

DATA MULTIPLEX SYSTEM USING 1200-TYPE DATA MULTIPLEXER

DESCRIPTION

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1. GENERAL

1.01 This section contains the functional, physical, and maintenance descriptions of the Data Multiplex System (DMS) which uses the 1200-type data multiplexer (DM).

1.02 This section is being reissued to include a description of the 58A1 data mounting, the PS13 circuit card, the 1200B data multiplexer, the maintenance kit containing the PS16 circuit card, and the shelf used for rack mounting the 1800A data control unit (LCU).

1.03 The DMS provides time division multiplexing service for economical and reliable bulk transmission of low-speed asynchronous data channels between a master DM and up to three remote DMs. The service will accommodate data channels with standard rates of 120 characters (1200 bits) per second and lower. In addition, one or two synchronous data channels may be multiplexed along with the asynchronous channels. These channels are hereafter referred to as "derived synchronous channels". Transmission between DMs is via high-speed analog or digital synchronous private lines.

1.04 The DM used in the DMS (Fig. 1) features flexible rearrangement of asynchronous channel assignments by use of the 1800A-L1 or 1800B-L1 data control unit. The 1800A-L1 data control unit, hereafter referred to as the local control unit (LCU), is connected to one of the DMs to form the master DM. The 1800B-L1 data control unit, hereafter referred to as the remote control unit (RCU), is located at some remote location and accesses the DMS master DM via the direct distance dialing (DDD) network (Fig. 2). The DMS maintenance features provide the means to automatically activate loopbacks and use an internal test circuit in the master DM to troubleshoot the system. In addition, external test equipment may be used with an RCU located at a multiplexer test facility (MTF). ♦MTF access is via the switched network through a data set 212A to an asynchronous test port Electronic Industries Association (EIA) interface on the master DM.♦

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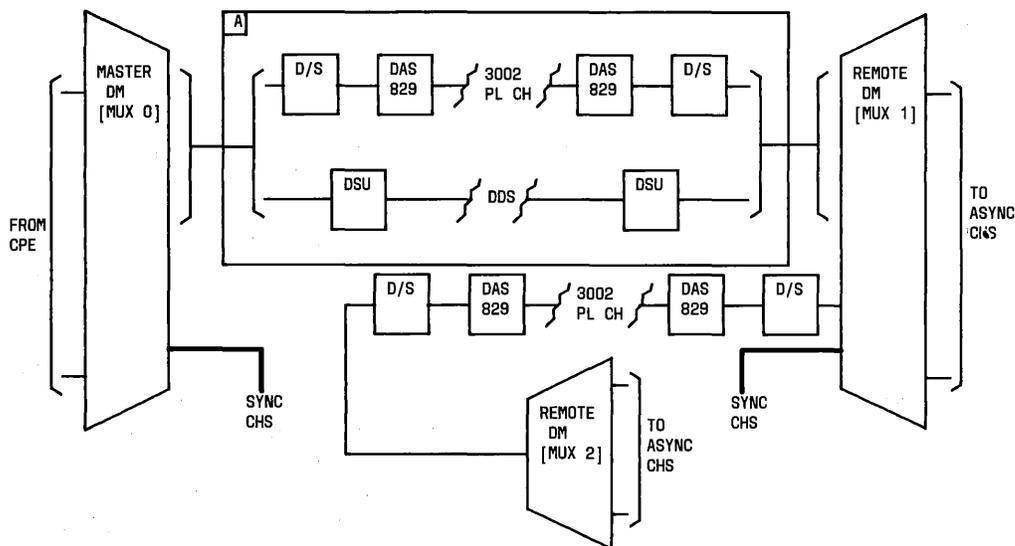


Fig. 1—Typical DMS Network Using 1200-Type Data Multiplexers

1.05 The DMS is primarily intended as a bulk data communications link between groups of asynchronous data terminals. Figure 1 shows a typical application of a DMS. In this case, a host computer (CPE) at the master DM is linked to two remote DMs in tandem. One of the synchronous ports of the master DM is assigned to equipment which transmits synchronous data. This synchronous data is multiplexed along with the asynchronous data coming from the low speed ports of the multiplexers to form a "Derived Synchronous Channel."

1.06 One synchronous line equipped with appropriate synchronous data sets (DSs) or data service units (DSUs) connects the master DM (MUX 0) to remote DM (MUX 1). The remote DM (MUX 1) to remote DM (MUX 2) synchronous line may only be equipped with DSs unless circuit pack PS9B is used. If circuit pack PS 9B is used and DDS operation is provided on synchronous port 1 of the DM then DDS operation is also permitted on synchronous ports 2 and 3 of the DM. In the configuration of Fig. 1, communication (asynchronous and derived synchronous data channels) between the MUX 0 and MUX 2 passes through MUX 1.

An alternate configuration might employ a separate synchronous line from the master DM to *each* of the remote DMs.

1.07 The DMS multiplexes asynchronous channels which serve both duplex and half-duplex terminals. All of the standard information/stop bit codes for asynchronous transmission are supported. The DMs and synchronous lines used to transmit multiplexed asynchronous and derived synchronous channels are duplex. Table A summarizes the asynchronous, derived synchronous, and synchronous speeds permitted.

1.08 Data transmission in the DMS is organized around a 9-bit character structure. Asynchronous data into the multiplexer is stripped of start and stop bits and the information bits (up to 8) are sent as part of a 9-bit word to the other multiplexer. At the other multiplexer start and stop bits are added and the data word is regenerated at the appropriate asynchronous interface. The ninth bit of the word identifies whether the other 8 bits are data or control information. If no data is available, the 9-bit word contains control information consisting of five bits of EIA control information, a break

