NO. 1B NETWORK CONTROL POINT
DECRIPTION
COMMON CHANNEL SIGNALING SYSTEMS

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1. GENERAL

A. Introduction

1.01 This AT&T Practice describes the 1BNCP (No. 1B network control point) office (SD-3F045-01) used in a CCS (common channel signaling) network. A 1BNCP is referred to hereafter in this practice as an NCP (network control point).

1.02 This AT&T Practice is a general revision and as such no revision arrows are used to denote changes.

1.03 An NCP contains the hardware, software, and data base information used to provide a variety of custom routing and billing services. Service-related queries from offices in a CCS network are routed using the CCS packet switching technique to an NCP where replies are formulated and returned to the originating offices.

1.04 The NCP generic program (1NCPx) provides a support environment for software that makes possible a particular service or set of services. A generic program that provides a particular service or set of services is called an NCP application. The number of applications each NCP is capable of supporting depends on the application memory requirements. The memory requirements vary with each application.

B. CCS Network Relationship

1.05 An NCP is connected to a CCS network via an STP (signal transfer point) office. An STP acts as a switching center to route packets of signaling information (service-related queries and replies) to their appropriate destinations. An NCP is connected to an STP by a ring-based architecture and digital 56-kbps (kilobits per second) A-links (access signaling links) with no length limitations. An NCP may terminate a maximum of eight A-links.

2. PHYSICAL DESCRIPTION

2.01 An NCP uses the AT&T 3B20D model 3 computer and its peripherals. The 3B20D model 3 computer is specifically designed to provide duplex computer, memory, data storage, and associated input/output peripherals. The peripherals are tailored for use specifically with an NCP but are not considered part of the basic 3B20D computer. Most of the hardware components in an NCP are a part of the 3B20D computer. Other hardware consists of 3B20D computer peripherals to the NCP, to the digital 56-kbps signaling links, and to the operations support systems.

2.02 The basic floor plan for an NCP is shown in Fig. 1. An NCP consists of the following equipment:

(a) Processor cabinets 0 and 1 — J1C187A-1

(b) Tape/disk cabinets 0 and 1 — J1C186A-1

(c) Ring node cabinet — J3F011D-1

(d) Digital facility access/alarm cabinet — J3F010C-1

(e) Power distribution cabinet — J1C185A-1

(f) Maintenance/administrative positions.

2.03 All cabinets are 6 feet tall, 26 inches wide, and 30 inches deep. The cabinets are bolted together side by side. Each cabinet is equipped with doors front and back, casters, and insulating, nylon-tipped, adjustable leveling feet.

A. Processor Control Cabinets

2.04 An NCP is equipped with two processor control cabinets (PROC0 and PROC1) as shown in Fig. 2. Each processor control cabinet contains the following equipment:

(1) Power distribution unit

(2) Central processor unit

(3) Main store, input/output, and disk file controller unit

(4) Main store and input/output processor growth unit

(5) Input/output processor basic unit

(6) Cooling unit

(7) Port switch unit (PROC0 only).

The units housed in processor cabinet PROC0 are designated as "0" units, and the units housed in processor cabinet PROC1 are designated as "1" units. For example, DFC0 (disk file controller 0) is housed in processor cabinet PROC0, and DFC1 is housed in processor cabinet PROC1.

Power Distribution Unit

2.05 The power distribution unit (Fig. 3) is comprised of six 30D fuse blocks, receptacles, and terminal strips. The unit uses 70- and 74-type fuses. The 74-type fuse is fast-blow fuse, and the 70-type fuse is a slow-blow fuse, which provides a visual indication of a blown fuse. The power distribution unit distributes —48 Vdc to units on the processor cabinet.

Central Processor Unit

2.06 The central processor unit consists of the circuit packs shown in Fig. 4. The central processor unit is powered by two 495FA power converters and controlled by a power control circuit pack (Fig. 5). The power control circuit pack provides manual power switches, LED status indicators, control switches, and a 5-volt power-up initialization supply.

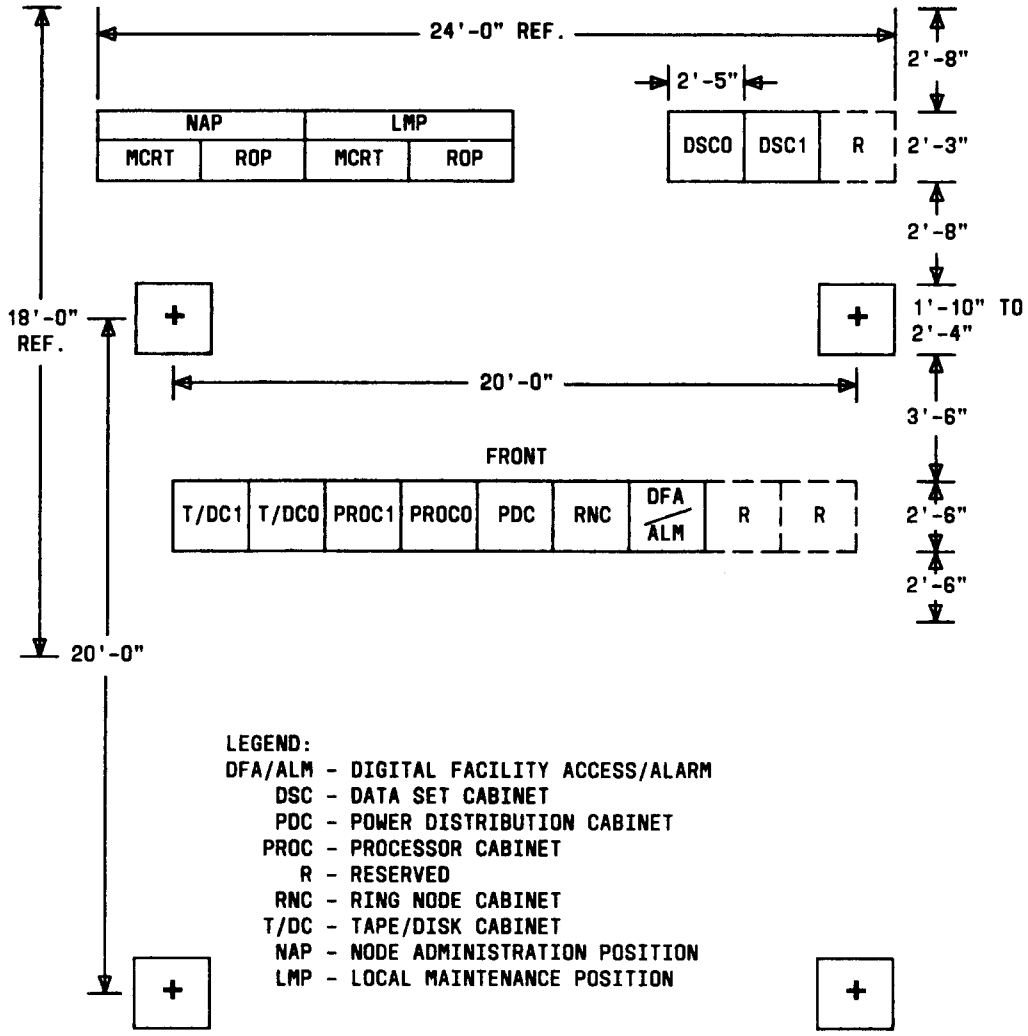


Fig. 1—1BNCP Basic Floor Plan

Main Store, Input/Output, and Disk File Controller Unit

2.07 The main store, input/output, and disk file controller unit (Fig. 6) consists of circuit packs that make up the input/output system interface, disk file controller, and main store. The main store, input/output system interface, and disk file controller are powered by two 495FA power converters and controlled by a power control circuit pack (Fig. 5). The power control circuit pack provides manual power switches, LED status indicators, control switches, and a 5-volt power-up initialization supply.

2.08 The main store portion of the unit has positions for eight main store array circuit packs. The main store may contain TN28 or TN56 main store array circuit packs. The TN28 circuit pack has a 1 Mbyte (megabyte) memory capacity, and the TN56 circuit pack has a 2 Mbyte memory capacity. The TN28 and TN56 circuit packs can not be mixed on the same processor control cabinet due to hardware changes.

Input/Output Processor Basic Unit

2.09 The IOP (input/output processor) basic unit houses circuit packs for the IOP, peripheral community 0, and peripheral community 1 as shown in Fig. 7. Each peripheral community consists of up to four peripheral controller circuit packs. The spe-

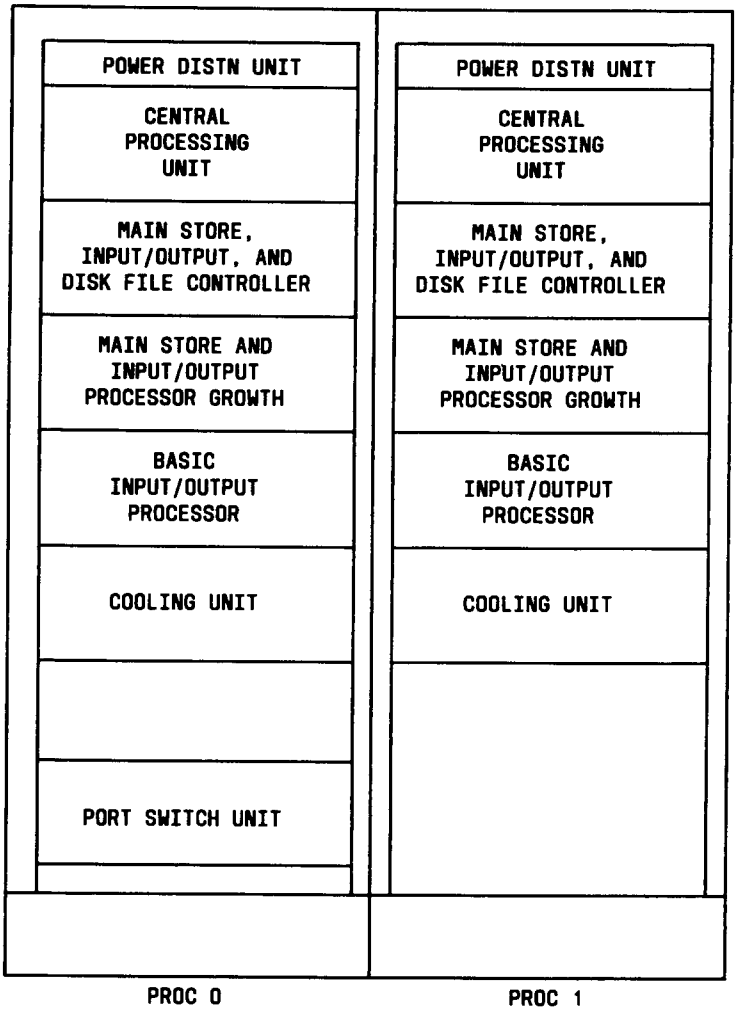


Fig. 2—Processor Control Cabinets

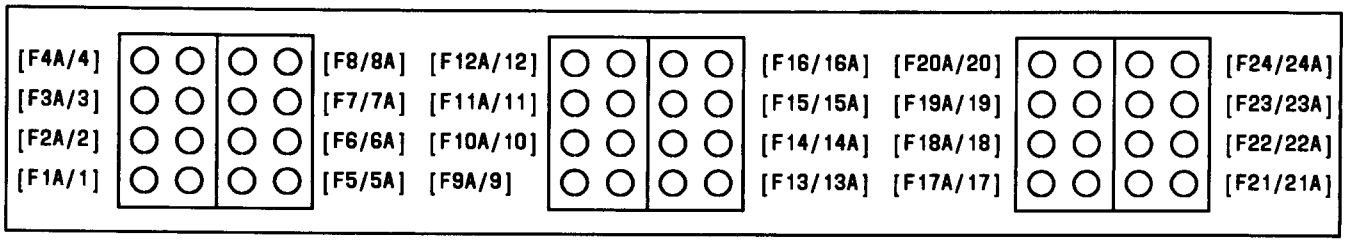
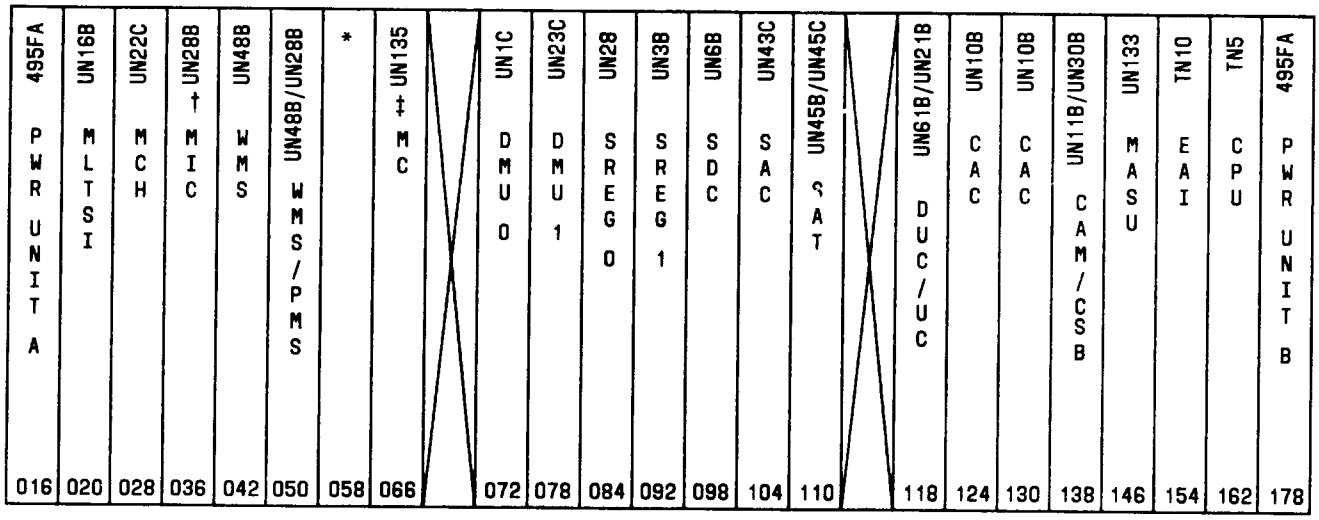


