DIGITAL CENTRAL OFFICE — PACKET NETWORK INTERFACE (DCO — PNI) DESCRIPTION

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1. GENERAL

1.01 The DCO-PNI (Digital Central Office - Packet Network Interface) is a microprocessor-based statistical multiplexer. It performs X.25 PAD (Packet Assembly/Disassembly), protocol, and speed conversion. The DCO-PNI provides a direct interface for NTE (Network Terminal Equipment) to facilitate communication with the equipment from a central location. This allows intelligent NTE to communicate with various I/O (Input/Output) devices as well as with other OSSs (Operation Support Systems). For remote provisioning and maintenance purposes the OSSs are connected directly or indirectly through the DOM (Digital Office Manager) interface to the DCO-PNI via the PINET (Packet Internal Network). The PINET uses an X.25 protocol data packet switching network to interconnect data transmission devices across the country. This DCO-PNI allows:

(a) *Terminal Concentration* — A local terminal serves all DACS (Digital Access Cross-Connect System) frames and GMAP (Granger Maintenance, Alarmand Programming) processors connected to the same DCO-PNI.

(b) *Autonomous Messages Printing* — A dedicated printer displays all alarm and other equipment-generated messages from the DACS frames and GMAP processors connected to the DCO-PNI.

(c) *All Messages Printing* — A dedicated printer displays all autonomous and demand messages to and from the DACS frames and GMAP processors connected to the DCO-PNI. Request messages to the frames are not displayed.

(d) *Remote Provisioning and Maintenance* — Access through the PINET allows the DACS frames and GMAP processors to be provisioned and maintained from a central location.

1.02 This section is being reissued to include information concerning the latest changes to the DCO-PNI and its interfaces. Also, this section is reissued to describe the DOM configuration that exists in some DCOs.

A. NTE Access

1.03 The DCO-PNI provides an interface to intelligent NTE. Presently, DACS frames and GMAP processors are the only NTE that the DCO-PNI interfaces. A TABS (Telemetry Asynchronous Block Serial) and ASCII board is being developed for NCOE (Network Channel Office Equipment) and various echo cancelers, respectively. In the future, a TABS board will interface the echo cancelers to the DCO-PNI.

B. Direct PINET Access Interface

1.04 An overall diagram of the DCO-PNI Remote Provisioning System is shown in Fig. 1. This figure shows a direct interface to the DCO-PNI via a modem into the Level 2 board. Circuit orders are entered into the OSS from the SDS (Selective Distribution System) to automatically provision the equipment. The PCC (Provisioning Control Center) interface to the OSS is used to manually provision the equipment. The information is formatted by the OSS into commands usable by DACS or GMAP equipment.

1.05 In the Remote Provisioning System, the PINET connects the OSS to the DCO-PNI. The interconnection uses 9600-baud data lines. The information being transmitted contains DACS or GMAP status and provisioning commands.

C. PINET Access With DOM Interface to OSS

1.06 The DOM interface of the DCO-PNI provides access to several OSSs. The No. 2SCCS (No. 2 Switching Control Center System) is for alarms; DACS-OSS is for provisioning and restoring; FAMAS (Facility Maintenance and Administration System) is for facility monitoring; and DSTS (Digital Service Test System) provides demand testing capabilities. An overall diagram of the DCO-PNI Remote Provisioning System with the DOM interface is shown in Fig. 2. The DOM interface gives the remote provisioning system three additional features:

1. Provisioning support — frame restoral
2. Memory/Image Transfer support
3. Access to FAST (Facility Analysis Surveillance and Testing).

2. PHYSICAL DESCRIPTION

2.01 The DCO-PNI comes in a 6-foot cabinet which can accommodate two complete DCO-PNIs and their associated modems.

2.02 The DCO-PNI cabinet is especially made to shield its contents so that radiation of radio frequency waves generated by this equipment will not adversely affect surrounding central office equipment. Peripheral equipment such as the MEMOTEC* switch and modem should be placed inside the cabinet.

2.03 If the DOM is used, the AT&T 3B2/400 computer is located outside the cabinet; however, the associated MICOM PAD† should be located inside the cabinet.

2.04 The DCO-PNI cabinet also contains the power supply and data connector panel. See the NJ08576A1 drawing of the cabinet. See the NS08576-01 drawing for programming and strapping options.