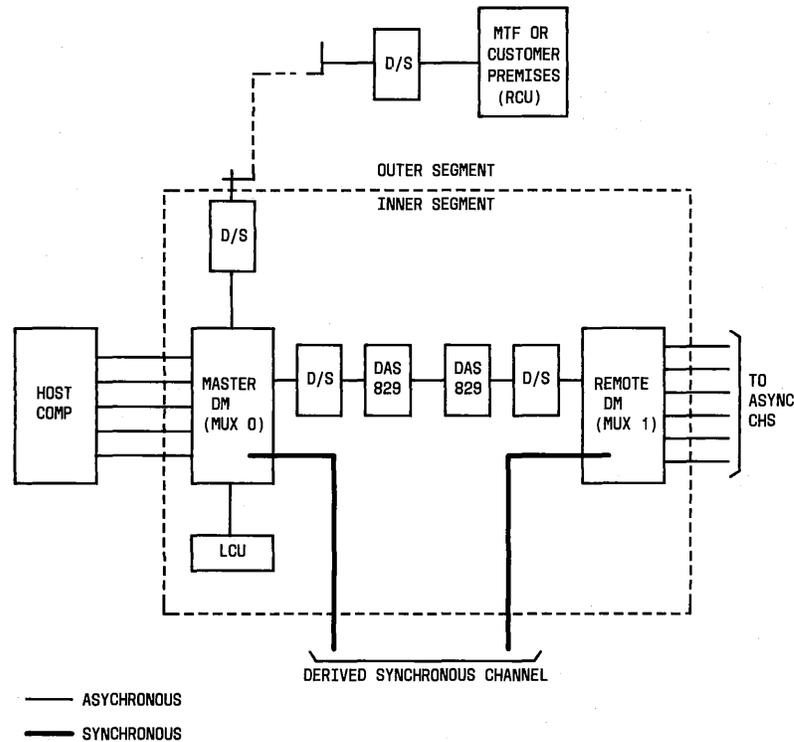


Fig. 2—Typical DMS Network Showing MTF Access to System

TABLE A
DMS ASYNCHRONOUS
AND SYNCHRONOUS SPEEDS

ASYNCHRONOUS		SYNCHRONOUS (BPS)	
BPS	CPS*	DERIVED CHANNEL	LINES
74.2	10	1200	1200
75	10	2400	2400
110	10	4800	4800
134.5	15		9600
150	15		
300	30		
600	60		
1200	120		

* Characters per second for standard character structure at that speed. Other supported character structures may be used provided that the cps shown for a speed is not exceeded by more than 10%.

signal, a test bit, and a loopback request for the asynchronous channel. A SYNC word is inserted every 192 words to maintain synchronization between multiplexers. Five other 9-bit words out of the 192 words in a frame are used for intermultiplexer communication.

1.09 The service objective of the DMS is an average character error rate of 10^{-4} or better. The character error rate in low-speed bit streams demultiplexed from high-speed synchronous lines will be the same as the error rate for 9-bit blocks on the line. The availability of the DMS is based upon the channels supported by the high-speed synchronous lines. The reliability and availability of such channels are estimated to have an average downtime of 68 minutes per channel per month (99.84 percent availability).

1.10 The total number of high-speed lines between DMs and synchronous channels in any configuration must be three or less. No more than three **remote** DMs can be in any configuration. The eight equipment arrangements and NET options (1 through 8 in Fig. 3) are designated as basic configurations because each employs a unique pattern

for interleaving the multiplexed frames. The subset configurations use the same frame interleaving patterns as the 8 basic configurations with 10 additional equipment arrangements which bring the total possible system configurations to 18.

2. FUNCTIONAL DESCRIPTION

2.01 The DMs are the core of a DMS network (Fig. 2). One DM is designated to be the master for the network and the others are designated as remotes. One end of all network channels must appear at the master DM since access for control and monitoring in all channels is via the master. In addition, channel assignment and other information for the remote DMs are also under control of the master.

2.02 The 1200-type DM provides a standard time division multiplexing mode of operation. Standard multiplexing dedicates an asynchronous channel on the high-speed synchronous line for access by only one asynchronous port in the master DM and only one corresponding port on only one remote DM.

A. 1200A Data Multiplexer (DM)

2.03 The 1200A DM (Fig. 4) provides up to 16 asynchronous channel interfaces and 3 synchronous line interfaces. The synchronous line (port 1, port 2, and port 3) interfaces may be either connected to synchronous lines from other DMs or (port 2 and port 3 only) provide access for a derived synchronous channel.

B. 1200B Data Multiplexer (DM)

2.04 The 1200B DM (Fig. 5) provides up to 16 asynchronous channel interfaces and one synchronous line interface. The 1200B serves as an economical remote multiplexer where only one synchronous line is required and the standard multiplexing mode is used. The 1200B cannot be used as a master DM or as an intermediate DM in "drop" configurations, or where derived synchronous channels are required. The 1200B is controlled by fixed logic and cannot generate its own frame information. It accepts time slot assignments from the master multiplexer and stores the information in a memory that is protected against loss of power.