Fig. 3—Power Distribution Unit



LEGEND:
- CAC - CACHE CONTROL
- CAM - CACHE MEMORY
- CPU PC - CENTRAL PROCESSOR UNIT POWER CONTROL
- CSB - CACHE STORE BOARD
- DMU - DATA MANIPULATION UNIT
- EAI - EMERGENCY ACTION INTERFACE
- FPU - FLOATING POINT UNIT
- MASU - MAIN STORE UPDATE
- MC - MICROCONTROLLER
- MCH - MAINTENANCE CHANNEL
- MIC - MICROSTORE (PROGRAMMABLE)
- MLTSI - MICROLEVEL TEST SET INTERFACE
- PMS - PROGRAMMABLE MICROSTORE
- SAC - STORE ADDRESS CONTROL
- SAT - STORE ADDRESS TRANSLATOR
- SDC - STORE DATA CONTROL
- SREG - SPECIAL REGISTERS
- UC - UTILITY CIRCUIT
- WMS - WRITABLE MICROSTORE

* CAN BE:
- UN140 (FPU)
- UN48B (WMS)
- UN28B (PMS)

† CAN BE:
- MC4C077A1 (UN288)
- MC4C077A1B (UN288)

‡ MC4C076A1 (UN135)

Fig. 4—Central Processor Unit

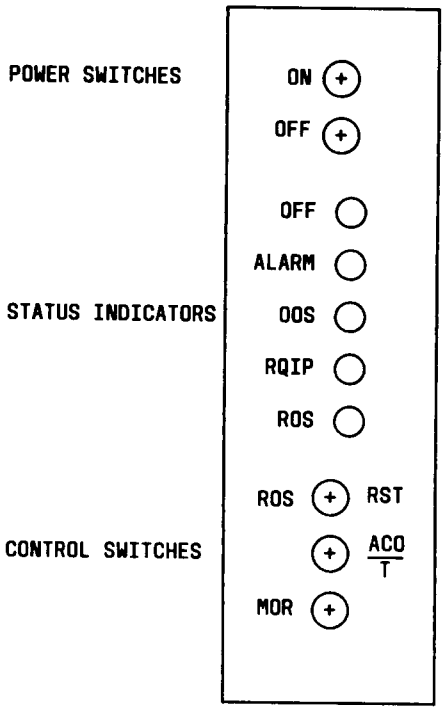
cific peripheral controller circuit packs are equipped according to the NCP application.

2.10 Each peripheral community is also equipped with TN9 circuit packs, which provide independent +12 and −5 volts for peripheral controller memories and +/−12 volts for communication interfaces. The 495FA power unit H on the right side of the unit provides 5-volt logic power for the IOP control portion and community 0. The 494GA power unit J provides 5-volt logic power for community 1. The 495FA power unit G on the left side of the unit provides 5 volts for the central processor unit growth. The IOP power control circuit pack (TN6 circuit pack) (Fig. 5) provides manual power switches, LED status indicators, control switches, and a 5-volt power-up initialization supply.

Main Store and Input/Output Processor Growth Unit

2.11 The main store and IOP (input/output processor) growth unit (Fig. 8) has positions for eight additional main store array circuit packs and two peripheral communities (2 and 3). Each peripheral community consists of up to four circuit packs. The specific peripheral controller circuit packs are equipped according to the NCP application.

2.12 Each peripheral community is also equipped with a TN9 circuit pack, which provides inde-



LEGEND:
- ACO - ALARM CUTOFF SWITCH
- MOR - MANUAL OVERRIDE SWITCH
- OOS - OUT OF SERVICE
- ROS - REQUEST OUT OF SERVICE
- RQIP - REQUEST IN PROGRESS
- RST - REQUEST RESTORE TO SERVICE SWITCH
- T - LAMP TEST SWITCH

Fig. 5—Power Control Circuit Pack

pendent +12 volts and —5 volts for peripheral controller memories and +/—12 volts for communication interfaces. The 495FA power unit E on the left side of the growth unit supplies 5 volts logic power for both peripheral communities. The power unit F on the right side supplies 5 volts logic power for the main store and IOP growth circuit packs.

Cooling Unit

2.13 The cooling unit (Fig. 9) consists of two fan tray assemblies. Each fan tray assembly is equipped with two —48 Vdc powered fans, a mesh air filter to trap dust particles, and a fan failure detector circuit. The four fans blow air upward through the equipment mounted on the processor cabinet. Each fan tray assembly also provides two fan failure LED indicators (FAN A and B), a red power off switch (OFF), and a green on/reset switch (ON/RESET).

Port Switch Unit

2.14 The port switch unit (Fig. 10) is located at the bottom of PROC0 (processor cabinet 0). The port switch unit contains two port switches (TF4 circuit packs) and two scanner/signal distributor interface circuit packs (TF2). One port switch serves the local MCRT (maintenance cathode-ray tube) and the other port switch serves the local maintenance ROP (read-only printer). The function of a port switch is to ensure that the device (MCRT or ROP) is connected to the primary operating central processor through IOP basic unit IOPB0 or IOPB1. The signal distributor interface circuit packs connect system alarms to office alarms.

B. Tape/Disk Cabinets

2.15 An NCP is equipped with two tape/disk cabinets (T/DC0 and T/DC1) as shown in Fig. 11. Each tape/disk cabinet has a power distribution unit (located at the top of each cabinet) consisting of four 30D fuse blocks. The 30D fuse blocks are used to distribute —48 Vdc to the cabinet units.

2.16 The tape/disk cabinet T/DC0 houses one KS-23113 magnetic tape drive unit and four KS-22875, L11 340-Mbyte (megabyte) fixed storage disk drives (disks 0 through 3). Each 340-Mbyte fixed storage disk drive has its own KS-22997, L2 power supply and ED-4C480 power switch. A 340-Mbyte fixed storage disk drive is shown in Fig. 12. The storage medium for the 340-Mbyte disk drive is a rigid platter arrangement, not removable from the disk drive assembly.

2.17 The magnetic tape drive unit (Fig. 13) has a plastic-hinged front cover to protect the tape transport from dust and foreign matter. A transparent window in the front allows tape motion to be seen. The cutout in the front cover allows access to the control panel.

2.18 The tape/disk cabinet T/DC1 has space for eight 340-Mbyte disk drives, but the NCP currently uses only four 340-Mbyte disk drives on T/DC1 (disks 4 through 7). An NCP office currently uses eight 340-Mbyte disk drives; disks 0 through 3 on T/DC0 and disks 4 through 7 on T/DC1 as shown in Fig. 11.

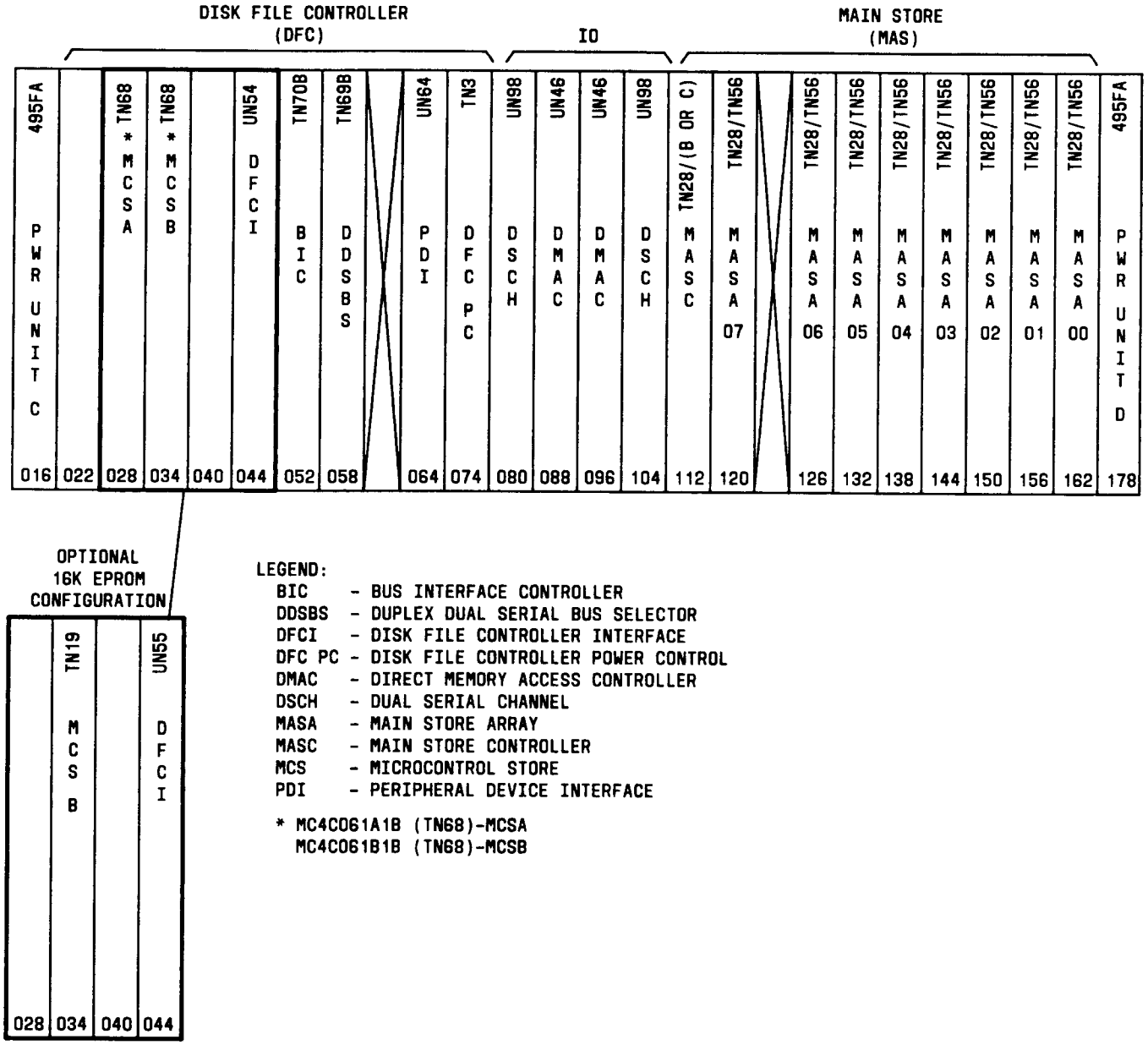


Fig. 6—Main Store, Input/Output, and Disk File Controller Unit

C. Ring Node Cabinet

2.19 An NCP is equipped with one ring node cabinet as shown in Fig. 14. The ring node cabinet is equipped with the following:

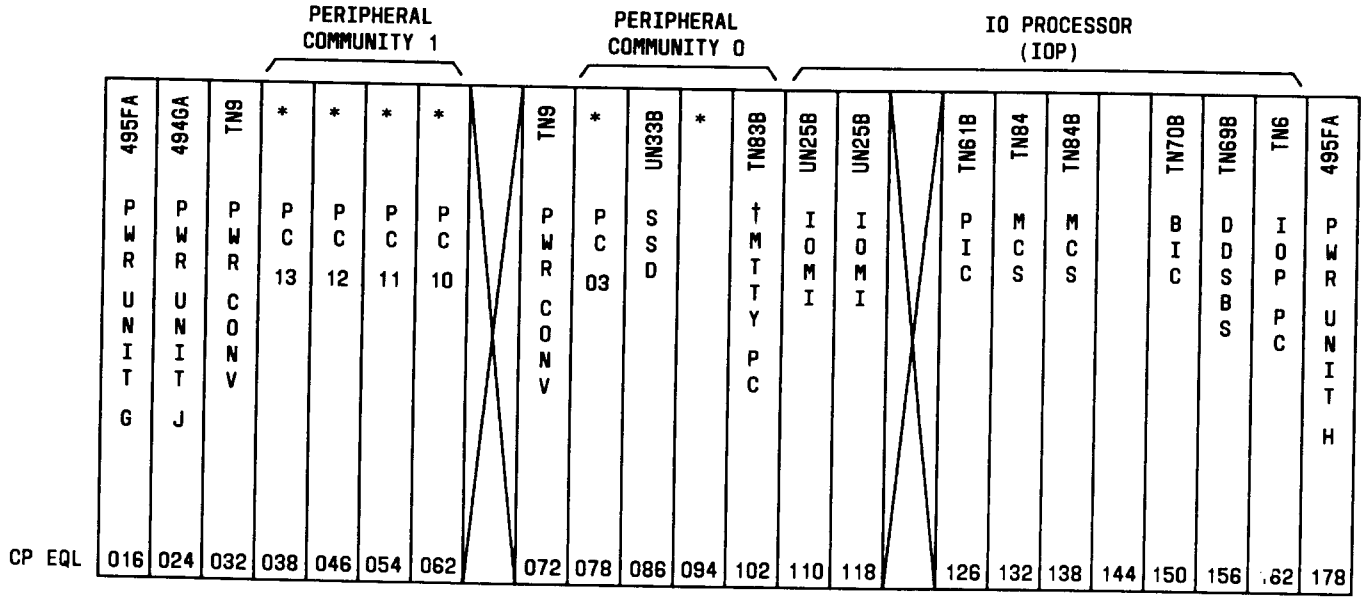
(a) Fuse panel and alarm control unit

(b) Link node unit B (two units)

(c) 3B interface unit (two units)

(d) Cooling unit

(e) Two plenum cover assemblies.



