 2, No. 2A, No. 3, and No. 4A ESS and 1A Processor Electronic Switching System Index
966-200-101—General Description—No. 2B ESS
966-210-100—General Description—No. 2 ESS
Floor Plan Data—FPD 820-600-150

Questionnaire—E-8071—No. 2 and 2B ESS
Questionnaire—E-8100—No. 2A and No. 2C ESS
Current Drain Data
SD-2H100-02 No. 2 and No. 2B ESS

3. DRAWINGS

Keysheet

SD-2H100-01—No. 2 and No. 2B Electronic Switching Systems

Circuits

SD-1A144-01—+130V and -130V Power Distributing Circuit
SD-1A148-01—+24V and -48V Power Distributing Circuit
SD-1A213-01—AC Power Distributing Circuit
SD-2H078-01—Communication Bus Circuit
SD-2H083-01—+6V Power Distribution Circuit
SD-2H084-01—+24V and −48V Power Distributing Circuit
SD-2H091-01—+48V Power Distribution Circuit
SD-81899-01—Grounding Circuit

Wiring and Cabling

ED-1A153-01—Table of Wire Gauges and Types of Insulation—No. 1 and No. 2 ESS
ED-1A200-10—Method of Connecting Power and Ground
ED-1A227-01—Method of Running Switchboard
ED-4C078-30—No. 2B ESS Maintenance Frame Interface Cabling
ED-4C079-30—No. 2B ESS Processor Frame Interface Cabling

TABLE A
LEAD RESTRICTIONS

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (ohms)
Ground Cross Detecting	2H096-01	SC(00)0 SC(00)3	50
		SC(01)0 SC(01)3	50
		SC(02)0 SC(02)3	50
Outgoing Trunk Circuit Switchboard 3CL in Distant Building	2H105-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
		SC(02)0 SC(02)3	100
		SC(03)0 SC(03)3	100
Outgoing Trunk Circuit Verification Request and Intercept	2H107-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
Incoming Trunk Circuit Switchboard 3CL in Distant Building Third-Wire Coin Control Simplexed Rering Signal	2H108-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(02)0 SC(02)3	50
		SC(03)0 SC(03)1	15
		SC(03)2 SC(03)3	15

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Incoming Trunk Circuit LTD 14 or LTC 3	2H109-01	SC(01)0 SC(01)3	15
		SC(02)0 SC(02)3	100
		SC(03)0 SC(03)1	15
		SC(03)2 SC(03)3	15
		SC(04)0 SC(04)3	100
		SC(05)0 SC(05)3	100
Incoming Trunk Circuit-Distant Step-By-Step Reverse Battery Supervision (A&M Only)	2H111-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
2-Way Trunk E&M Lead Supervision	2H112-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
Outgoing Trunk Circuit Switchboard No. 3CL in Distant Building	2H113-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
		SC(02)0 SC(02)3	100
		SC(03)0 SC(03)3	100
		SC(04)0 SC(04)3	100
		SC(05)0 SC(05)3	100

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Customer Dial Pulse Receiver (A&M Only)	2H114-01	SC(00)0 SC(00)3	100
Ringing Circuit, Individual 2-Party, Coin, and PBX	2H116-01	SC(00)0 SC(00)3	50
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
MF Transmitter Circuit	2H121-01	SC(00)0 SC(00)3	15
		SC(00)1 SC(00)2	15
		SC(01)0 SC(01)3	15
		SC(02)0 SC(02)3	100
		SC(03)0 SC(03)3	100
Trunk Dial Pulse Transmitter	2H122-01	SC(00)0 SC(00)3	50
		SC(01)0 SC(01)3	50
Trunk Dial Pulse Receiver	2H123-01	SC(00)0 SC(00)3	100
MF Receiver Circuit	2H124-01	SC(00)0 SC(00)3	30
		SC(01)0 SC(01)3	30
		SC(02)0 SC(02)3	30
		SC(03)0 SC(03)3	30
		SC(04)0 SC(04)3	30
		SC(05)0 SC(05)3	30

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
MF Receiver Circuit (Cont)		SC(06)0 SC(06)3	30
		SC(07)0 SC(07)1	100
		SC(07)2 SC(07)3	100
Coin Control—Dial Tone First and Range Extension	2H125-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)3	15
		SC(02)0 SC(02)3	100
Ringing Circuit	2H126-01	SC(00)0 SC(00)3	50
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
Ringing Circuit for Coded Superimposed Reverting and Off-and-On-Hook Ring Back	2H126-02	SC(00)0 SC(00)3	50
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
Transmission Test Terminations	2H127-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
		SC(02)0 SC(02)1	15

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Transmission Test Terminations (Cont)		SC(02)2 SC(02)3	15
Continuity Polarity Test	2H128-01	SC(00)0 SC(00)3	100
Station Ringer Test	2H129-02	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	25
		SC(01)1 SC(01)2	25
		SC(02)0 SC(02)3	50
Station Ringer Test Circuit	2H129-02	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	25
		SC(01)1 SC(01)2	25
TOUCH-TONE® Detector Test	2H131-01	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	100
		SC(02)0 SC(02)3	100
Tone Presence Detector	2H132-01	SC(00)0 SC(00)3	200
Dial Pulse Receiver Test	2H133-01	SC(00)0 SC(00)3	50
MF Test Environment	2H134-01	SC(00)0 SC(00)3	100
Ringing and Coin Control Test	2H135-01	SC(00)0 SC(00)1	50
		SC(00)2 SC(00)3	50