C. 53A1 Data Mounting (Auxiliary Channel Unit)

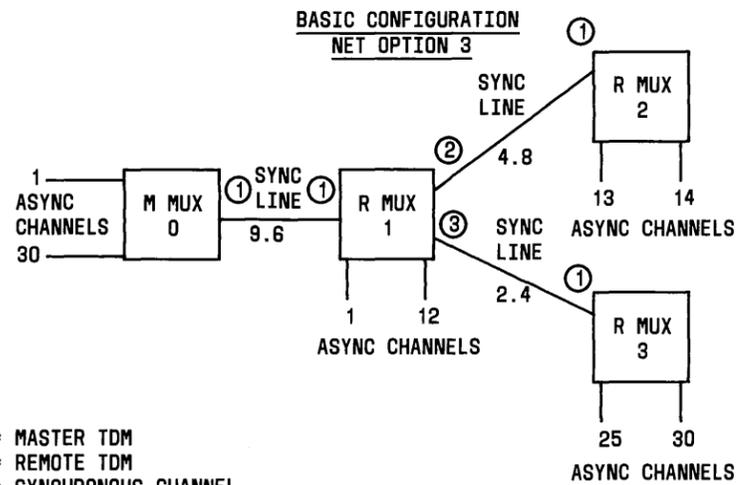
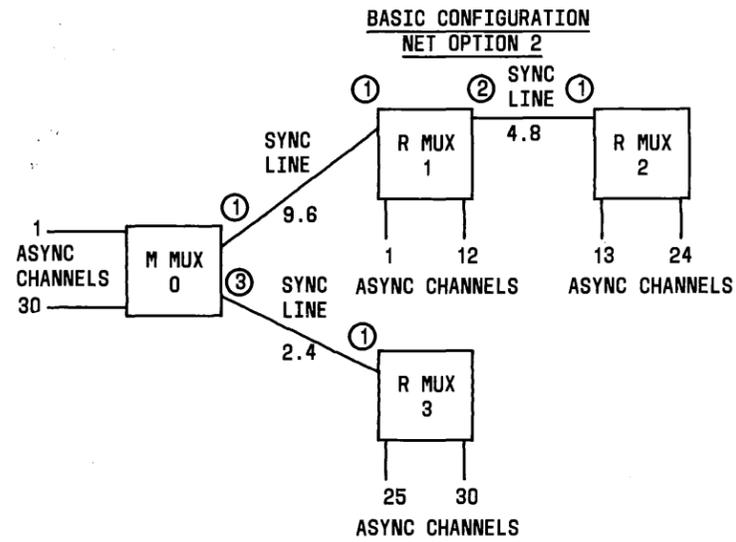
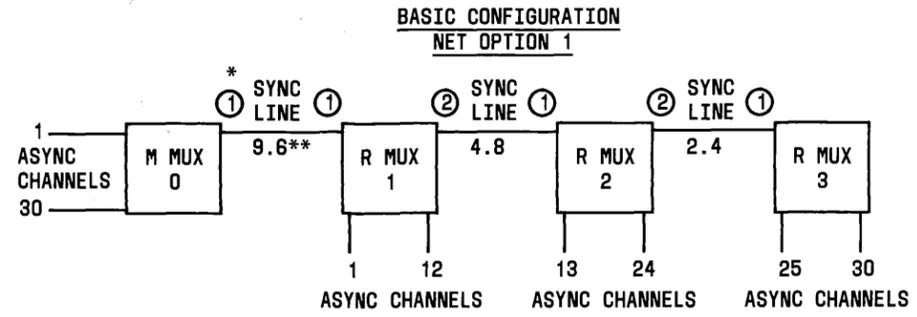
2.05 The 53A1 data mounting (Fig. 6) provides the power supply and mounting space for up to 16 additional asynchronous channel interfaces. This permits the DMS asynchronous channel capacity to be expanded from 16 up to 32. The 53A1 data mounting is connected to the 1200-type DM via a 3-foot, 50-conductor cable (A25B) which is supplied with the 53A1.

2.06 In a central office arrangement, it is recommended that the 1200A, 1200B, and 53A1 be equipped with a PS13 circuit card. The PS13 circuit card has indicators on its faceplate to indicate the status of 16 asynchronous channels (zero or nonzero speed settings), whether the 3 synchronous lines are in or out of sync, and to indicate status of the +5, +12, and -12 volt power supplies.

2.07 In a rack mounted arrangement in a central office, the PS13 circuit card allows the craft to check the status of the asynchronous channels, synchronous lines, and voltages while working at the front of the equipment rack. Note that in a central office arrangement, the rear (connector side) of the 1200-type DM and the 53A1 extend from the front of the equipment rack to allow easy access to the circuit cards and M25J cords.

D. 58A1 Data Mounting (Multiplexer Alarm Panel)

2.08 The 58A1 data mounting (Fig. 7) is 23 inches wide, 6 1/2 inches deep and 2 inches high. It provides an interface between 1200-type DM and/or 53A1 data mountings and the central office alarm system. Major and minor alarm indicators and an alarm cut-off switch (ACO) equipped with an indicator lamp are provided for each of four multiplexers (master or remote) or 53A1 data mountings. A major alarm is defined as a DC voltage drop greater than 20 percent on any one or all three of the DC supply voltages to each multiplexer or 53A1. The voltage monitoring circuits are designed to detect a drop of 20 percent on a +5.2 volt multiplexer input through 82.5 ohms, a +5.0 volt (53A1) input through 78.7 ohms, a +12 volt input through 249 ohms, and/or a -12 volt input through 249 ohms. A minor alarm is defined as a loss of synchronization involving one or more multiplexers. A contact closure is required at the synchronization (minor) alarm input to activate the circuit. The alarm circuit outputs consist of four



M MUX = MASTER TDM
 R MUX = REMOTE TDM
 SC = SYNCHRONOUS CHANNEL
 * = SYNCHRONOUS PORT NUMBER
 ** = SYNCHRONOUS LINE SPEED

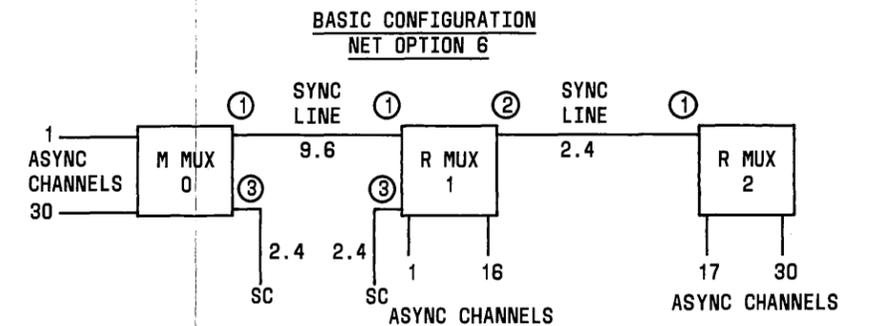
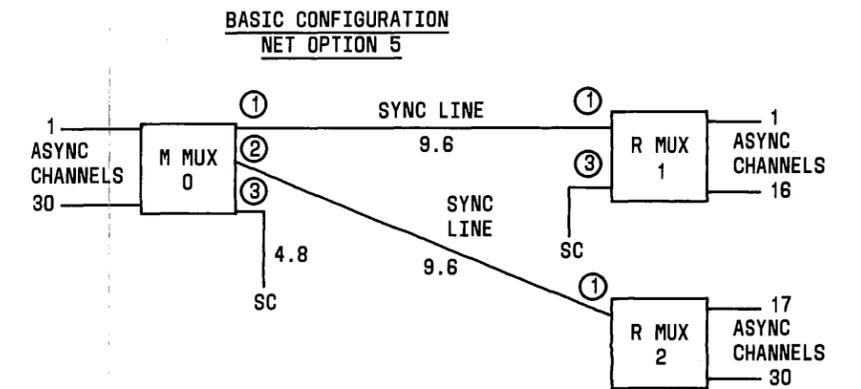
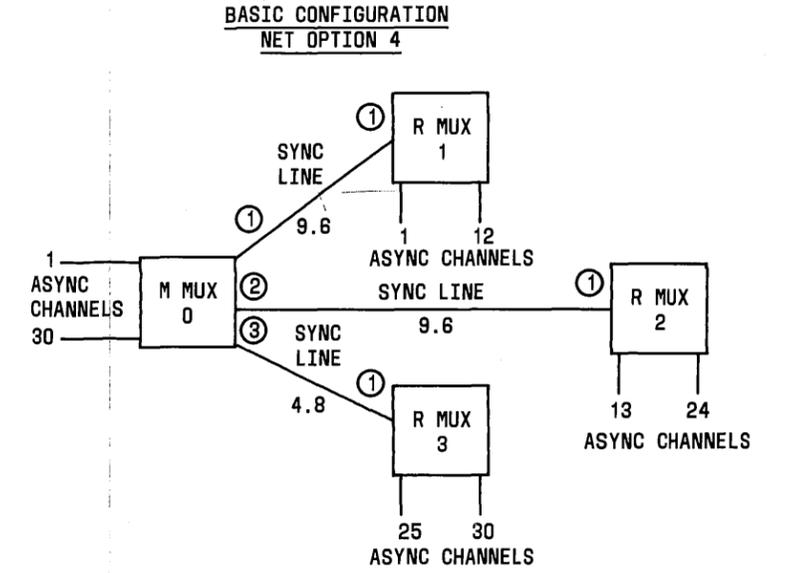