LEGEND:

BIC - BUS INTERFACE CONTROLLER
DDSBS - DUPLEX DUAL SERIAL BUS SELECTOR
IOMI - INPUT OUTPUT MICROPROCESSOR INTERFACE
IOP PC - INPUT OUTPUT PROCESSOR POWER CONTROL
MCS - MICROCONTROL STORE
MTTY PC - MAINTENANCE TTY PERIPHERAL CONTROLLER
PC - PERIPHERAL CONTROLLER
PIC - PERIPHERAL INTERFACE CONTROLLER
SSD - SCANNER/SIGNAL DISTRIBUTOR

TN74B(MC4C011A1B) - ASYNCHRONOUS LINE CONTROLLER
TN75C(MC4C048A1B) - SYNCHRONOUS LINE CONTROLLER
TN82 - DIRECT USER INTERFACE CONTROLLER

UN134(MC4C087A1) - TAPE CONTROLLER
UN52 - TAPE CONTROLLER
UN145 - TAPE CONTROLLER USED WITH KS-23113,L12 RECORDER FOR FAST BACKUP FEATURE
TN82(MC4C062, ISSUE 2) - HIGH SPEED SYNCHRONOUS DATA LINK CONTROLLER
TN82(MC4C051A1) - DIRECT USER INTERFACE CONTROLLER

* SPECIFIC PERIPHERAL CONTROLLER (PC) CIRCUIT PACKS (EQUIPPED PER APPLICATION):

† CAN BE EQUIPPED WITH A TN83 OR TN983 (MC4C132A1)

Fig. 7—Input/Output Processor Basic Unit

The plenum cover assemblies force air from the cooling unit through to the top of the ring node cabinet.

Fuse Panel and Alarm Control Unit

2.20 The fuse panel and alarm control unit (Fig. 15) consists of the following:

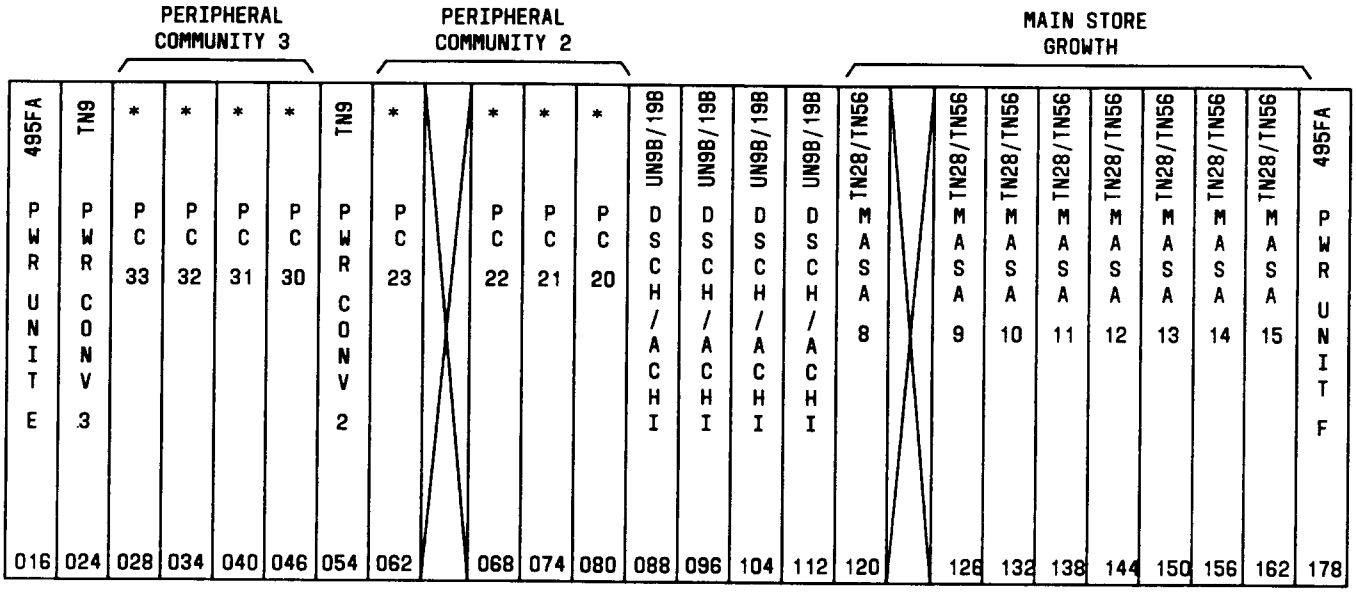
(a) An alarm cutoff key (ALARM CUTOFF), a lamp test key (LAMP TEST), and a power alarm reset key (ALARM RESET) which contains the power alarm lamp.

(b) Jacks for one portable data terminal (TTY), an office telephone (TEL), and a spare (SPARE).

(c) Six 30D fuse blocks connected to six cabinet power feeders distribute power to ring node cabinet units.

(d) Alarm relays MNA, MNB, MJA, and MJB connected to the NCP office alarm unit (not shown in Fig. 15)

(e) Terminal strips (not shown in Fig. 15).



LEGEND:
ACHI - APPLICATION CHANNEL INTERFACE
DSCH - DUAL SERIAL CHANNEL
MASA - MAIN STORE ARRAY
PC - PERIPHERAL CONTROLLER

* SPECIFIC PERIPHERAL CONTROLLER (PC) CIRCUIT PACKS (EQUIPPED PER APPLICATION).

Fig. 8—Main Store and Input/Output Processor Growth Unit

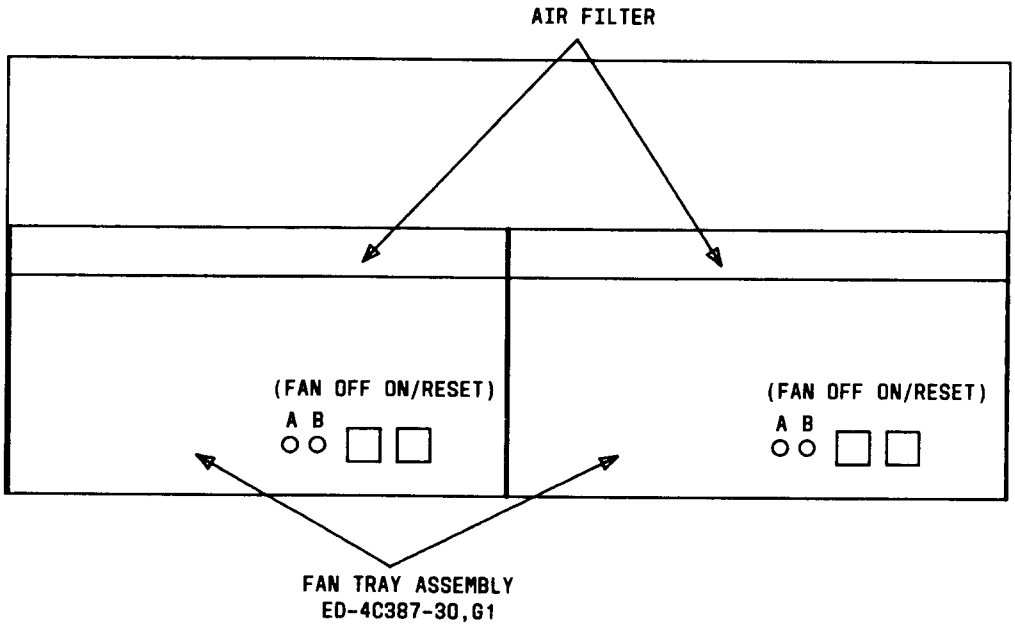


Fig. 9—Cooling Unit

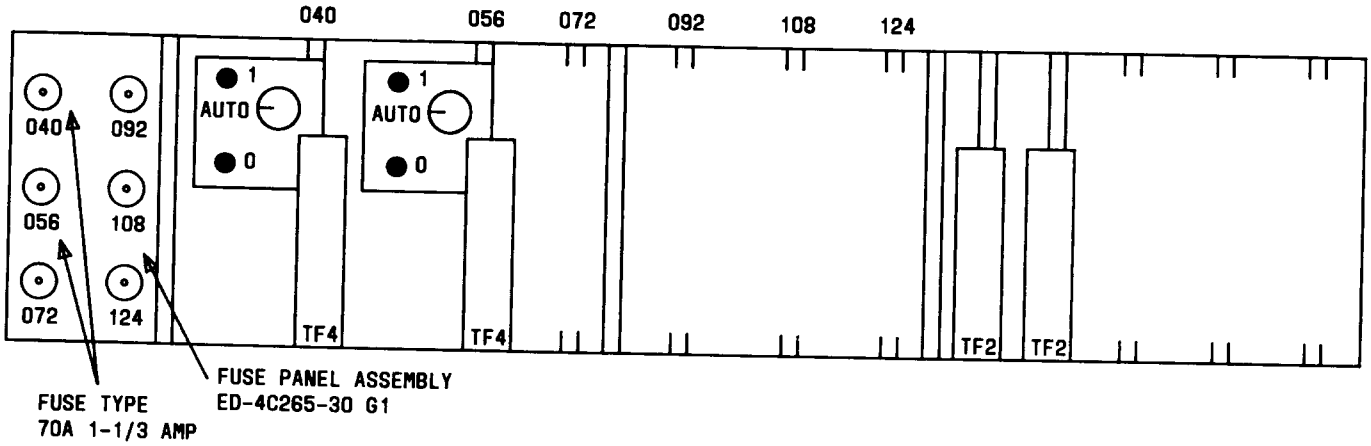


Fig. 10—Port Switch Unit

The fuse panel and alarm control unit provides various control, communication, power distribution, and alarm functions.

Link Node Unit B

2.21 The ring node cabinet is equipped with two B-type link node units as shown in Fig. 14. Each link node unit (Fig. 16) is arranged to house two dc-dc power converters, two padded interframe buffers, circuit packs for three link nodes, and the required backplane wiring connections.

3B Interface Unit

2.22 The ring node cabinet is equipped with two 3B interface units as shown in Fig. 14. Each 3B interface unit (Fig. 17) is equipped with two dc-dc power converters, two padded interframe buffers, circuit packs for one ring peripheral controller node, circuit packs for one link node, and the required backplane wiring.

Cooling Unit

2.23 The cooling unit (Fig. 9) consists of two fan tray assemblies. Each fan tray assembly is equipped with two —48 Vdc powered fans, a mesh air filter to trap dust particles, and a fan failure detector circuit. The four fans blow air upward through the equipment mounted on the ring node cabinet. Each fan tray assembly also provides two fan failure LED indicators (FAN A and B), a red power off switch (OFF), and a green on/reset switch (ON/RESET).

D. Digital Facility Access/Alarm Cabinet

2.24 The digital facility access cabinet (Fig. 18) consists of the following:

(a) Fuse panel and alarm control unit

(b) Alarm unit

(c) Digital service unit mountings 0 and 1

(d) AC distribution panel units 0 and 1

(e) Channel service unit mountings 0 and 1

(f) Digital service adapter unit

(g) AC power unit mounting.

Fuse Panel and Alarm Control Unit

2.25 The fuse panel and alarm control unit (Fig. 19) consists of the following:

(a) An alarm cutoff key (ALARM CUTOFF), a lamp test key (LAMP TEST), and a power alarm reset key (ALARM RESET) which contains the power alarm lamp.