2.05 If the DCO-PNI does not interface a DOM, there are six possible types of circuit boards in a DCO-PNI cabinet. They are the Level 2, Level 3, ROP (Read Only Printer), Terminal, DACS, and GMAP boards. If the DCO-PNI interfaces a DOM, there are seven possible types of circuit boards in a DCO-PNI

* Trademark of MEMOTEC DATA COM, INC.
† Trademark of MICOM CORP.

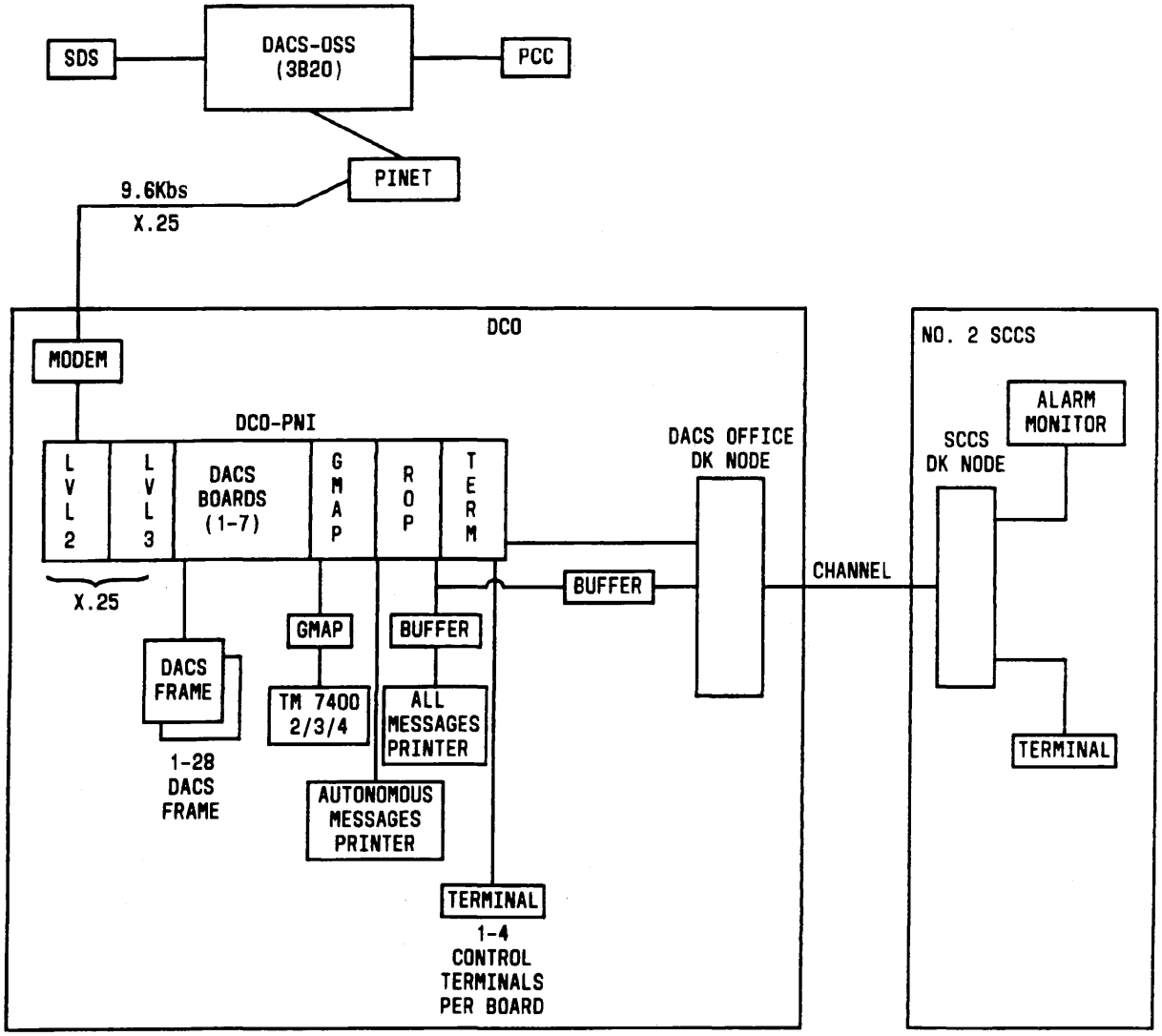


Fig. 1—DCO-PNI Remote Provisioning System

cabinet. They are the PAD, DOM, ROP, Terminal, DACS, GMAP, and TABS boards. Each DCO-PNI has 16 slots available for circuit boards. The required boards are the Level 2, Level 3, ROP, and Terminal boards (direct interface) or the PAD, DOM, ROP, and Terminal boards (DOM interface). The rest are available for use as required by an individual office. The boards are placed in the slots from left to right as needed. Except for slots 1 and 2, no particulararrangement of boards is required, but no empty slots may be left between boards, i.e., all empty spaces should be to the right of the slots used in the cabinet.

