LINE AND NUMBER ADMINISTRATION

OVERVIEW

NETWORK ADMINISTRATION

DIGITAL MULTIPLEX SYSTEM-10

CONTENTS PAGE

1. GENERAL

A. Purpose

1.01 This section provides an overview of line and number administration considerations for the Digital Multiplex System-10 (DMS-10*) with references to more detailed information where applicable. Controlled assignment is necessary to ensure efficient equipment utilization. The technical and administrative restrictions which affect line and number assignments are described herein. Loading plans are also described since they are the basis for the assignment process. Prior to making any line assignment, the network administrator should have a working knowledge of the DMS-10 switching network

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and line packs. A brief description of both is contained in this section.

1.02 Whenever this section is reissued, this paragraph will contain the reason for reissue.

1.03 The title of each figure contains a number(s) in parentheses which identifies the paragraph(s) in which the figure is referenced.

B. Responsibilities

1.04 Network Administration is responsible for assurance that the Loop Assignment Center (LAC) and the Residence Service Center have adequate line equipment and directory numbers (DNs) to meet service demands. In a manual environment, lines and DNs available for assignment are provided by means of lists. Mechanized assignment systems provide direct assignment based upon controls input by the network administrator. In a mechanized environment, Network Administration is responsible for controlling the assignment process instead of physically preparing assignment lists. A sample of a manual assignment list is contained in Section 241-120-010.

1.05 Network Administration is jointly responsible with traffic engineering for preparing a loading plan, and is responsible for implementing that loading plan.

2. SWITCHING NETWORK

A. Network Modules

2.01 The basic unit in the switching network is the network module. Network modules are always provided in pairs. Each pair of modules make up a network group capable of serving approximately 2000 lines and associated trunks. The switching network comprises up to three network groups (or six network modules). Each network module has 16 multiplex loops, 2 of which are reserved for service circuits while the other 14 are available for connection to peripheral equipment.

2.02 The multiplex loops within a network group are always paired for the purpose of providing multiple access to peripheral modules serving analog circuits. Each of the paired multiplex loops normally controls two perpheral shelves but is capable of controlling four peripheral shelves when a failure occurs in a mate loop (see Fig. 1).

2.03 In addition to switching functions, the switching network also provides service network functions. A pair of multiplex loops in each network group is always assigned to a service network interface to access tone and digit senders. Another pair of multiplex loops can be assigned, if required, to the digital conference circuits. This leaves 28 multiplex loops available for switching speech paths for each network group. A detailed description of the switching network is contained in Northern Telecom Practice (NTP) 297-3001-150.

B. Peripherals

2.04 The peripheral equipment (PE) in the DMS-10 provides an interface between the digital signals of the multiplex loops and the transmission and signaling facilities of lines and trunks. The peripheral equipment is grouped into units called peripheral equipment modules. A PE module is normally configured into a physical unit in the form of a PE shelf. Connection between a multiplex loop and a PE shelf is made through multicontact connectors.

2.05 Each analog PE module/shelf has the physical capacity to serve up to 14 circuit packs for analog lines and trunks and service circuits.

2.06 Paired multiplex loops are assigned to four analog peripheral modules/shelves. Each of these two loops normally serve two of the four modules/shelves. In an event of a failure affecting one of these loops, the mate takes over all four analog peripheral equipment modules/shelves.

C. Interfaces

2.07 Four interfaces are available to interconnect the DMS-10 with external transmission facilities. They are:

- Analog Line Interface
- Analog Trunk Interface
- Digital Trunk Interface
- Remote Digital Line and Trunk Interface.

2.08 The following subparagraphs give a brief description of each of the preceding interfaces.

(a) ***Analog Line Interface:*** Several circuit pack types are available for subscriber line

features. Normally, a line interface circuit pack can service four single party lines. Pulsing may be manual, rotary, or TOUCH-TONE* service.

(b) ***Analog Trunk Interface:*** Several analog trunk interface circuit packs are available to provide 2W E&M, 4W E&M, and loop signaling methods. The pulsing for incoming or outgoing trunks can be dial pulse (DP) or multifrequency (MF) with wink, delay dial, or immediate dial. They can be used as toll or interlocal. Normally, a trunk interface circuit pack can serve two trunks.