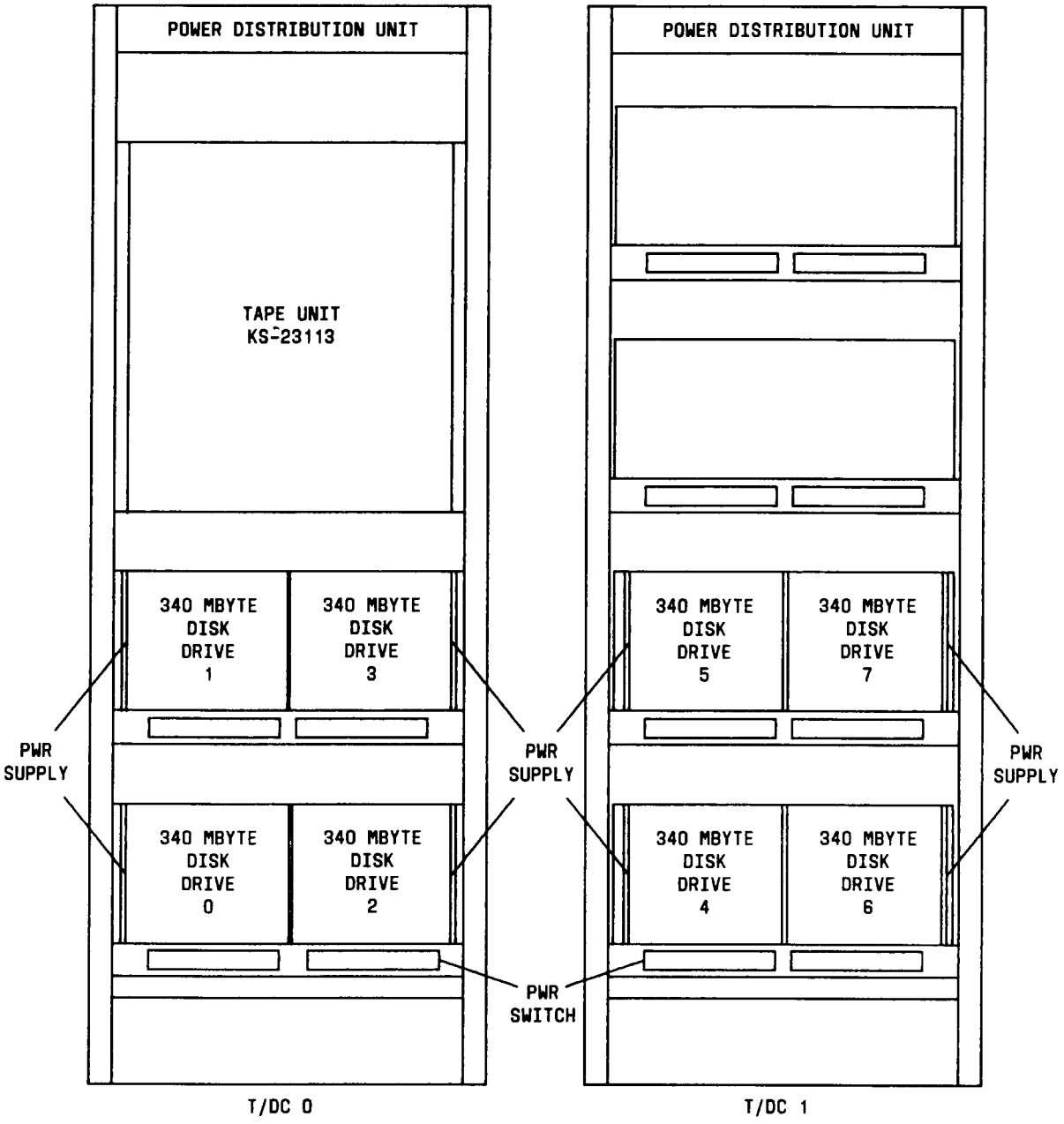


Fig. 11—Tape/Disk Cabinets

(b) Jacks for one portable data terminal (TTY), and office telephone (TEL), and a spare (SPARE).

(c) Two 30D and four 23A fuse blocks to distribute power to digital facility access cabinet units.

(d) Alarm relays MNA, MNB, MJA, and MJB (not shown in Fig. 19).

(e) Terminal strips (not shown in Fig. 19).

The fuse panel and alarm control unit provides various control, communication, power distribution, and alarm functions.

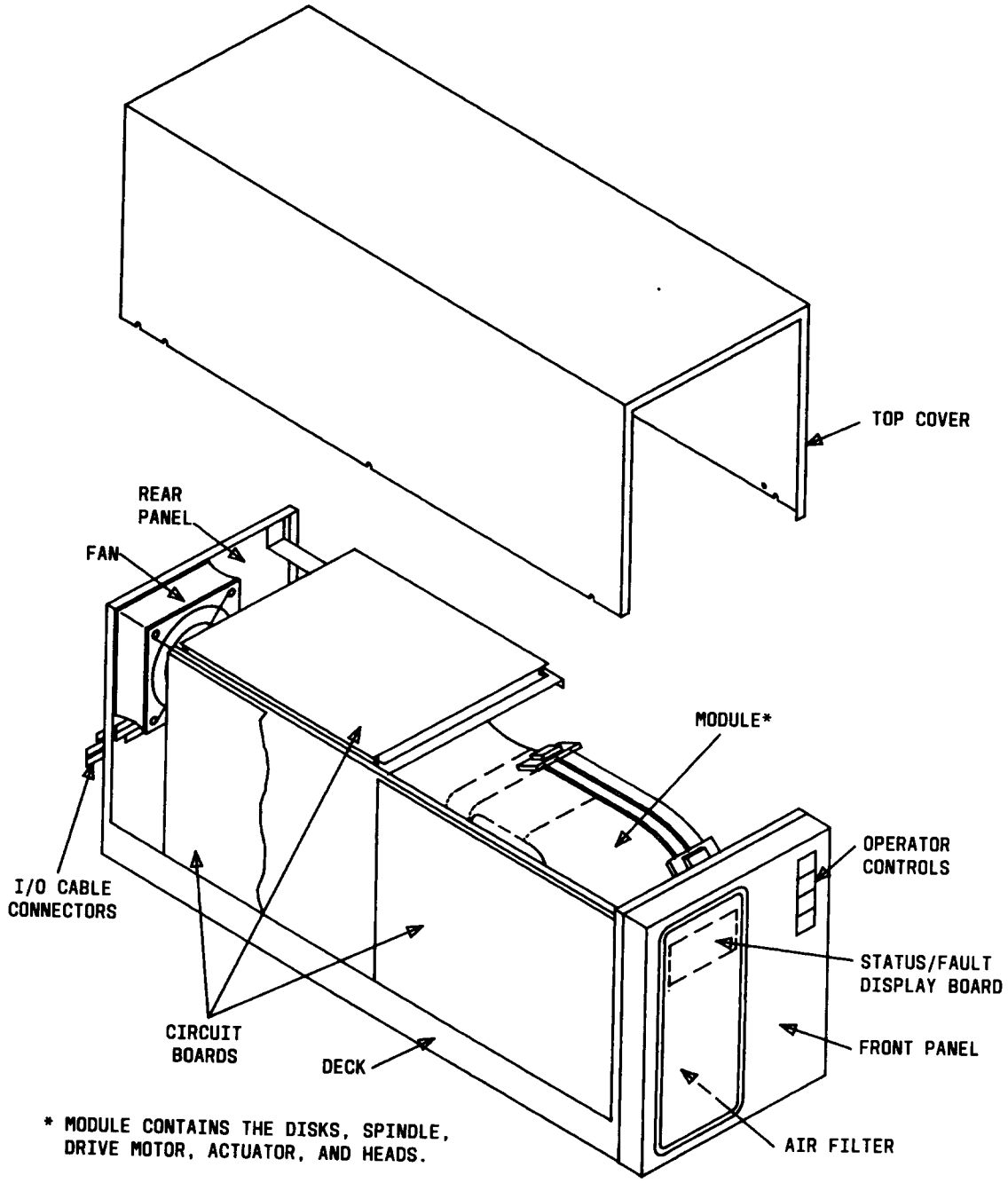


Fig. 12—340-Megabyte Fixed Storage Disk Drive

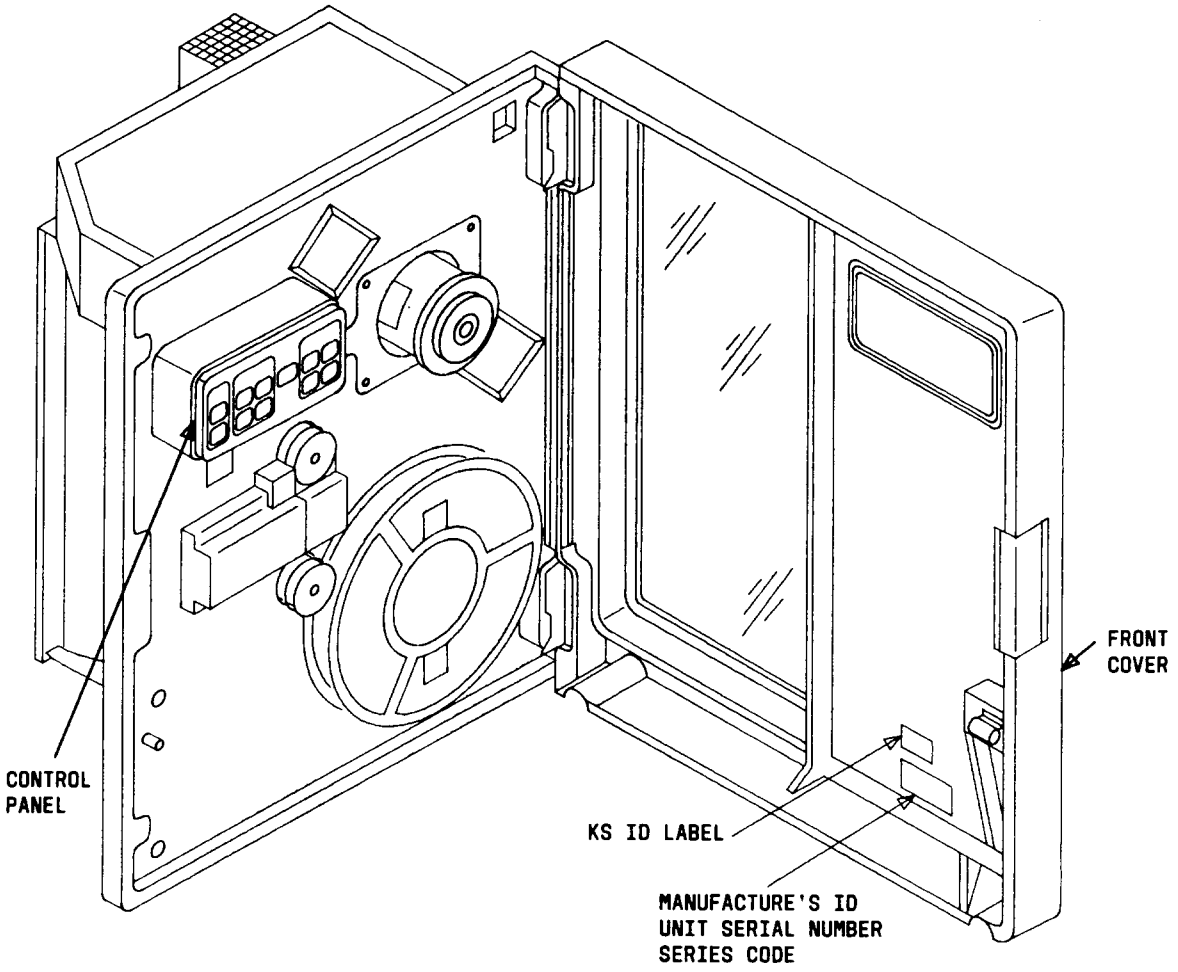


Fig. 13—Tape Unit

Alarm Unit

2.26 The alarm unit (Fig. 20) consists of the following:

(a) System alarm relays SMJ, SMN, CRI, RAC0, IR, and FLR

(b) Power alarm relays PMJ, PMN, and BD

(c) Aisle alarm relays MJ0-MJ3 and MN0-MN3

(d) Repeating coil RC1

(e) Inductor L1

(f) Tone generator circuit pack TG

(g) Terminal strips (not shown in Fig. 20).

2.27 The alarm unit collects NCP office alarms and provides the corresponding audible and visual status indications.

Digital Service Unit Mountings

2.28 The digital facility access cabinet is equipped with two digital service unit mountings as shown in Fig. 18. Each digital service unit mounting may house a maximum of five *DATAPHONE** Z2556A data service units. Each Z2556A data service unit is equipped with a *CT*† 8000 adapter kit. Each

* Registered trademark of AT&T.

† Trademark of Commutech Incorporated.