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Ringing and Coin Control Test (Cont)		SC(01)0 SC(01)3	50
Combined Milliwatt and Loop Around Test	2H136-02	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
3-Port Conference	2H137-01	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	100
		SC(02)0 SC(02)3	100
Interrupter Applique	2H138-01	SC(00)0 SC(00)1	100
		SC(00)2 SC(00)3	100
Outgoing Trunk Circuit Local Test Desk No. 14	2H141-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)3	15
Outgoing Trunk Circuit X-Bar TDM, CAMA, TSP, OR TSPS	2H144-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
Outgoing Trunk Circuit Repair Service Desk No. 2	2H147-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)3	100

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLES	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
2-Way Trunk Start Pulsing Signal	2H148-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	50
		SC(01)2 SC(01)3	50
Incoming Trunk Circuit Local Tandem—Delay Dial	2H149-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
Outgoing Trunk Circuit Coin Zone Dialing 3CL in Distant Building	2H151-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
		SC(02)0 SC(03)3	100
		SC(03)0 SC(03)3	100
		SC(04)0 SC(04)3	100
		SC(05)0 SC(05)3	100
Incoming Trunk Circuit from Distant S X S	2H154-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
Dial Pulse Repeater Circuit with Pulse Correction	2H155-01	SC(00)0 SC(00)1	50
		SC(00)2 SC(00)3	50

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Dial Pulse Repeater Circuit with Pulse Correction (Cont)		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
Code Call Interface Circuit Sleeve Lead Supervision	2H156-01	SC(00)0 SC(00)1	50
		SC(00)2 SC(00)3	50
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
2-Way Long Haul Trunk Circuit Dial Pulsing E&M Lead Supervision 4-Wire Term. Set	2H157-01	SC(00)0 SC(01)0	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)3	100
2-Way Long Haul Trunk Circuit MF Pulsing E&M Leads Supervision 4-Wire Term. Set	2H158-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
		SC(01)0 SC(01)3	100
Link/Trunk Switching Circuit	2H163-01	C CM	100
		FCG FCGM	100
		FD FDM	100
		F1 F1M	100

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Link/Trunk Switching Circuit (Cont)		F0 F0M	100
		G1 G1M	100
		G2 G2M	100
		G3 G3M	100
		G4 G4M	100
		G5 G5M	100
		G6 G6M	100
		G7 G7M	100
		G GF	100
		GFM GM	100
		O OG	100
		OGM OM	100
		SD SDM	100
		S1 S1M	100
		S0 S0M	100
		TF TFF	100
		TFFM TFM	100
		T1 T1M	100
		T0 T0M	100

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Attendant Loop Circuit	2H172-01	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	100
Foreign Exchange Trunk Circuit	2H174-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
6-Port Conference Circuit	2H176-01	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	100
		SC(02)0 SC(02)3	100
		SC(03)0 SC(03)3	100
		SC(04)0 SC(04)3	100
		SC(05)0 SC(05)3	100
Customer Dial Pulse Receiver Circuit	2H177-01	SC(00)0 SC(00)3	100
Foreign Exchange Trunk Circuit (Long Haul) Supervision on A and B Leads Ground Start	2H180-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15
Transmission Test Terminations Circuit	2H185-01	SC(00)0 SC(00)1	15
		SC(01)2 SC(01)3	15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
Line Access Trunk Circuit with or without Reverse Battery Supervision	2H186-01	SC(00)0 SC(00)1	15
		SC(00)2 SC(00)3	15 15
		SC(01)0 SC(01)1	15
		SC(01)2 SC(01)3	15
Master Scanner Applique	1A133-01	SC(00)0 SC(00)1	25
		SC(00)2 SC(00)3	25
Emergency Manual Line	1A156-01	SC(00)0 SC(00)3	100
		SC(01)0 SC(01)3	100
TOUCH-TONE Calling Detector	1A173-01	SC(00)0 SC(00)3	30
		SC(01)0 SC(01)3	30
		SC(02)0 SC(02)3	30
		SC(03)0 SC(03)3	30
		SC(04)0 SC(04)3	30
		SC(05)0 SC(05)3	30
		SC(06)0 SC(06)3	30
		SC(07)0 SC(07)3	30
		SC(08)0 SC(08)3	30

TABLE A
LEAD RESTRICTIONS (Cont)

CIRCUIT TITLE	SD NO.	CRITICAL LEAD DESIGNATION	COMBINED SERIES RESISTANCE LIMIT (OHMS)
TOUCH-TONE Station Test	1A199-01	SC(00)0 SC(00)3	30
		SC(01)0 SC(01)3	30
		SC(02)0 SC(02)3	30
		SC(03)0 SC(03)3	30
		SC(04)0 SC(04)3	30
		SC(05)0 SC(05)3	30
		SC(06)0 SC(06)3	30
		SC(07)0 SC(07)3	30
		SC(08)0 SC(08)3	30
Remote Master Scanner Applique	1A210-01	SC(00)0 SC(00)1	50
		SC(00)2 SC(00)3	50
Emergency Manual Line 3C or 3CL	1A243-01	SC(00)0 SC(00)3	100

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