Fig. 3—Network Configurations

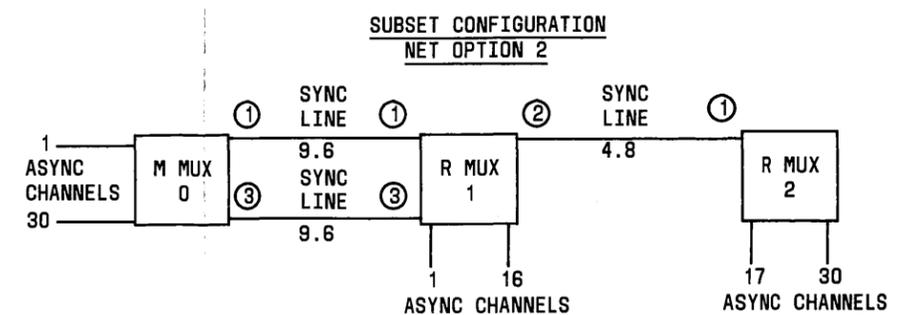
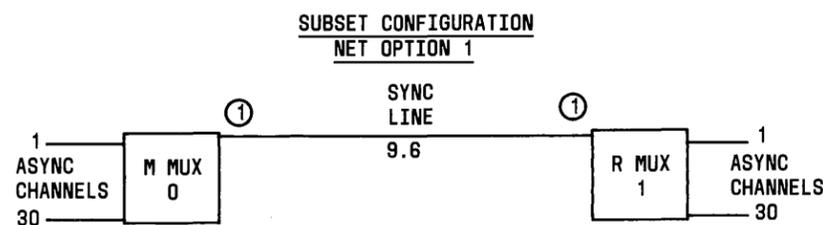
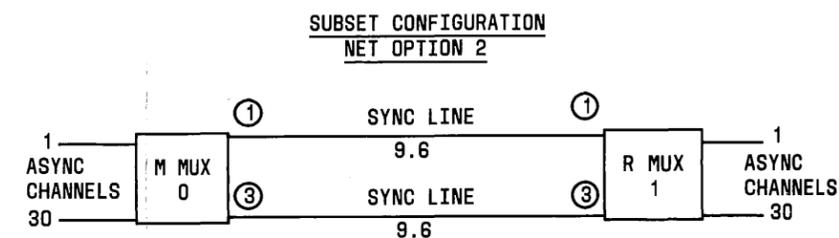
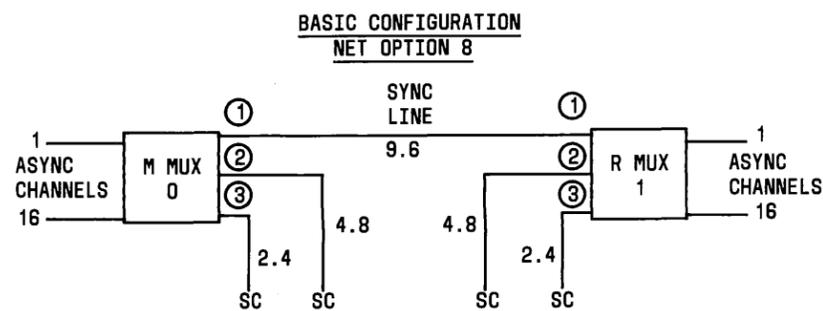
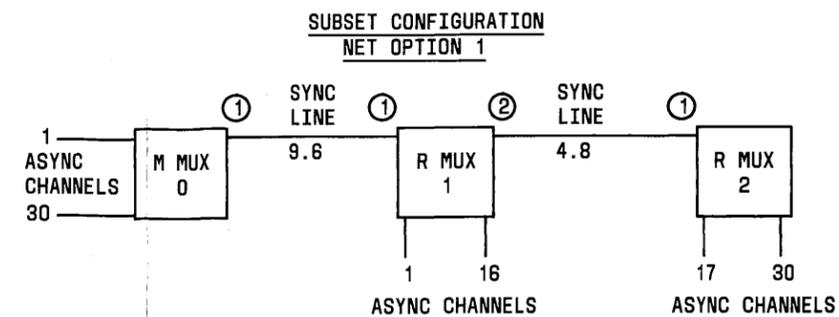
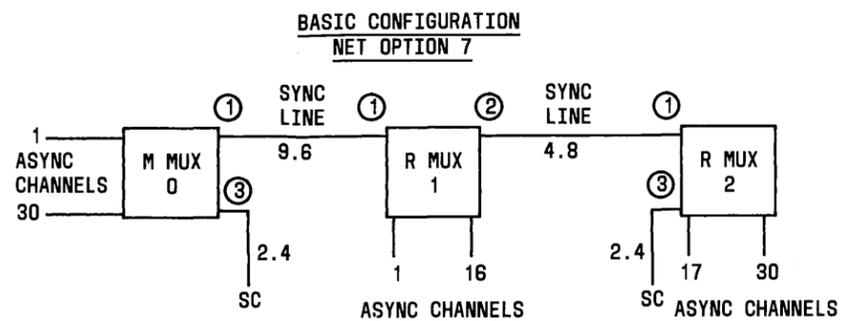