(c) ***Digital Trunk Interface:*** A direct digital interface between DS-1 type carrier (typically terminating at the far end on D1D, D2, D3, or D4 channel banks or another direct digital interface) and the DMS-10 is provided by a peripheral equipment unit called the digital carrier module (DCM). A description of digital carriers may be found in NTP 297-3201-102.

(d) ***Remote Digital and Trunk Interface (Remote Equipment Module [REM]):*** The remote equipment module gives the DMS-10 the capability to extend its internal network multiplex loops up to approximately 70 miles away from the central office. This facility allows the peripheral equipment interfacing lines and trunks to be situated at a remote site.

3. CIRCUIT PACKS

3.01 Most of the circuit packs used in the DMS-10 are of two types, common equipment and peripheral equipment. The peripheral equipment types are available for line assignment. A detailed description of all packs is contained in NTPs 297-3001-182 and 297-3001-150, and the DMS-10 Translation Guide (TG).

4. ASSIGNMENT CONSIDERATIONS

A. Responsibility

4.01 Certain administrative considerations govern the assignment distribution in an office. The main administrative consideration of line assignment is the class-of-service balance. The DMS-10 network is virtually nonblocking. However, a class-of-service spread is recommended to minimize differences in call mix and traffic patterns.

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B. Class-of-Service Balance

4.02 Spreading lines by class of service across the PE shelves is the simplest method to achieving good load balance. Special attention should be given to uniform distribution of assignments over the multiplexed loops, since an overload in this stage of switching can cause service blockage. The capacity of a multiplexed loop is 600 hundred call seconds (CCS). Usage data for these loops may be found on Operational Measurement (OPM) 006. A detailed description of this measurement block may be found in NTP 297-3001-456 and Section 241-120-040.

4.03 Assignment procedures should be done in the following sequence to ensure good balance:

(a) From the lowest numbered PE bay to the highest numbered PE bay

(b) From shelf 1 to shelf 6

(c) From card slot 11 to card slot 1 on each shelf

(d) From unit (circuit) 1 to unit (circuit) 4 on each circuit pack of the proper type.

4.04 Only one line should be assigned for each circuit pack for each shelf before proceeding to the next shelf. Lines with different classes of service ***may be mixed*** on a circuit pack of the proper type.

4.05 Most of the restricted slots or multiple use slots are located in the low numbered slot positions (see Fig. 2). This is the reason for starting with card slot 11 and assigning right to left toward slot 1 on each shelf of the PE bay. The restricted slots or multiple use slots should be used only when necessary or when the office is approaching its line capacity.

4.06 In determining where to make assignments, the following must be considered:

(a) On which shelf in what bay was the last assignment made?

(b) Is there a circuit pack of the proper type on the next shelf in sequence in the bay?

(c) Is there a vacant circuit number (unit) on the circuit pack?

(d) Is the line to be assigned classified as Essential? (If so, it must be assigned to a circuit pack of the proper type in slot 12, 13, or 14.)

Note: Nonessential customers may be assigned to slots 12, 13, or 14. However, enough slot locations should be held in reserve to meet essential forecasts.

4.07 The following listing is an example of a typical line assignment sequence.

ASSIGNMENT	BAY	SHELF	PACK	UNIT	ASSIGNMENT	BAY	SHELF	PACK	UNIT
1	02	2	11	X	13	05	5	09	X
2	02	3	11	X	14	05	6	10	X
3	02	4	11	X	15	08	2	04	X
4	02	5	11	X	16	08	3	09	X
5	02	6	10	X	17	08	4	14	X
6	03	1	10	X	18	01	1	10	X
7	03	2	06	X	19	01	2	09	X
8	03	3	08	X	20	01	3	08	X
9	03	4	05	X	21	01	4	11	X
10	03	5	07	X	22	01	5	12	X
11	03	6	06	X	23	01	6	07	X
12	04	1	05	X	24	02	1	08	X

X = Available unit number

C. Corrective Action

4.08 Corrective action for imbalance may consist of an embargo on assignments in shelves associated with overloaded multiplexed loops or line equipment transfers from these shelves. Section 241-120-040 discusses detailed corrective action for multiplex loop imbalance.