2.06 The same basic circuit board is used for each of the board types. The boards are modified for each specific application by using different plug-ins, EPROM (Erasable Programmable Read Only Memory)integrated circuits, and strapping options. See the DCO-PNI Maintenance Section 365-680-304AC for detailed optioning information.

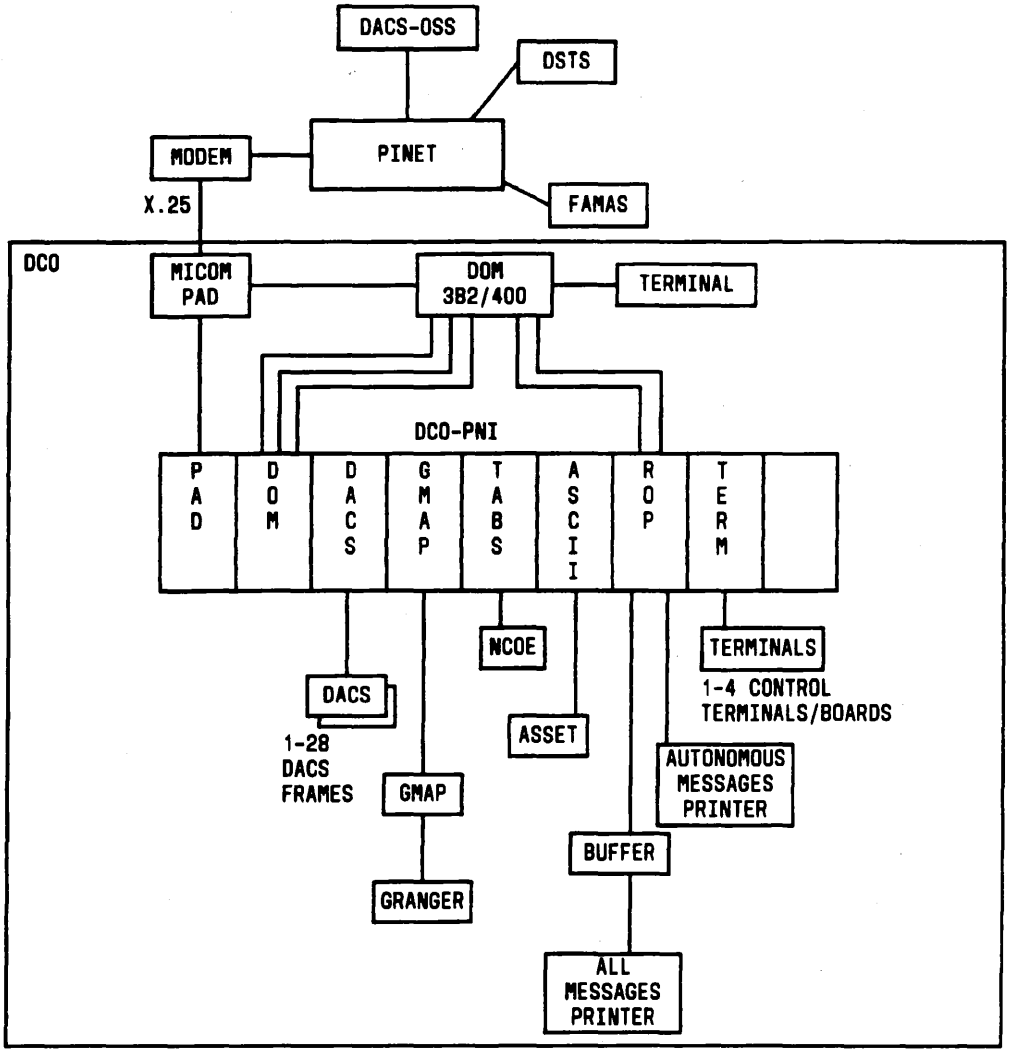


Fig. 2—DCO-PNI Remote Provisioning System With DOM Interface

3. FUNCTIONAL DESCRIPTION

A. Direct PINET Access Interface

3.01 This interface provides access to DACS-OSS for provisioning and restoring DACS frames and GMAP processors. The interface is through a modem, Level 2 board, and Level 3 board. The direct PNI interface converts X.25 protocol from DACS-OSS on PINET to protocol and speed compatible with DACS frames and GMAP processors.