Fig. 3—Network Configurations (cont)

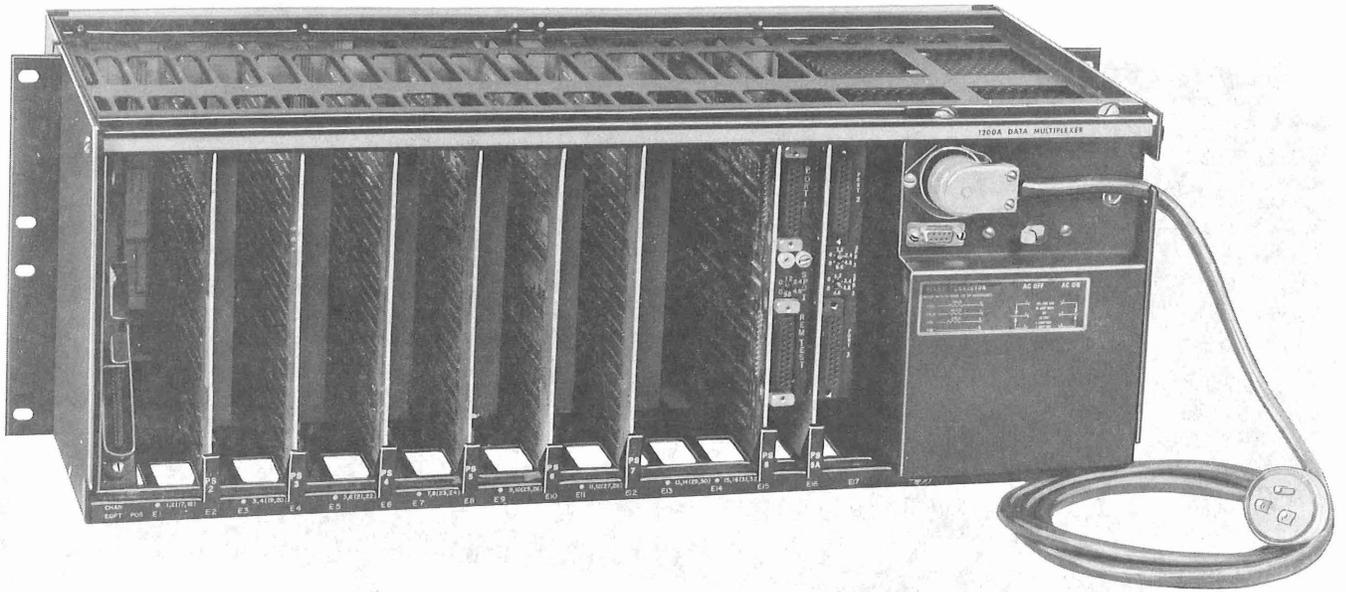


Fig. 4—1200A DM, Rear View

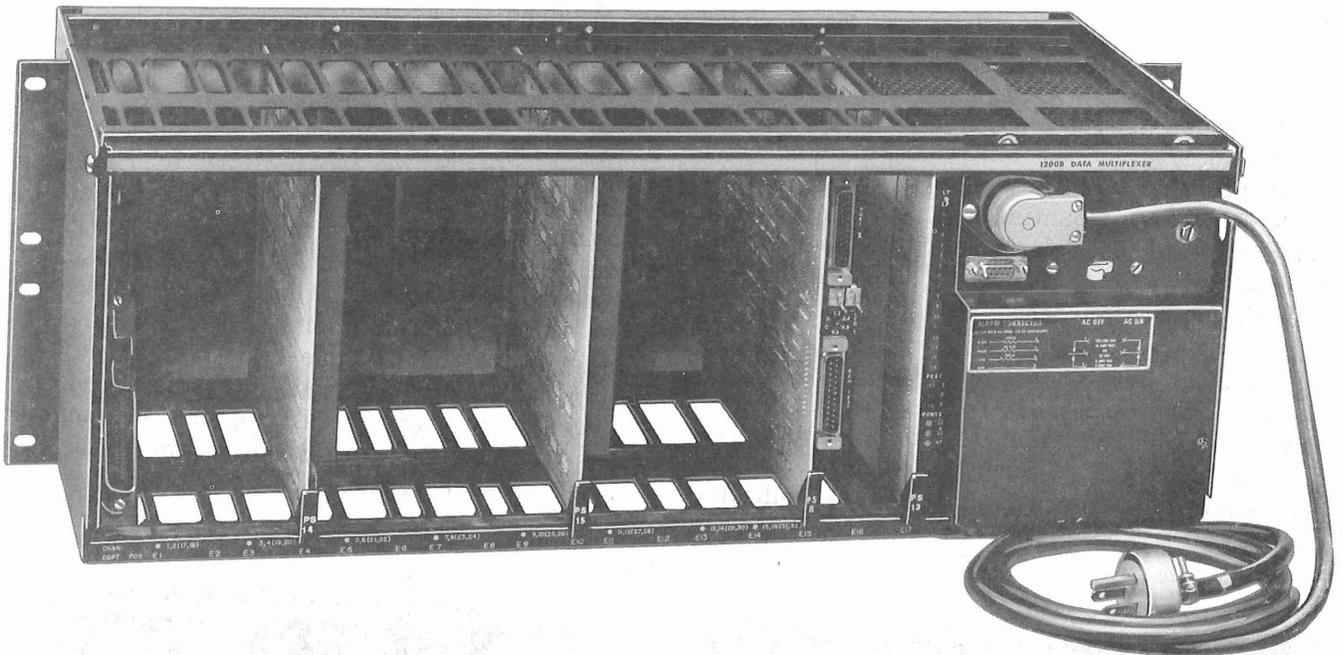


Fig. 5—1200B DM, Rear View

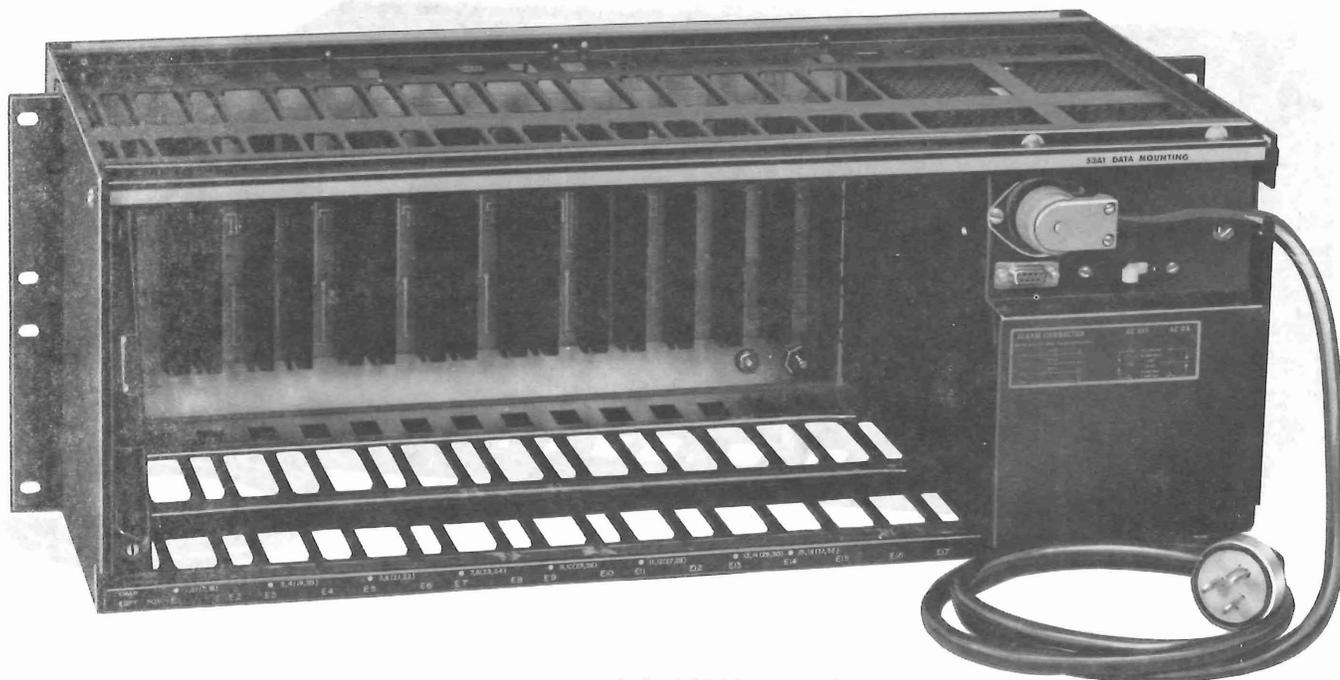


Fig. 6—53A1 Data Mounting

isolated contact closures which activate the audible and visual loops of the central office major and minor alarm circuits. Loss of central office power to the 58A1 data mounting will result in a power (major) alarm. The alarm cutoff feature may be disabled for any or all alarm loops on a per multiplexer or 53A1 basis.

E. 1800A-L1 Data Control Unit (LCU)

2.09 The LCU, shown in Fig. 8, is connected to a 1200A DM to form the master DM. The LCU serves as a control unit and status indicator

for the network. Controls are provided to make channel assignments and to activate loopbacks for testing. Indicators are provided which display speed, code, and destination information as well as fault indications, asynchronous channel activity, and the state of the interface leads for any selected asynchronous channel. The LCU is connected to and receives power from the master DM via a 50-conductor (B25A) cable 15 feet in length. The B25A cable