D. Directory Numbers

4.09 There are no technical restrictions on the assignment of DNs. However, it is recommended that once ***one*** DN is assigned in a block of ten consecutive numbers, the rest of the numbers in the block should be assigned to avoid using excessive words in data store memory.

(a) Blocks of numbers must sometimes be reserved for DN utilization plans and area transfers.

(b) Directory Number Hunt (DNH) lines may or may not be sequentially numbered. However, it is desirable to reserve blocks of consecutive numbers for future DNH customers to efficiently use data store memory.

E. Utilization

4.10 After capacities have been defined for the DMS-10, the Network Administrator must develop a DN utilization plan. The following steps are used in the preparation of the plan:

(a) Determine reserved number requirements

(b) Determine the main station equivalent of the limiting capacity item

(c) Determine the number of directory numbers to be assigned for the NXX at exhaust.

The utilization plan should be reviewed by the traffic engineer.

F. Aging

4.11 Directory numbers are considered available for assignment when certain aging requirements have been met or when intercept studies have been made to determine candidates for reassignment. Guidelines for number aging are found in Section 780-200-014, Determination of Line and Number Requirements.

G. Intercepting Studies

4.12 When the recommended aging intervals cannot be met and it is necessary to reassign numbers in less than the prescribed time, a study of incoming call volume may be necessary to determine which numbers will be made available for reassignment. The study is conducted for a 7-day period. The recommended procedure for taking the study is described in Section 780-200-014.

H. Line Equipment Responsibility

4.13 Network Administration is responsible for monitoring spare line equipment. When the line demand begins to exceed forecasted limits, notify traffic engineering to discuss the addition of line packs.

I. Restrictions

4.14 Line equipment assignment restrictions in the DMS-10 are dependent on pack type. Northern

Telecom Practice 297-3001-305 and the DMS-10 TG list station option compatibility, line options to pack type compatibility, and pack position assignments restrictions.

(a) Essential service customers must be assigned to a PE located in slots 12, 13, or 14.

(b) Customers requiring ground start lines must be assigned to a pack type designated for ground start.

(c) Coin lines must be assigned to a pack type designated for coin.

(d) Certain PE locations must be reserved as standby line circuits. These locations will be used by central office personnel when subscribers are transferred from a disabled pack. When the disabled pack is replaced, the customers are returned to their original location. Network Administration must place an embargo on the PE location designated as standby lines to prevent them from being assigned for service order activity.

(e) Peripheral Controller 1 (PC1) will be located in card slot 15 of each PE shelf provided.

(f) Peripheral Controller 2 (PC2) will be located in card slot 16 of each PE shelf provided.

(g) Peripheral Maintenance Access (PMA) should be located in card slot 14 of shelf 1 of each PE bay provided.

(h) Line and Trunk Test (LTT) should be located in card slots 5 and 6 of PE bay 1, shelf 1.

(i) Noller Interface (NOLR), if provided, should be located in card slot 3, PE bay 1, shelf 2.

(j) Auxiliary Ring and Tone (ARGT), if provided, should be located in card slot 4, PE bay 1, shelf 2.

(k) Miscellaneous Line (MIXL), if provided for use in conjunction with NOLR, should be located in card slot 5, PE bay 1, shelf 2.

(l) Incoming Trunk Test (ITTK), if provided, should be located in card slot 4, PE bay 1, shelf 1.

5. LINE ASSIGNMENT FUNCTIONS

A. Line Assignment Lists

5.01 Network Administration issues lists of line equipment and DNs available for assignment to the LAC and/or Residence Service Center. It is essential that the LAC and/or Residence Service Center has a sufficient quantity of available line equipment and/or DNs.

5.02 In a manual environment, the list of lines and numbers available for assignment is entered on an assignment list such as the one designated in Section 241-120-010 or a locally designed equivalent.