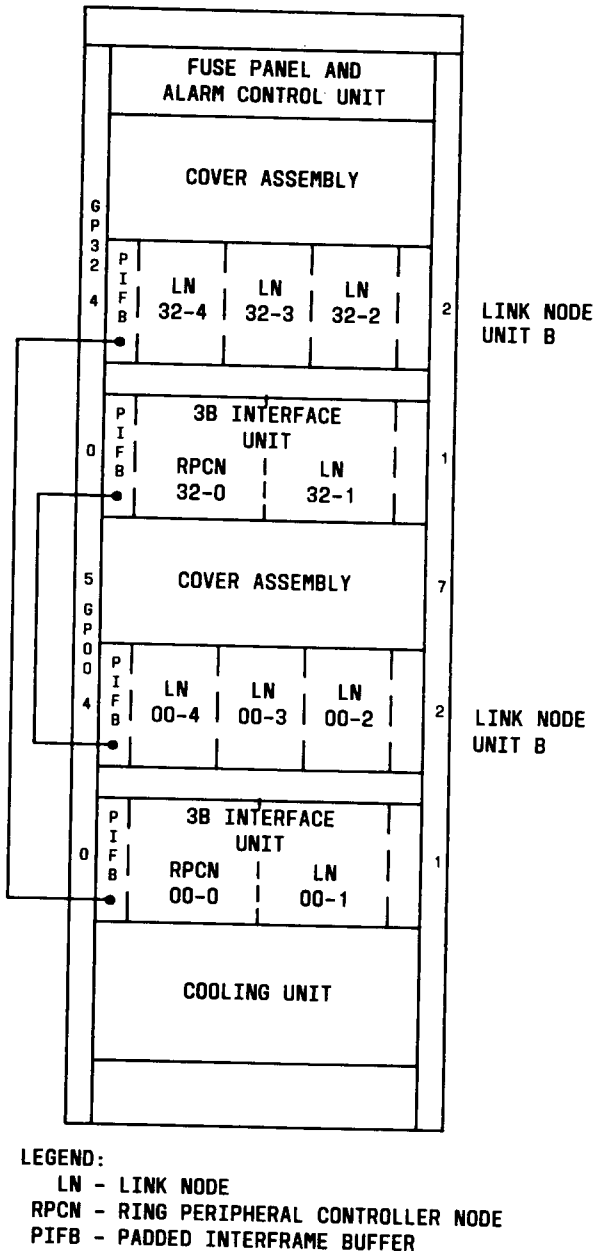


Fig. 14—Ring Node Cabinet

CT 8000 adapter kit consists of a special mounting bracket and a lead adapter for the line side of the data service unit. Each Z2556A data service unit is associated with a digital service adapter (TF5 circuit pack).

AC Distribution Panel Units

2.29 The digital facility access cabinet is equipped with two ac distribution panel units as shown in Fig. 18. Each ac distribution panel unit is rear mounted and consists of five double ac outlets and one connector plug on the rear panel. The ac distribution panel units obtain 120 Vac from the ac power units housed in the ac power unit mounting and distribute it to the Z2556A data service units in the digital service unit mountings.

Channel Service Unit Mounting

2.30 Each channel service mounting is equipped with a terminal strip (P1) located at the rear of the unit. The terminal strip is used to connect cabling from the digital service adapter unit to the transmission facility.

Digital Service Adapter Unit

2.31 The digital service adapter unit (Fig. 21) consists of ten digital service adapters (TF5 circuit packs) and the required backplane wiring. Each digital service adapter is associated with a data service unit and provides two switches (S1A and S1B). These switches are set for 56-kbps operation (S1A ON and S1B OFF).

AC Power Unit Mounting

2.32 The ac power unit mounting (Fig. 22) consists of two ac power units (PU0 and PU1). Each ac power unit consists of a 495H1 and 393A power module. The ac power units obtain —48 Vdc from the fuse panel and alarm control unit and provide 120 Vac to the ac distribution panel units.

E. Power Distribution Cabinet

2.33 The power distribution cabinet (Fig. 23) consists of a filter fuse panel and a control panel. The power distribution cabinet requires two —48 Vdc power feeders (A and B) from a dc source. The filter fuse panel is divided in half with each half receiving a dedicated —48 Vdc input on a cable pair (—48 Vdc and return) from the local battery plant. The —48 Vdc is then distributed from the filter fuse panel to the power distribution units located at the top of each cabinet. The control panel contains alarm and charging circuits to include a charging probe.

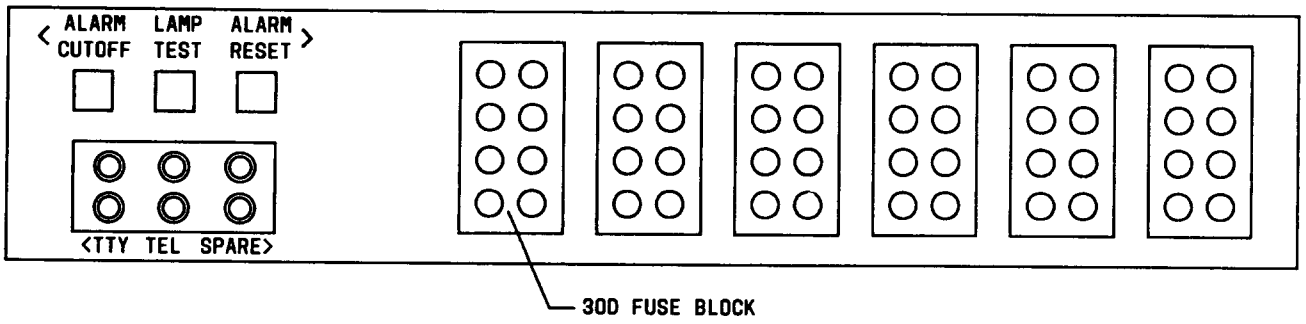


Fig. 15—Fuse Panel and Alarm Control Unit

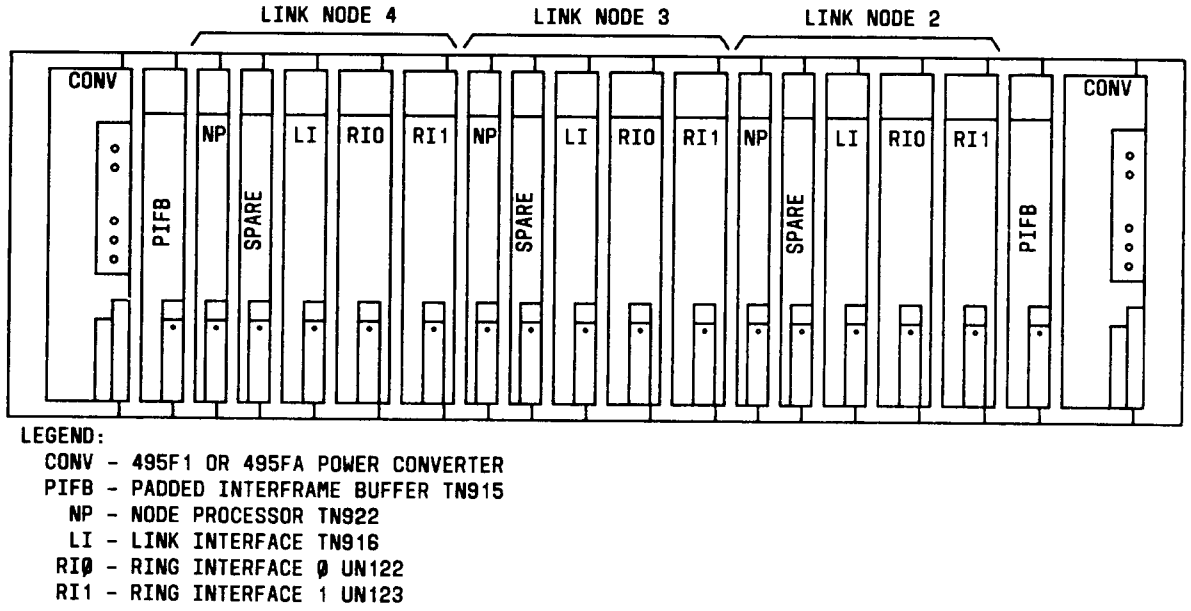


Fig. 16—Link Node Unit B

F. Maintenance/Administrative Positions

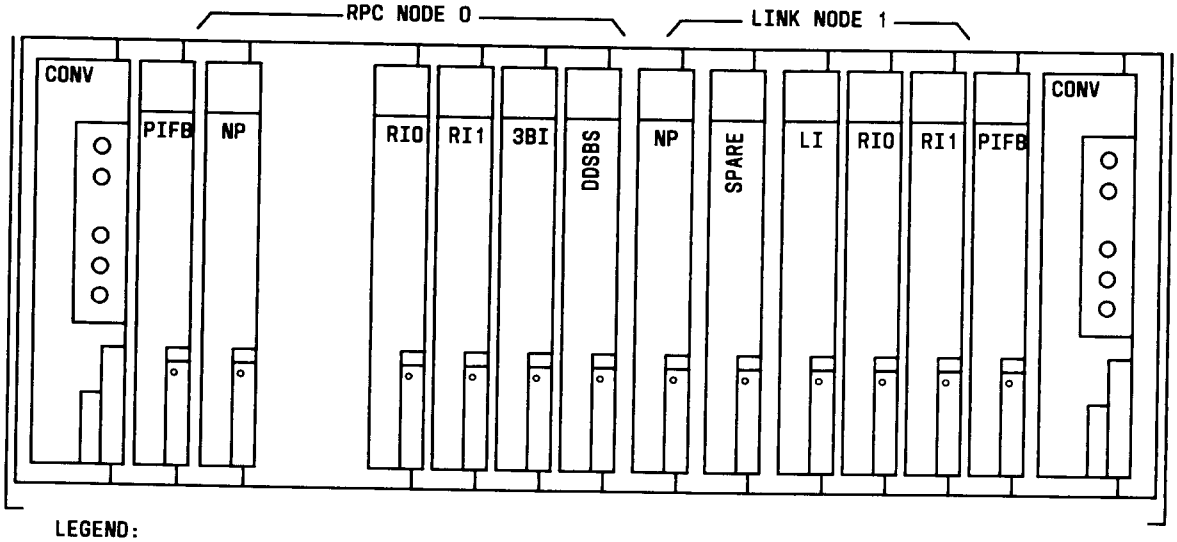
Local Maintenance Position

2.34 The local maintenance position (LMP0) is the craft maintenance interface to an NCP. The LMP0 consists of the local MCRT (maintenance cathode-ray tube) terminal and the local maintenance ROP (receive-only printer). The local MCRT is a KS-22921, L1 color video terminal and the local maintenance ROP is a *Teletype** model 40 ROP. The MCRT terminal accepts maintenance input commands via a keyboard and displays responses and system status. The ROP provides a permanent copy of maintenance activity for future reference. The LMP0 is connected to the IOP0 and IOP1 units via the port switch.

Node Administration Position

2.35 The node administration position (NAP0) consists of an MCRT color terminal (KS-22921, L1) and a model 40 ROP. The NAP0 may be located in the immediate vicinity of an NCP and provides a recent change capability. The NAP0 also provides access to various NCP performance reports. The NAP0 is connected to IOP0.

* Registered trademark of AT&T.



LEGEND:
- CONV - 495F1 OR 495FA POWER CONVERTER
- PIFB - PADDED INTERFRAME BUFFER TN915
- NP - NODE PROCESSOR TN922
- LI - LINK INTERFACE TN916
- RIØ - RING INTERFACE Ø UN122
- RI1 - RING INTERFACE 1 UN123
- 3BI - 3B INTERFACE TN914
- DDSBS - DUPLEX DUAL SERIAL CHANNEL SELECTOR TN69B
- RPC - RING PERIPHERAL CONTROLLER

Fig. 17—3B Interface Unit

Remote Maintenance Position

2.36 The remote maintenance position (RMP) consists of an MCRT color terminal (KS-22921, L1) and an optional model 40 ROP. The RMP displays system status and provides for limited maintenance functions. The RMP is located in a remote maintenance center which is staffed continuously. The RMP is connected to IOP1.

3. FUNCTIONAL DESCRIPTION

3.01 Figure 24 shows a functional block diagram of an NCP. An NCP provides two independent duplicated central processors represented physically by PROC0 and PROC1 in Fig. 2. The central processors are represented in the NCP functional block diagram as CU0 (control unit 0) and CU1 (control unit 1). A central processor consisting of the central processor unit, main store, direct memory access, and input/output bus functions is switchable (on-line/off-line). One central processor is always on-line. The on-line central processor keeps both main stores (on-line and off-line) and the disk drives up to date in case a central processor switch is necessary.