may be extended to a maximum of 50 feet. The unit may be desk top or shelf mounted. A special shelf is provided for mounting the LCU in a cabinet designed for 23 inch mountings.



Fig. 7—58A1 Data Mounting

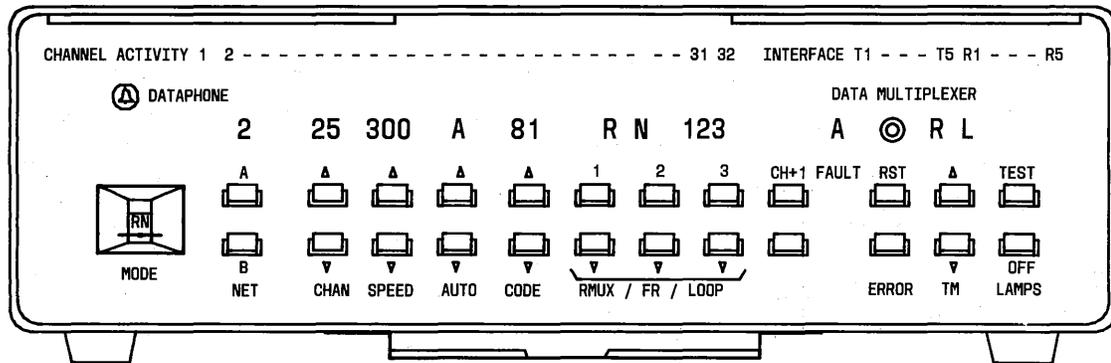


Fig. 8—1800A-L1 Data Control Unit (LCU)

F. 1800B-L1 Data Control Unit (RCU)

2.10 The RCU may be located at any remote location and accesses the DMS via a DDD connection to the master DM. The telephone company may establish several remote locations equipped with the RCUs to aid in maintenance of the DMSs. These locations are designated as the Multiplexer Test Facility (MTF). Customers may also establish remote locations equipped with RCUs to provide their own system monitoring.

2.11 The RCU has the same indicators and controls as the LCU and in addition has a 300/1200 bit per second speed select button located below the CH+1 button (Fig. 9). The RCU is equipped with two 25-pin EIA connectors (Fig. 10). One of the 25-pin connectors is for connection to the data set used to access the DMS and the other provides the means to connect external test

equipment to the system. The RCU requires a separate source of 117-volt, 60-Hz power.