B. Line Equipment Transfers

5.03 Line equipment transfers (LETs) may be required for various reasons. Full consideration must be given to alternative methods for achieving the desired result. Due to the cost of line transfer activity, every effort must be made to keep the volume of LETs to a minimum.

5.04 Line transfers for load balance purposes are probably the most common if directed service order activity cannot achieve a balance. In a manual environment, the list of lines transferred may be entered on the form designated in Section 241-120-010 or a locally devised equivalent.

6. INTERCEPT ARRANGEMENTS

A. Purpose

6.01 Intercept arrangements are hardware and software combinations provided to terminate calls in cases where connection to the called party cannot be made. These terminations may be in the form of connections to local or remote announcements or to operator positions for the purpose of informing a customer why the call was not completed.

B. Types

6.02 Calls placed to a vacant DN, a DN with"deny terminating" option, and DNs associated with stations which are suspended, deleted, or changed are automatically intercepted. The route that these calls take is specified in the generic route section of the office configuration record. Generic routes to be specified are as follows:

- VCDN—Vacant Directory Number

- DNT—Denied Terminating
- TSUS—Temporarily Suspended DN
- DNIC—Disconnected DN
- DNCH—Directory Number Change.

7. RECORD RECONCILIATION

7.01 Periodically, a comparison of machine translations versus Network Administration and/or customer billing records should be performed for the purpose of uncovering discrepancies. The dump of machine translations can be accomplished by accessing one or several of the Data Modification (DMO) overlay areas available. This DMO program permits the network administrator to access the DMS-10 via a TTY and query a specific overlay area. Section 241-120-030 describes DMO and discusses the various reports available to Network Administration.