A. Central Processor Unit

3.02 The central processor unit is represented functionally in Fig. 24 as the CC (central control) in each processor (CU0 and CU1). The central processor unit provides high-speed control functions (logic, control, and arithmetic processes) required by an NCP. The central processor unit is a microprogrammed processor using a read-only memory to contain a series of microinstructions which direct the activity of the 3B20D computer. Fields within the microinstructions are used to define the type of destination registers, define operations to be performed, provide part of the address of the next instruction, and provide check bits to verify proper operation of the microstore. There are sixteen 32-bit general registers in the central processor unit that are usable. The central processor unit also contains special registers used to store the results of internal operations.

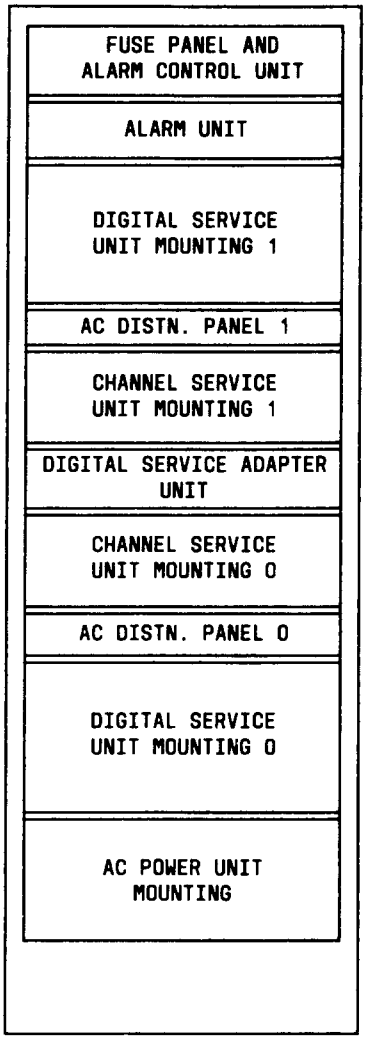


Fig. 18—Digital Facility Access/Alarm Cabinet

B. Main Store

3.03 The MAS (main store) is a 40-bit semiconductor-type memory used to store program instructions and data. The central processor is a 32-bit machine; each word stored in the MAS consists of four 8-bit bytes of information. The MAS is full-word (32 bits), half-word (16 bits), or byte (eight bits) addressable by the central processor unit. The communication path between the MAS and other units is via the MAS bus. The MAS bus is a combination of three buses: a control bus, an address bus, and a data bus. A single main store controller circuit pack interfaces the MASA circuit packs with the MAS bus.

3.04 The basic element of the MAS is the MASA (main store array) circuit pack. Depending upon the option selected, each MASA circuit pack contains one megabyte (TN28 circuit pack), or two megabytes (TN56 circuit pack) of dynamic, volatile, random-access semiconductor memory. Dynamic means that the stored memory data is not permanent and must be refreshed at definite time intervals or the stored information will be lost. Volatile means that, if power is interrupted, stored information is lost. Random-access means that any address in the MAS may be read out or written into on command without regard to previous or subsequent addresses.

3.05 The MAS is used to store the NCP generic program (1NCPx) and any application programs. The 1NCPx generic program requires 7 megabytes of MAS memory. Additional memory may be added to support the NCP application programs. The maximum MAS memory capacity of an NCP is 16 megabytes.

3.06 In normal operation, one central processor unit (including the MAS) is active and the other is standby. The active central processor unit writes into the active MAS and the standby MAS. This provides an up-to-date backup MAS should a central processor switch become necessary because of an error condition.

C. Direct Memory Access System

3.07 The NCP direct memory access system (DMA 0-0 and DMA 1-0 as shown in Fig. 24) provides the capability for direct data transfers between the MAS and peripheral devices. A NCP has a large number and variety of peripherals to accommodate, a wide range of device speeds (TTY versus disk), and operational processing differences. The DMA system transfers large blocks of data to or from the 340-Mbyte disk drives via the disk file controllers. The DMA system also controls a large number of slower speed devices, such as TTYs, through the IOPs (input/output processors). The DMA system of each central processor is equipped with two DMAC (direct memory access controller) and a maximum of six DSCH (dual serial channel) circuit packs located on the MAS, I/O, and DFC unit (Fig. 6) and the MAS and IOP growth unit (Fig. 8).

3.08 A DMAC provides and controls the facility for moving data between peripheral devices and MAS without involving the central processor unit

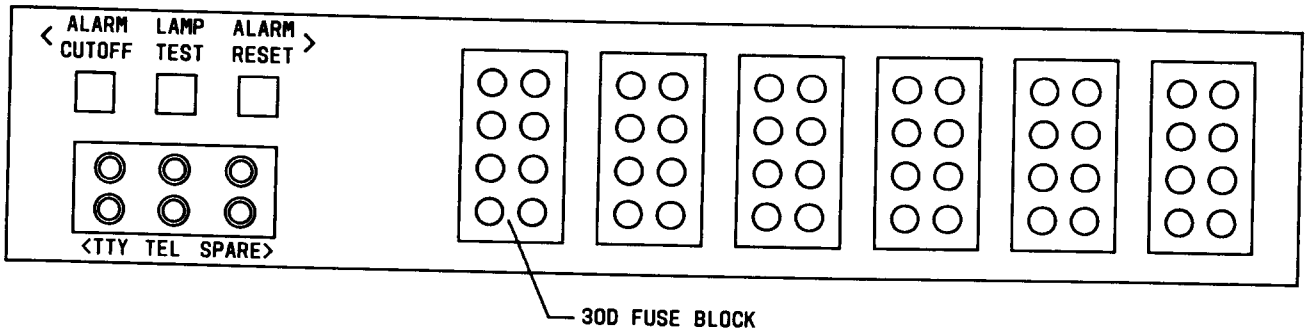


Fig. 19—Fuse Panel and Alarm Control Unit

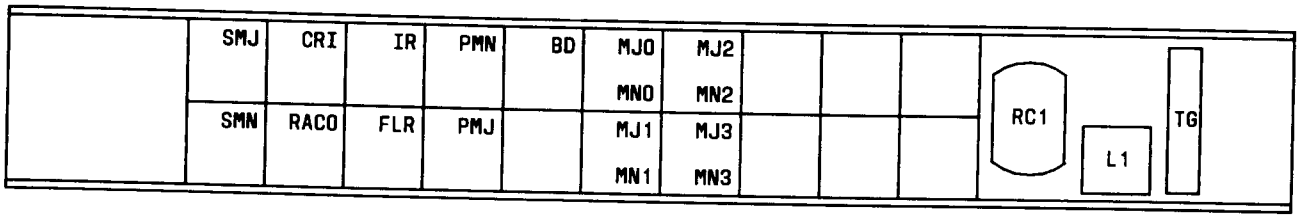


Fig. 20—Alarm Unit

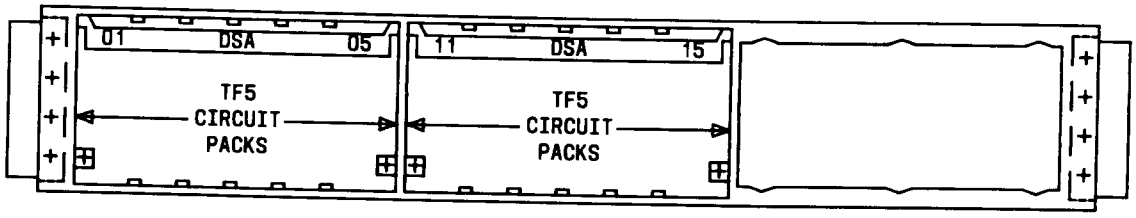


Fig. 21—Digital Service Adapter Unit

directly in the data transfer. Each DMAC can support concurrent operation of as many as 32 peripheral devices (16 on each of two DSCHs). The data communication between the central processor unit, DMAC, and MAS is over parallel data buses.

3.09 A DSCH provides a high-speed serial data link to each peripheral device. At the peripheral device, a DDSBS (duplex dual serial bus selector) (TN69 circuit pack) converts the serial data back to a parallel format. Two serial ports are also provided on each DDSBS circuit pack to allow each peripheral device to communicate with the DMA system of each central processor.

D. Input/Output Processor and Peripheral Controllers

3.10 Each central processor is equipped with an IOP basic and IOP growth (IOPB0, IOPG0, IOPB1, and IOPG1) as shown functionally in Fig. 24. An IOP functions as a front-end processor to control I/O transfers between the central processor unit and various peripheral units, and thereby reduce the load on the central processor unit. The IOP is intended for use with terminals, data links, magnetic tape units, and other slow-speed/medium-speed peripheral units requiring block transfers of data to and from the MAS. The IOP itself is a peripheral device driven by a DMAC.

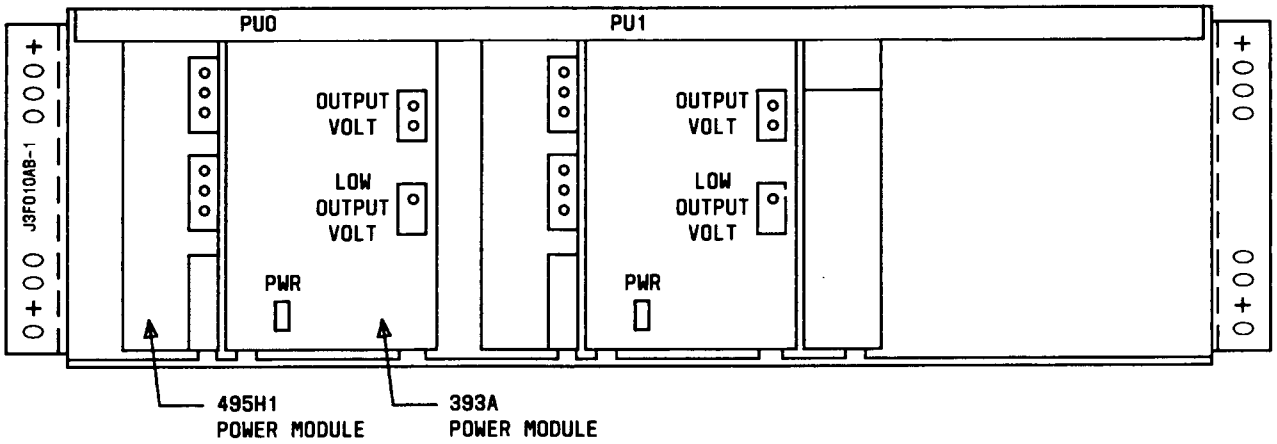


Fig. 22—AC Power Unit Mounting

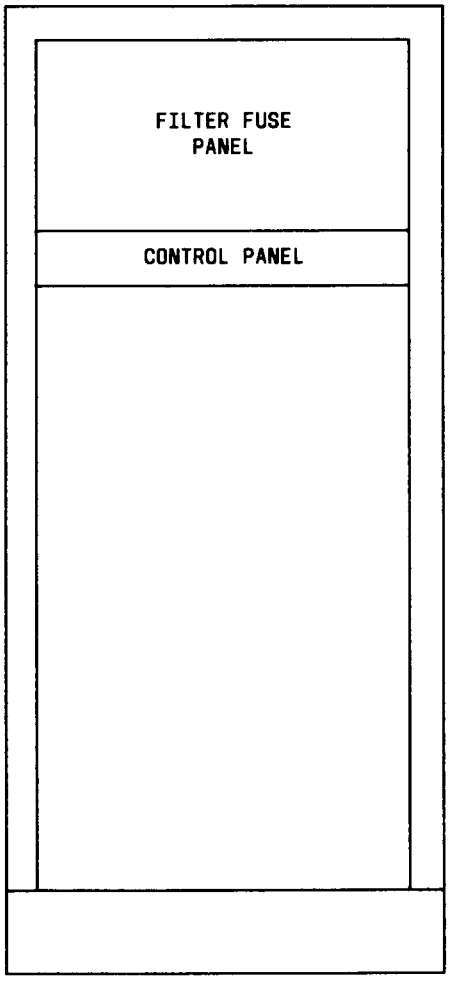


Fig. 23—Power Distribution Cabinet

3.11 An IOP interfaces the central processor unit with up to four peripheral communities. An IOP basic unit (Fig. 7) provides two communities (0 and 1). An IOP growth unit provides for the addition of peripheral communities 2 and 3. Each peripheral community contains four individual PC (peripheral controllers). Each PC is programmed to handle up to four peripheral devices (using two duplex ports). The PCs are equipped with internal microprocessors and are selective in that different types of PCs terminate different peripheral devices. For example, TTYCs (teletypewriter controllers) terminate TTYs, SDLCs (synchronous data link controllers) terminate synchronous data links, and an MTC (magnetic tape controller) terminates the magnetic tape unit.

3.12 A microprocessor designated a PIC (peripheral interface controller) is located in an IOP basic unit and provides an interface between the IOP basic unit and the IOP growth unit. The PIC also provides control for PCs in both units.

E. Ring Architecture

3.13 An NCP uses a ring architecture to interface with the digital A-links. The ring is an electrical loop consisting of ring nodes interconnected by two ring buses. One ring bus propagates data in one direction and the other ring bus propagates data in the opposite direction.