G. Synchronous Lines

2.12 Interconnection between the DMs in a network is via either a 3002 4-wire private line facility or the digital data system (DDS). Circuit pack PS9 determines DDS operation. When circuit pack PS9 is used in the DM, use of the DDS is restricted to synchronous port 1 only. Synchronous lines 2 and 3 must be provided by 3002 facilities. If circuit pack PS9B is used in place of PS9, DDS operation is permitted on all 3 synchronous lines if DDS operation is provided on synchronous port 1 of the DM. The allowable synchronous line speeds are 1.2, 2.4, 4.8, and/or 9.6 kilobits per second (kb/s).

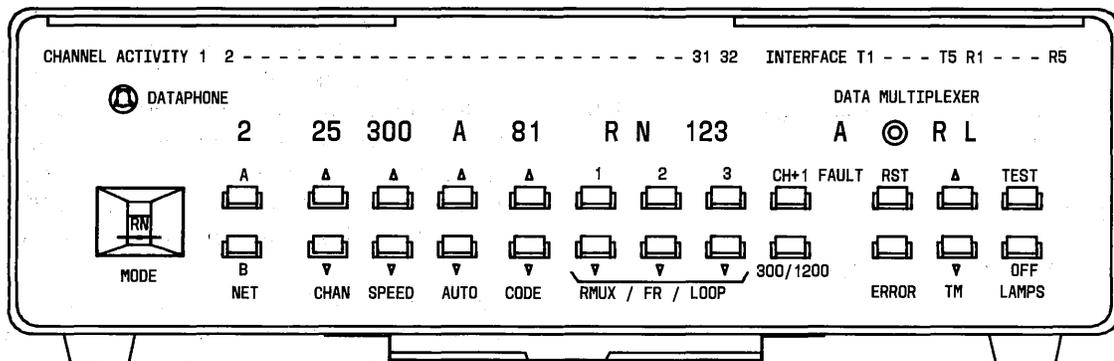


Fig. 9—1800B-L1 Data Control Unit (RCU) Front View

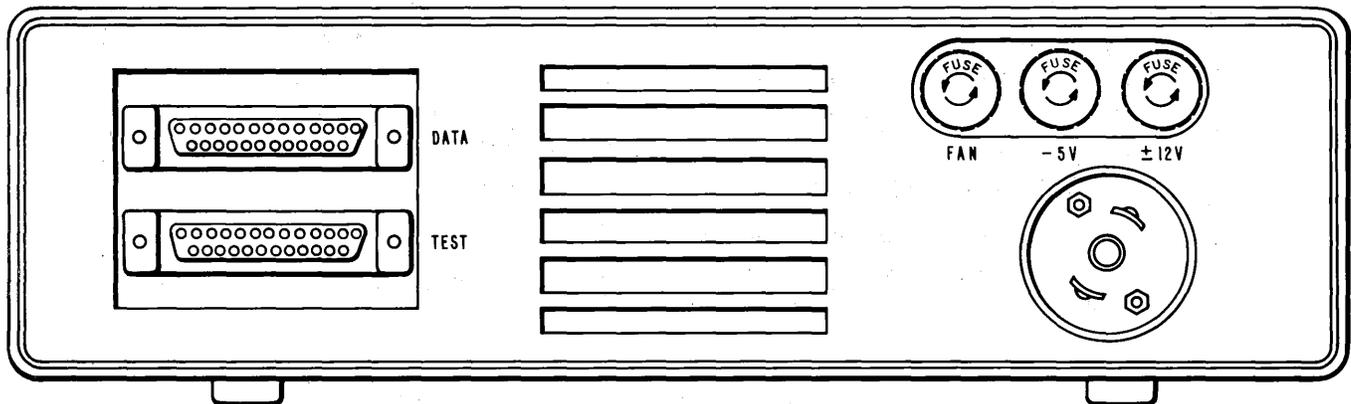


Fig. 10—1800B-L1 Data Control Unit (RCU), Rear Panel

H. Asynchronous Extensions

2.13 The asynchronous channels are extended from the master or remote DMs as follows:

- (a) By direct cabling to terminal equipment
- (b) By private line or DDD data set connections.

I. Synchronous Extensions (Derived Synchronous Channels)

2.14 The DMS permits multiplexing of one or two derived synchronous channels along with the multiplexed asynchronous channels. ♦Derived synchronous channels are limited to synchronous ports 2 and 3 only.♦ The derived synchronous channel speeds may be 1.2, 2.4, or 4.8 kb/s.

J. Interfaces

2.15 ♦The following interfaces are supported by the DMs:

Synchronous:

- EIA Standard RS-232-C

Asynchronous:

- EIA Standard RS-232-C
- MIL STD 188C

- (20 mA and 62.5 mA) current interface

K. Physical Arrangement

2.16 The basic installations for the DMs use the KS-20018-type cabinet for customer premise installations and bay mounting for some central office installations. These installations include data sets and data auxiliary set (DAS) 829-types and/or DSUs with the DMs thereby requiring placement relationships in the cabinets and bays. Task Oriented Practice (TOP) 590-104-104 and Section 590-010-201 supply information to aid in establishing cabinet arrangements.

3. MAINTENANCE FACILITIES

3.01 A serving test center (STC) on each DMS network is designated the control STC (CSTC) for the network. The CSTC coordinates all circuit order, service order and test activity of installations, final preservice tests, and system rearrangements. A centrally located MTF (Fig. 2) equipped with RCUs is available for assisting the CSTC in testing of, and trouble isolation on, the DMS.

3.02 The CSTC, STCs, and data test centers (DTCs) are responsible for the final isolation and service restoral using standard operating procedures for all network segments. There is no test equipment unique to a DMS required at any STC or DTC.

3.03 Each customer will be encouraged to establish a network management center for performing tests, loopbacks, trouble isolation, centralized reporting, and screening of network problems. The customer will be requested to have the center perform the trouble isolation procedures and diagnostics before contacting the CSTC. It is expected that the CSTC will be able to clear most troubles without involving the MTF. However, if required the CSTC may request the MTF to use the RCU to help isolate a trouble to a particular network segment. The CSTC will then refer the trouble to the STC or DTC responsible for that segment. The STC or DTC is responsible for further isolation and service restoral using standard operating procedures. The CSTC will be responsible for monitoring the progress of the STC or DTC and turning services back to the customer.