B. PINET Access With DOM Interface

3.02 The DOM interface consists of a modem, MICOM 800 PAD, and a 3B2/400 minicomputer. There can be only one DCO-PNI connected to a DOM. The DCO-PNI functions as the PC-MUX (Protocol-Converting Multiplexer).

3.03 The DOM system maintains the functionality and interfaces of the DCO-PNI. It adds the ability to send information on DACS-terminated

facilities to FAMAS2 for use by the FMAC along with the FAST system features. FAMAS provides centralized DS-1 facility monitoring and correlation and long-term performance analysis of DS-1 facilities. The DOM also provides functionality for ASSET (Advanced Switchable Signaling and Echo Canceling Terminal/USEC (Universal Services Echo Canceler) and NCOE (Network Channel Office Equipment).

C. DACS Interface

3.04 The DCO-PNI can contain up to 7 DACS boards. Each board supports 4 DACS frames. Any control terminal connected to the DCO-PNI can access any one of 28 DACS frames.

D. GMAP Processor Interface

3.05 The DCO-PNI allows access to either M4 or M2/M3 TM 7400 transmultiplexers through a GMAP processor board. The board has 4 ports. All 4 ports may be used for M4 Granger while no more than 1 port may be used for M2/M3 Grangers. One Master M4-GMAP will support 16 slave M4-GMAPs while one Master M2/M3-GMAP will service up to 3 slave M2/M3 GMAPs.

E. ROP Interface

3.06 The DCO-PNI provides one slot for a ROP interface. The interface has two ports. One of the ports is used to connect the All Messages Printer. The other port is used to connect the Autonomous Messages Printer.

3.07 The All Messages Printer displays all messages to and from the DACS frames and GMAP processors. It requires a data buffer that accepts and stores data at 9600 baud and sends it at 1200 baud which is compatible with the printer's speed.

3.08 The ROP (All Messages) printer circuit board will also be half-tapped to provide access to the DCO-PNI for the No. 2 SCCS surveillance system. The No. 2 SCCS interface is provided by half-tapping a cable between the All Messages Printer and the PNI. This allows access to a 64K buffer set to receive at 9600 baud and output at 1200 baud. The output is connected to a statistical multiplexer channel that ultimately terminates on the RWC (Remote Work Center) DATAKIT* network multiplexer where it is connected to an SCCS logging port.

* Trademark of AT&T

3.09 The Autonomous Messages Printer displays all alarm- and equipment-generated messages from the DACS frames and GMAP processors.

F. Terminal(s) Interface

3.10 The DCO-PNI contains up to 3 terminal boards which support up to 4 control terminals each. The terminal interface centralizes communications to the equipment that is connected to the DCO-PIN. If a DOM is used, some of the terminal access to certain technologies will be off the DOM.

4. DCO-PNI HARDWARE

4.01 Depending on the arrangement, the DCO-PNI contains the following circuit boards:

Direct Interface	DOM Interface
Level 2	PAD
Level 3	DOM
ROP	ROP
Terminal	Terminal
DACS	DACS
GMAP	GMAP
-	TABS

All boards have a basic card design with plug-in options for each specific task.

> ***Note:*** There is only one Level 2 and Level 3 board or PAD and DOM board used in a DCO-PNI. The PAD and DOM boards are used in central offices with the DOM interface to PINET.

A. Level 2 Board

4.02 This board interfaces the DACS frames and GMAP processors to the PINET X.25 network. Remote provisioning and restoring DACS frames and GMAP processors is accomplished through this network by DACS-OSS. The network allows the DACS-OSS to update provisioning and interrogate these frames for current status. See Fig. 1.