3.14 There are two types of ring nodes interconnected by the ring buses: ring peripheral controller nodes and link nodes. A simplified NCP ring

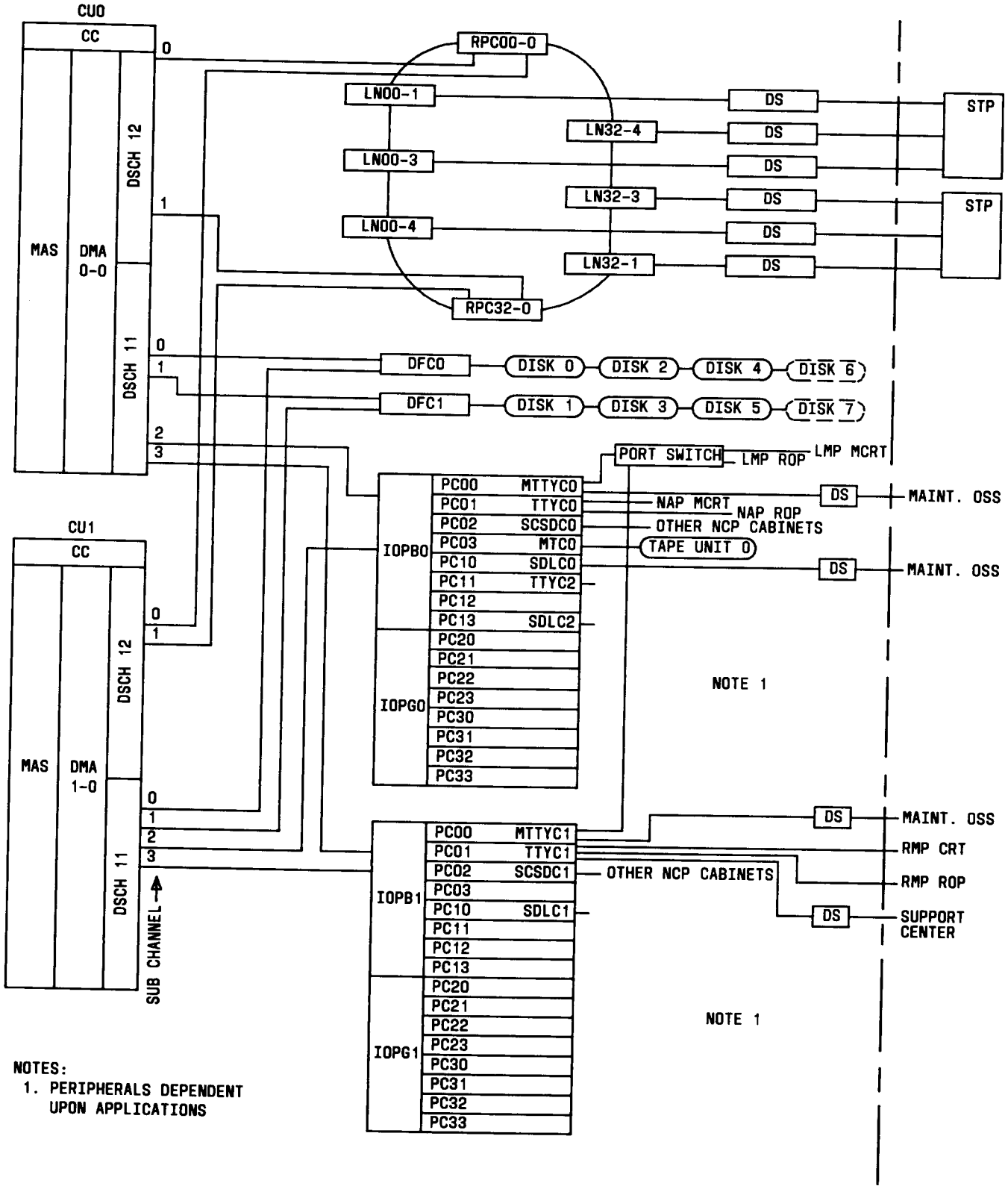


Fig. 24—1BNCP Functional Diagram

is shown in Fig. 25. An NCP ring consists of two ring peripheral controller nodes (RPCN 00-0 and RPCN 32-0) and a maximum of eight link nodes. The minimum number of link nodes required for an NCP is two.

3.15 A ring peripheral controller node acts as an interface between the ring and the 3B20D computer. The purpose of a ring peripheral controller node is to transfer and control the flow of data between the ring and the 3B20D computer. A ring peripheral controller node consists of a ring interface, node processor, a ring peripheral buffer interface, and a duplex dual serial bus selector as shown functionally in Fig. 26. The ring interface (RI0 and RI1) inserts messages onto the ring upon command from the node processor, extracts messages from the ring when appropriate, performs message error checks, and other maintenance functions. The node processor provides message handling and control functions. The ring peripheral buffer interface provides an interface between the node processor and the duplex dual serial bus selector. The duplex dual serial bus selector converts the parallel output of the ring to the serial format of the dual serial channel.

3.16 A link node acts as an interface between the ring and a digital A-link. The purpose of a link node is to transfer and control the flow of data between the ring and a digital A-link. A link node consists of a ring interface, node processor, and link interface as shown functionally in Fig. 27. The ring interface inserts messages onto the ring upon command from the node processor, extracts messages from the ring when appropriate, performs message error checks, and other maintenance functions. The node processor provides message handling and control functions. The link interface handles the transfer of encrypted data between the node processor and a digital A-link.

F. Digital Facility Access Circuit

3.17 A link node interfaces with a synchronous digital transmission facility through a digital facility access circuit. A digital facility access circuit consists of a digital service adapter (TF5 circuit

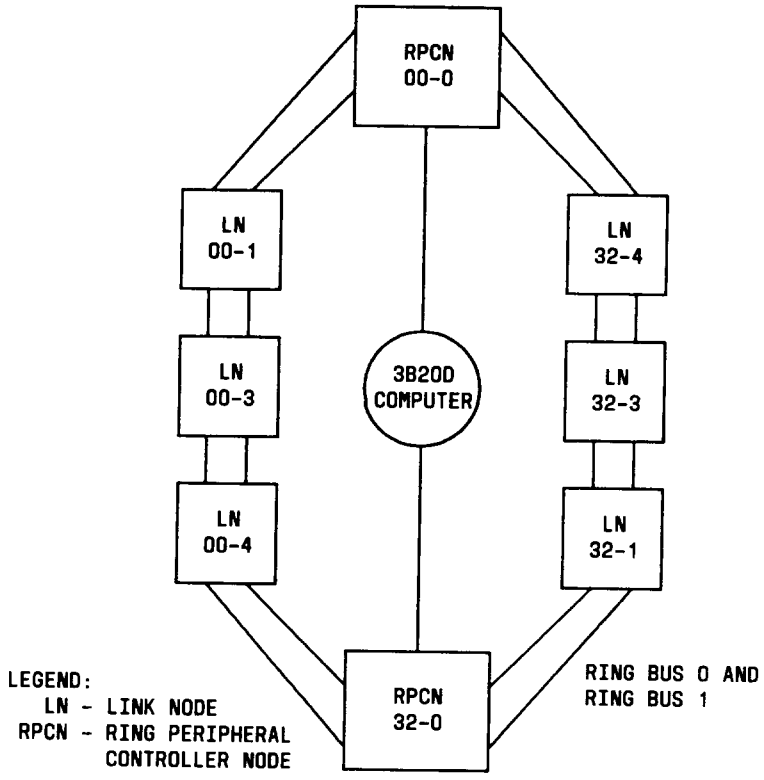


Fig. 25—Simplified NCP Ring

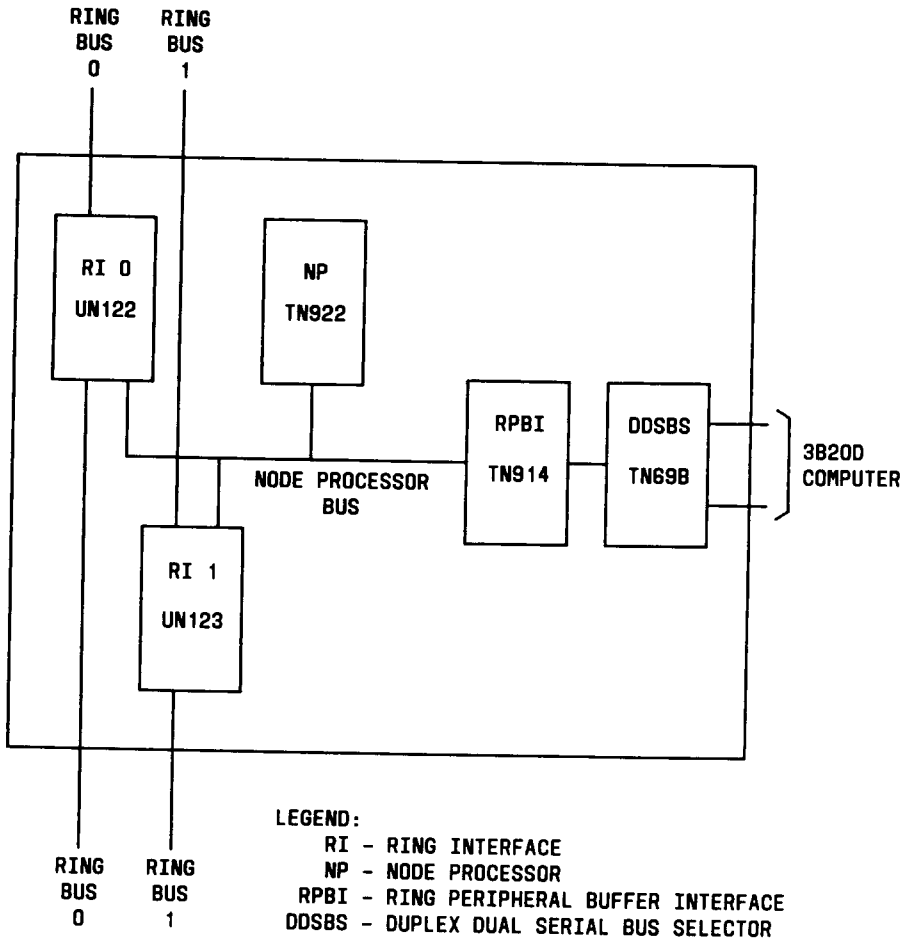


Fig. 26—NCP Ring Peripheral Controller Node

pack) and a *DATAPHONE* Z2556A data service unit as shown functionally in Fig. 28. A Z2556A data service unit contains customer interfaces and provides signal processing functions. The digital service adapter provides signal level translation between the link node and the Z2556A data service unit. The digital service adapter also provides an external loopback on the line side of the digital service adapter. The loopback is controlled by the 3B20D computer.

G. Disk Storage System

3.18 An NCP uses microprocessor-based disk file controllers (DFC0 and DFC1) and a maximum of eight 340-Mbyte fixed storage disk drives (disk 0 through disk 7) as shown functionally in Fig. 24. A DFC (disk file controller) provides microprocessor control which interprets and executes commands from the central processor unit to cause information transfers to and from the 340-Mbyte disk drives. A DFC can interface with the DMA (direct memory access) system of both central processors (on-line and off-line processor). The DFC0 controls disks 0, 2, 4, and 6. The DFC1 controls disks 1, 3, 5, and 7.

3.19 The 340-Mbyte disks serve as random access storage for system and application software, customer record data, and maintenance information. The 340-Mbyte disks also serve as a bootstrap device, containing information for system start-up. The disks 0 and 1 contain information necessary to bootstrap the NCP system and are referred to as the system disks. The disks 2 and 3, referred to as nonsystem disks, contain NCP specific and application information. Both system disks and nonsystem disks also contain customer record data. The disks 4 and 5 are simplex backup disks or warm spares. The disks 6 and 7 are expansion nonsystem disks.