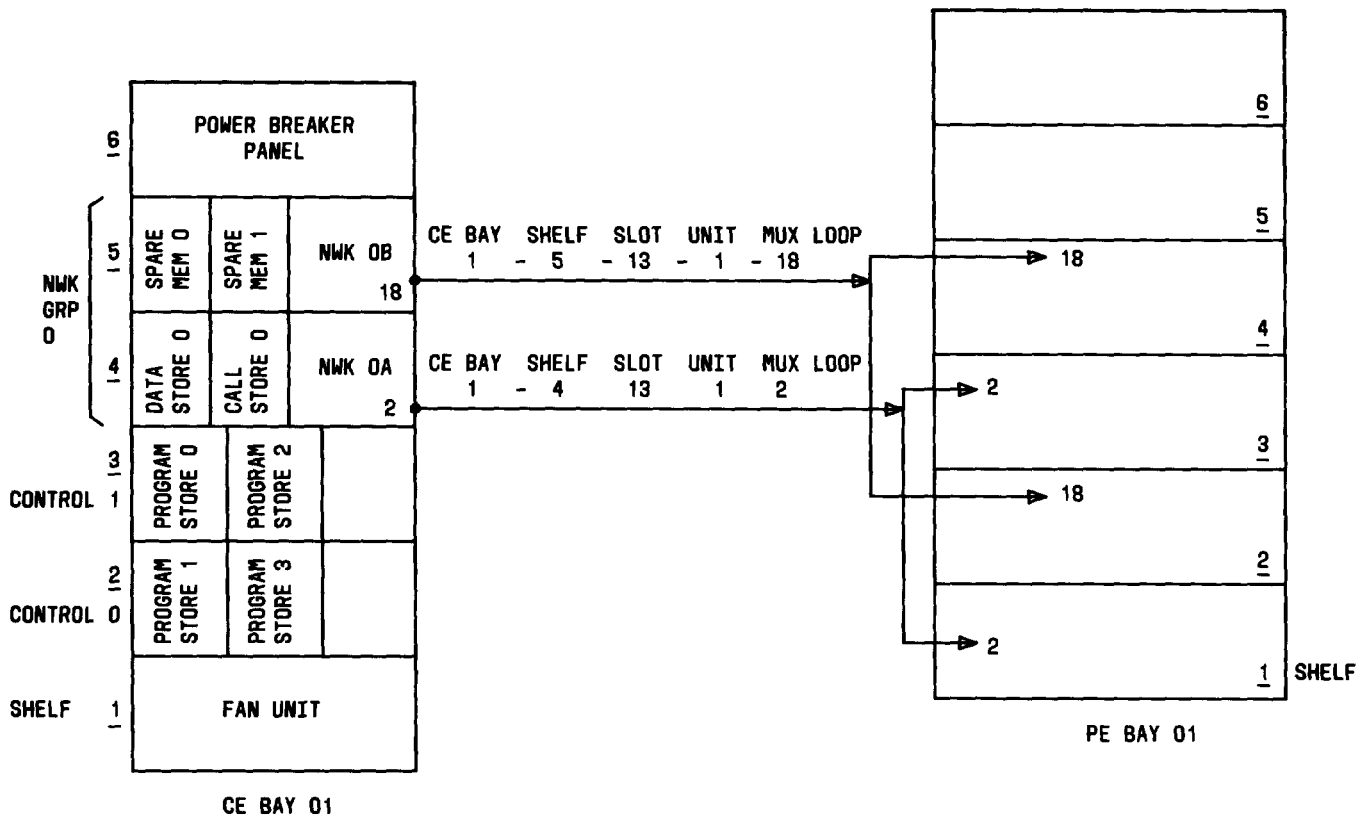
8. REFERENCES

8.01 The following Bell System Practices will aid the network administrator in accomplishing the required administrative functions. See Section 780-100-027 for a complete list of recommended documents.

SECTION	TITLE
241-120-010	Manual Office Records
241-120-020	Translations
241-120-030	Data Modification Operations
241-120-040	Data Management
241-120-050	Service Analysis
241-120-060	Machine Capacity Management
780-200-014	Determination of Line and Number Requirements
780-200-031	Busy Hour Determination—End Office

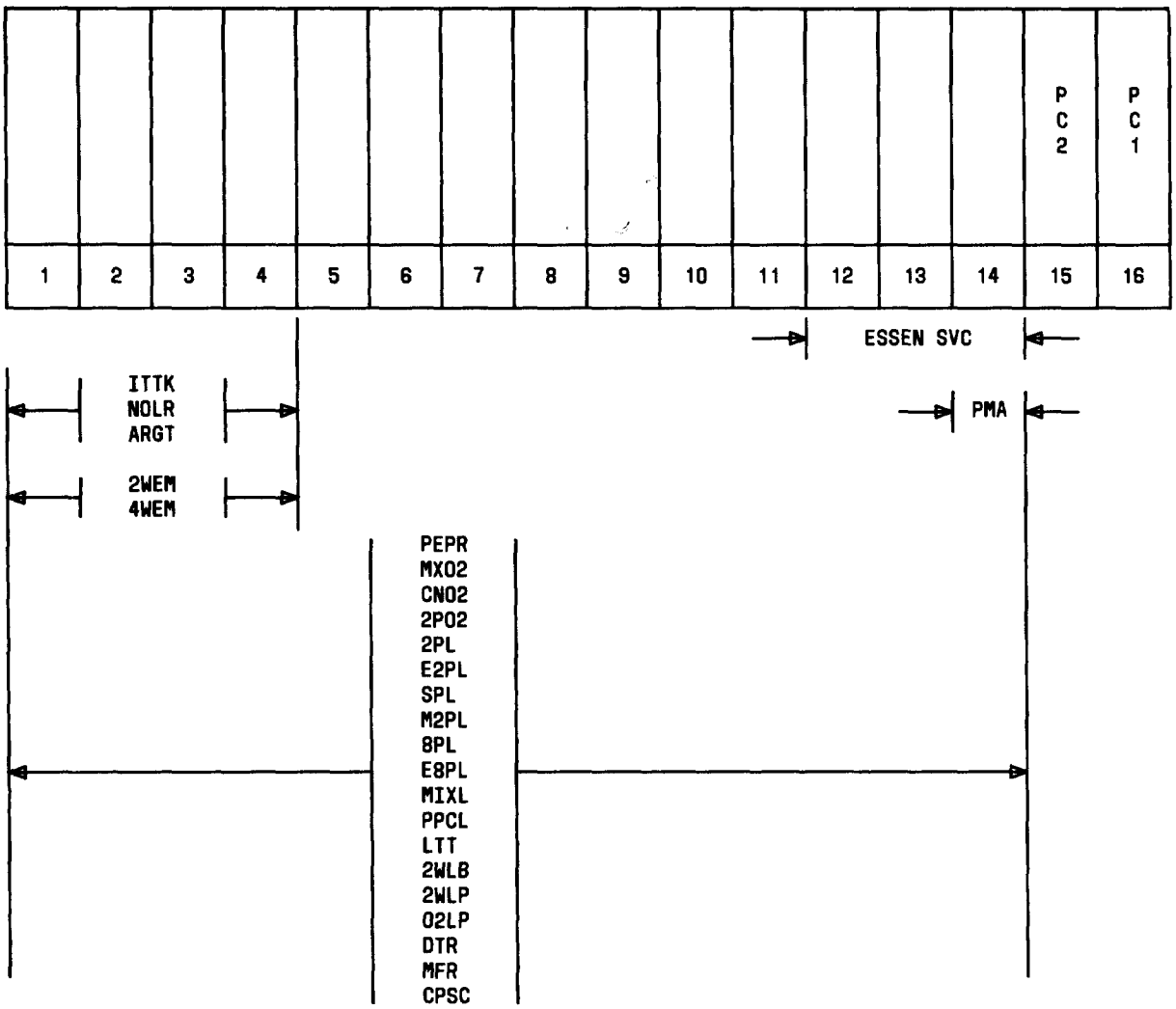
8.02 The following NTPs may be of use to the network administrator.