B. Level 3 Board

4.03 This board controls the PAD processes for the DCO-PNI. This board also interfaces the Level 2 board to the other DCO-PNI boards and has no external connections.

C. DOM Board

4.04 This board interfaces the DACS frames and GMAP processors to the PINET X.25 network through the MICOM PAD with the DOM arrangement. Remote provisioning and restoring DACS frames and GMAP processors is accomplished through this network by DACS-OSS. See Fig. 2.

D. PAD Board

4.05 This board controls the PAD processor for the DCO-PNI with the DOM arrangement.

E. ROP Board

4.06 This board interfaces two printers to the DACS control inputs. It also allows the addition of the No. 2 SCCS surveillance system. Only one ROP board is used in a DCO-PNI.

- *All Messages Printer* — Displays all messages to and from all of the DACS frames and GMAP processors. This output operates at 9600 baud and contains a buffer which allows a 1200-baud printer to be used.

- *Autonomous Messages Printer* — Displays all autonomous messages from the frames associated with the PNI. This output is 1200 baud and uses a 1200-baud printer.

- *No. 2 SCCS* — A system used to remotely monitor the equipment associated with the DCO-PNI.

F. Terminal Board

4.07 A terminal board interfaces up to four terminals. Each terminal may contact any frame or processor connected to the DCO-PNI. When additional terminals are required, another board may be installed. An additional board allows four more terminals to be connected. A maximum of three master terminal boards is allowed in a DCO-PNI.

G. DACS Boards

4.08 The DACS boards interface the control line of the DACS frames to the other boards in the DCO-PNI. All responses from DACS frames are directed to the Autonomous Messages Printer. Control inputs to the DACS frames may come from the local terminals, the No. 2 SCCS input, or DACS-OSS input.

4.09 Each DACS board is connected to four DACS frames. Each DCO-PNI may have a maximum of 7 DACS boards, for a maximum of 28 DACS frames. Growth expansion of DACS board is from left to right (facing front) of the DCO-PNI.

H. GMAP Board

4.10 The GMAP board interfaces Granger Master GMAPs for centralized maintenance and remote provisioning. Only one GMAP board is used in a DCO-PNI.

4.11 A GMAP board may interface a combination of Master M4-GMAPs and Master M2/M3-GMAPs totaling four.

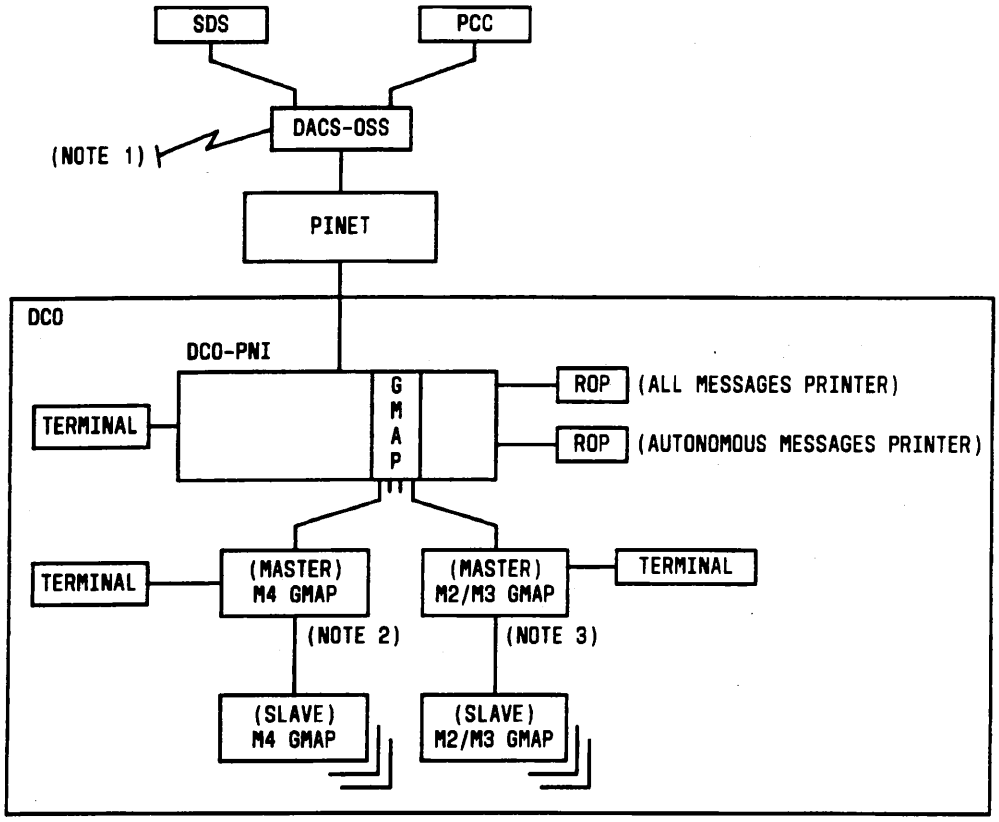
4.12 One Master M4-GMAP system supports up to 16 slave M4 GMAPs. One Master M2/M3-GMAP supports up to three slave M2/M3 GMAPs. See Fig. 3 for a view of the M4 and M2/M3 GMAP configuration.