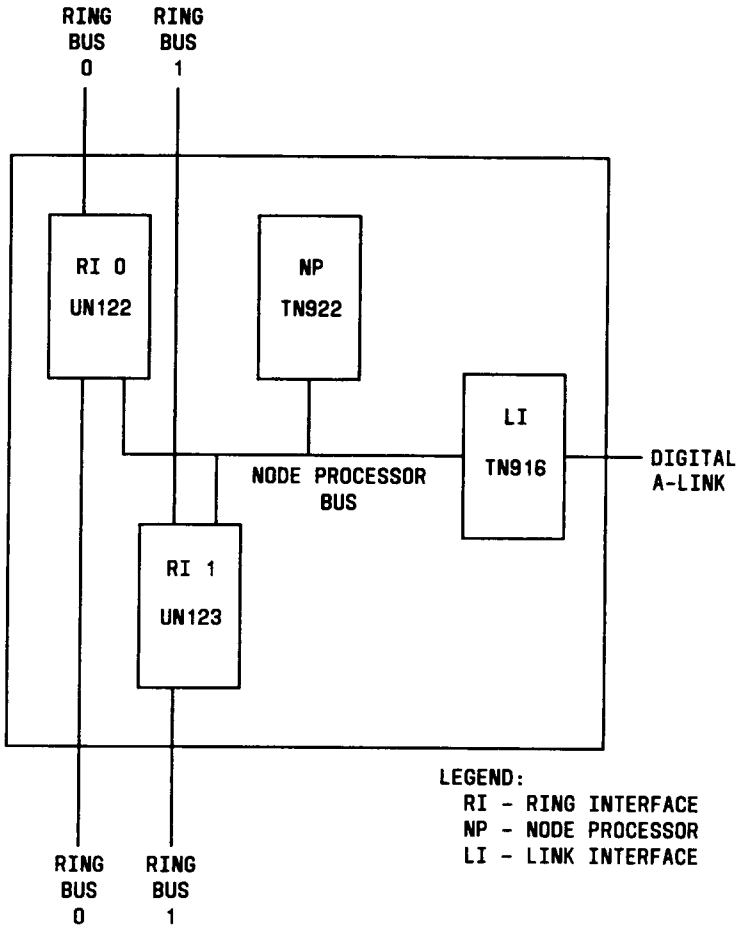


Fig. 27—NCP Link Node

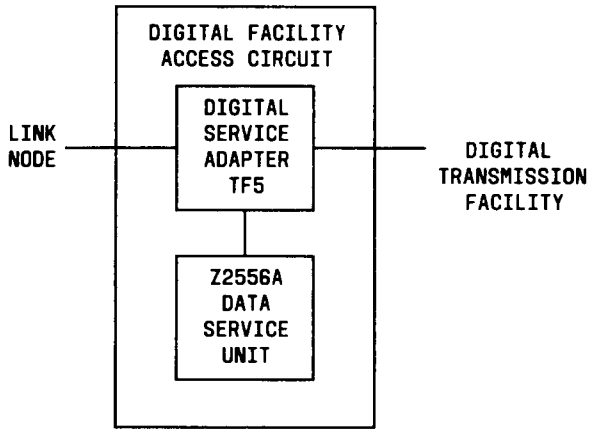


Fig. 28—Digital Facility Access Circuit

H. Magnetic Tape System

3.20 The magnetic tape unit is used primarily to load generic programs and broadcast warning messages. The magnetic tape drive is part of a fast backup feature that is used to reload the disks and system in a minimum amount of time. The magnetic tape unit is connected to IOP0.

I. Alarms

3.21 The alarm unit located on the digital facility access cabinet collects all NCP office alarms and provides the corresponding audible and visual status indications. Alarm signals from NCP equipment activate alarm relays on the alarm unit. The alarm relays provide the matching audible and visual alarms indications. The alarm unit also has the capa-

bility to remote alarm indications. The following types of office alarms are collected at the alarm unit:

(1) ***NCP System Alarms:*** NCP system alarms are generated by the 3B20D computer. They may originate in the 3B20D computer itself or be generated in response to scan point indications.

(2) ***Power Plant Alarms:*** Power plant alarms are generated by the power plant as a result of alarm conditions.

(3) ***Aisle Alarms:*** The NCP equipment frames are capable of generating major and minor hardware alarms. These are multiplied on an aisle basis.

4. SOFTWARE

4.01 The NCP system consists of the following three types of system software:

(1) DMERT (duplex multi-environment real-time) operating system

(2) NSPS (NCP support software)

(3) Application unique software.

Figure 29 illustrates the NCP software architecture and the relationship between the software systems. The DMERT generic program and the NSPS generic program are issued jointly for an NCP and are referred to as the NCP generic program 1NCPx.

A. Duplex Multi-Environment Real-Time Operating System

4.02 The DMERT (duplex multi-environment real-time) operating system provides for the basic operation of the 3B20D computer hardware. The name describes the characteristics of the operating system:

- Duplex — Supports duplexed equipment
- Multi-environment — Multiple operating system supervisors
- Real-time — Same time response requirements.

The DMERT operating system supports both a real-time and a time-sharing environment. Each application the DMERT operating system supports has different real-time demands. Because the DMERT operating system has a modular design, it can be tailored to different applications.

4.03 The DMERT operating system includes procedures that allow users to effectively share system resources, such as computer time, storage space, and peripheral devices. The DMERT operating system also manages and controls processes, interprocess communications, memory, file systems, interrupt handling, and system maintenance. There are additional software systems that augment, support, and/or run under the DMERT operating system. Included are the diagnostics, audits, and plant measurements.

4.04 The DMERT operating system maintains a process (executable program) hierarchy based on 16 execution levels. A process is a collection of segments in main memory that form an executable program. Processes at the highest execution level are dispatched first. For example, a process belonging to execution level 15 is dispatched before a process belonging to level 14, and so on.

4.05 For each execution level, the DMERT operating system maintains a list of waiting processes. When a process requests servicing, it is added to the appropriate list. As the DMERT operating system descends the hierarchy, it dispatches all the waiting processes at each level.

4.06 The DMERT operating system consists of a kernel and a set of modular, cooperating processes. The kernel directly controls the 3B20D computer hardware and does not depend on other operating system services. The kernel also controls memory management, bootstrap and initializations, timing, scheduling, and job queues.

4.07 Hardware information required for the DMERT operating system is contained in the ECD (equipment configuration data). The ECD is a data base containing the current status of all the 3B20D computer and peripheral hardware known to the DMERT operating system. The ECD also reflects any hardware configuration options in effect. For example, a record for CRT options contains terminal mode settings, scrolling sequences, number of visible lines, width of the CRT, and other options.

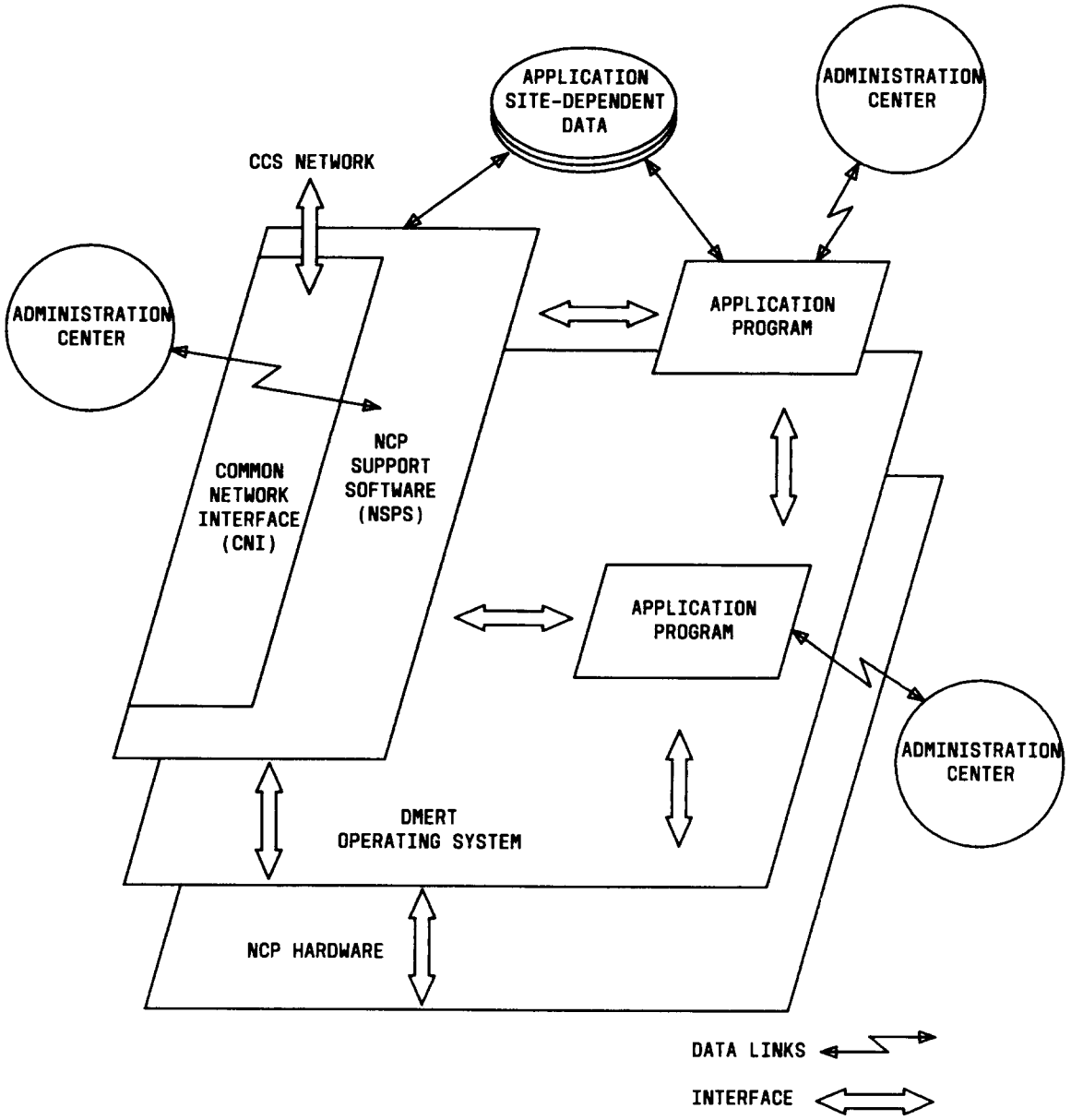


Fig. 29—NCP Software Architecture

B. NCP Support Software

4.08 The NSPS (NCP support software) provides the operational functions of an NCP including access to a CCS network. The NSPS is capable of supporting multiple applications simultaneously and providing facilities for the installation and update of applications. For example, the NSPS serves as an interface to a CCS network while an application is being installed or when it is unable to perform its normal functions. The NSPS also responds to incoming data while an application is updated or out-of-service. Application service performance is also monitored and displayed by the NSPS.

4.09 The NSPS serves as an interface between the DMERT operating system and the application programs, and between the application programs and the CNI (common network interface). The NSPS oversees the transfer of data between the CNI and

the appropriate application program. The CNI controls all interactions with the digital A-links including monitoring A-link performance and control of interfaces for A-link maintenance.

4.10 The CNI uses the IMS (interprocess message switch) for the processing of data to and from a digital A-link. The IMS is a general purpose interconnect mechanism. The IMS is implemented with link nodes and ring peripheral controller nodes to form a ring. Each link node and ring peripheral controller node has a node processor and its own software environment. The link node software controls the data flow between the ring and the digital A-links. The ring peripheral controller node software controls data flow between the 3B20D computer and the ring.

4.11 Also included in the NSPS are the specification files. The specification files consist of the NSPEC (node specification) file and the ASPEC (application specification) file. The NSPEC file contains all site dependent data particular to the NSPS. Each application program has an ASPEC file in the NSPS. The ASPEC files contain application identification data, disk allocation data, device allocation data, and routing data.

C. Application Software

4.12 An NCP provides custom routing and billing services by using various application programs. Each application program has an associated data base. An application program uses the NSPS and CNI to access a CCS network via A-links. Each application program interprets the query messages it receives, interrogates its data base, and formulates a response which is returned to the office that originally launched the query. An application program also controls the updating of the associated data base by the responsible administration center.

5. GLOSSARY

5.01 The following list of acronyms and abbreviations are the most commonly used when referring to an NCP.

A-link	access signaling link
ASPEC	application specification
CC	central control
CCS	common channel signaling
CNI	common network interface
CPU	central processor unit
CU	control unit
DB	data base
DDD	direct distance dialing
DDSBS	duplex dual serial bus selector
DFA/ALM	digital facility access/alarm cabinet
DFC	disk file controller
DMA	direct memory access
DMAC	direct memory access controller
DMERT	duplex multi-environment real-time operating system
DS	data set
DSA	digital service adapter
DSC	data set cabinet
DSCH	dual serial channel
ECD	equipment configuration data
IMS	interprocess message switch
I/O	input/output
IOP	input-output processor
IOPB	input-output processor basic
IOPG	input-output processor growth
kbps	kilobits per second
LI	link interface
LMP	local maintenance position
LN	link node

MAS	main store
MASA	main store array
Mbyte	megabyte
MTC	magnetic tape controller
MTTYC	maintenance teletypewriter controller
NCP	network control point
NP	node processor
NAP	NCP administration position
NSPEC	node specification file
NSPS	NCP support software
OSS	operations support system
PC	peripheral controller
PD	power distribution
PDC	power distribution cabinet
PIC	peripheral interface controller
PIFB	padded interframe buffer
PROC	processor cabinet
PU	power unit
RI	ring interface
RMP	remote maintenance position
RNC	ring node cabinet
ROP	receive-only printer
RPBI	ring peripheral buffer interface
RPCN	ring peripheral controller node
SCSDC	scan and signal distributor control
SDLC	synchronous data link controller
SF	specification file
STP	signal transfer point
T/DC	tape/disk cabinet
TTYC	teletypewriter controller
1BNCP	No. 1B network control point
1NCPx	network control point generic program