SECTION	TITLE
297-3001-060	Performance Oriented Practices User's Guide
297-3001-100	General Description
297-3001-105	Features and Services Description
297-3001-150	Equipment Identification
297-3001-181	Line Circuit Interface
297-3001-182	Trunk Circuit Interface
297-3001-200	System Growth Practices
297-3001-300	Input/Output System
297-3001-304	Data Modification—General
297-3001-307	Line Load Control
297-3001-311	Data Modification Manual
297-3001-456	Operational Measurements



NOTE: IN THIS EXAMPLE, MULTIPLEX LOOPS 2 AND 18 ARE PAIRED. IF THE PRIMARY LOOP 18 TO SHELVES 2 AND 4 FAILS, THE MATE LOOP (2) WILL CARRY ALL FOUR SHELVES. THE REVERSE IS ALSO TRUE.

Fig. 1—Example of Paired Multiplex Loops (2.02)



ABBREVIATIONS

SPL – SINGLE PARTY LINE
2PL – 2 PARTY LINE
E2PL – EXTENDED RANGE 2 PARTY LINE
M2PL – MULTIFREQUENCY 2 PARTY LINE
8PL – 8 PARTY LINE
E8PL – EXTENDED 8 PARTY LINE
MIXL – MISCELLANEOUS LINE
PPCL – PREPAY COIN LINE
ITTK – INCOMING TRUNK TEST
ARGT – AUXILIARY RING & TONE
NOLR – NOLLER INTERFACE
LTT – LINE & TRUNK TEST
MX02 – 0dB MISCELLANEOUS LINE
2P02 – 0dB GENERAL LINE
CN02 – 0dB PREPAY COIN LINE

CPSC – CAMA POSITION SIGNALING CIRCUIT
PEPR – PERIPHERAL PROCESSOR
02LP – OUTGOING LOOP TRUNK
2WLB – MISCELLANEOUS LOOP TRUNK
2WLP – 2 WAY LOOP TRUNK
2WEM – 2 WIRE E&M TRUNK
4WEM – 4 WIRE E&M TRUNK
DTR – DIGITONE RECEIVER
MFR – MF RECEIVER
PC1 – PERIPHERAL CONTROLLER 1
PC2 – PERIPHERAL CONTROLLER 2
PMA – PERIPHERAL MAINTENANCE ACCESS (1 PER PE BAY)
ESSEN SVC – ESSENTIAL SERVICE

Fig. 2—Peripheral Equipment Shelf Layout and Circuit Pack Location Restrictions (4.05)