I. TABS (Telemetry Asynchronous Block Serial) Board

4.13 The TABS board interfaces NCOE, ASSET, or USEC to DOM. Each board will have four ports available for these applications.

J. Power Supply

4.14 The DCO-PNI has one power supply which provides 5 Vdc, -5 Vdc, and 12 Vdc to the circuit boards. The power supply has a power switch, power indicator, and circuit breaker reset on the front panel. Each section of the power supply has over-voltage and over-current protection. Short-circuit protection circuitry is self-resetting.



Notes:
1. 1200 baud dial-up access for reports and equipment data.
2. One Master M4 GMAP system supports up to 16 Slave M4 GMAPs (bays). This supports a maximum of 408 M4 digroups.
3. One Master M2/M3 GMAP system supports up to 3 Slave M2/M3 GMAPs. This supports a maximum of 512 M2 or M3 digroups.

Fig. 3—Master M2/3/4-GMAP Configuration

5. ACRONYMS

5.01 The following acronyms, located throughout this document, have been consolidated for easy reference:

ACRONYM	DEFINITION
ASSET	Advanced Switchable Signaling and Echo Canceling Terminal
DACS-OSS	Digital Access Cross-Connect System—Operations Support System
DCO-PNI	Digital Central Office - Packet Network Interface
DOM	Digital Office Manager
DS	Digital Signaling
DSTS	Digital Service Test System
DTE	Digital Terminal Equipment
EPROM	Erasable Programmable Read Only Memory
FAMAS	Facility Maintenance and Administration System

ACRONYM	DEFINITION
FAST	Facility Analysis Surveillance and Testing
FMAC	Facility Maintenance Administration Center
GMAP	Granger Maintenance, Alarm and Programming
I/O	Input/Output
NCOE	Network Channel Office Equipment
NTE	Network Terminal Equipment
PAD	Packet Assembly/Disassembly
PCC	Provisioning Control Center
PC-MUX	Protocol - Converting Multiplexer
PINET	Packet Internal Network
ROP	Read Only Printer
RWC	Remote Work Center
SDS	Selective Distribution System
SPCS	Stored Program Control System
SSC	Special Service Center
TABS	Telemetry Asynchronous Block Serial
TTY	Teletype
USEC	Universal Services Echo Canceler
No. 2 SCCS	No. 2 Switching Control Center System

6. REFERENCES

6.01 The following sections should be referenced for specific information:

SECTION	TITLE
365-181-918AC	Terminal Operation Granger TM7400-M4
365-181-921AC	Terminal Operation Granger TM7400-M2/M3
365-680-300	PC-MUX System Description
MC-90017-09	DACS Input/Output Message Manual
365-680-301AC	DCO-PNI Description
365-680-302AC	DCO-PNI Installation and Acceptance
365-680-303AC	DCO-PNI Operation
365-680-304AC	DCO-PNI Maintenance
365-680-365AC	-
SM-20763	PC-MUX Application Schematic
NJ08587-01	-
NJ08576A1	Specification for a Protocol Converting Multiplex Cabinet (PC-MUX) Arranged for Digital Control Office-Packet Network Interface (DCO-PNI) Application
NT08576-30	Operating Support Systems PC-MUX for DCO-PNI Unit Wiring
NT08576-31	Operating Support Systems PC-MUX for DCO-PNI Interconnect Circuit
ED3B062-10	Method of Installing Computer Cabinets
NS08576-01	Application Schematic