3.04 To aid in trouble isolation and service restoral, a D180766 maintenance kit will be available which contains the following equipment.

- A circuit pack replacement for each type of circuit pack used in any DM (master or remote). These circuit packs are PS2-9, 11, 13-16 and three PS1s. The PS16 circuit pack is used to test the 1200-type DM.
- Replacement cords for the cords used to interface with synchronous data sets and data service units and for asynchronous data sets.
- Looping plug(s) to be used in testing data, timing and control interface leads.

The maintenance kit will not include 1800-type control units or 224-type power supplies.♦

3.05 DMS remote testing depends on the RCU at the MTF interacting with the master DM. The RCU permits the following monitoring and testing capabilities:

- Monitoring of the in-service circulating test bit
- Monitoring of the out-of-sync, data set retrain, and carrier fail conditions for the synchronous lines
- In-service monitoring of asynchronous derived channels using external test equipment

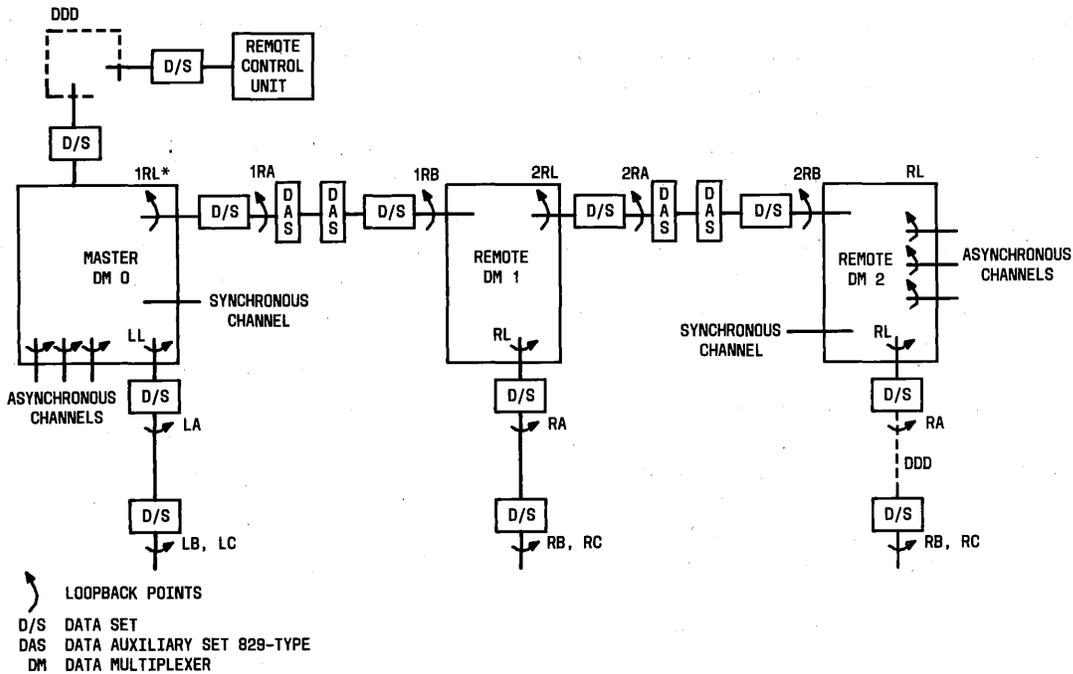
- Testing of asynchronous terminals at the master DM or remote DM using external test equipment
- Activation of loopbacks at various locations for testing of channels
- Use of either the internal test circuit of the master DM or external test equipment for performing tests.

3.06 A test circuit in the master DM performs a continuous in-service test of each asynchronous channel. A test bit, inserted in each control character, is circulated through the system. The test circuit checks the returned test bits and gives an indication (flash of activity lamp) on the LCU and (if connected to the system) RCU when errors occur.

3.07 Two categories of loopback are provided (Fig. 11); those within the DMs in the system (internal), and those at other equipment in the system (external). Internal loopbacks of the synchronous lines or asynchronous channels are activated from the LCU or an RCU via control characters generated by the master DM. The external loopbacks of asynchronous channel data sets are activated from the LCU or an RCU via EIA interface leads or signals in the data stream if the data set recognizes these commands. For other data sets, the loopbacks must be manually activated at the loopback point.

3.08 The test circuit in the master DM may be used to perform out-of-service loopback tests on the asynchronous channels. Only the selected asynchronous channel to be tested is taken out of service. The test may be conducted toward the asynchronous port of the master DM (local) or toward the asynchronous port of a remote DM. An indication is given of the condition of facilities and equipment out to the loopback point. The test characters are passed through the DM interfaces when external loopbacks are activated.

Caution: Care must be taken not to actuate any loopbacks until the channel to be tested has been selected with the LCU or RCU CHAN button. Otherwise, a channel which has not been released for testing will be taken out of service.



NOTE: MOST EXISTING BELL SYSTEM DATA SETS DO NOT PERMIT ACTIVATION OF LOOPBACKS THROUGH THE INTERFACE. HOWEVER, WHEN DATA SETS ARE DESIGNED TO PROVIDE INTERFACE LOOPBACKS, THE TDM WILL PROVIDE THE NEEDED CONTROL SIGNALS.

* THE 1 IN THE 1RL DESIGNATION INDICATES THAT THIS IS A LOOPBACK ON SYNCHRONOUS LINE 1 TO DESTINATION 1 (REMOTE DM 1).

Fig. 11—DMS Loopback Points

3.09 Internal loopback tests do not include the EIA circuitry (drivers, terminators, and interface connectors) of the asynchronous channels. However, these circuits are tested when external loopbacks are activated. Standard 25 pin EIA type interface plugs, prewired to loop back the data and control interface leads, are provided with each DM and may be connected to interface connectors as desired. The maintenance kit also provides looping connectors for loopback of interfaces equipped with M25J cords or MIL STD 188C 15 pin connectors.

3.10 The RCU is equipped with a 25-pin connector (Fig. 10) which permits use of any external test equipment that will connect to an EIA RS-232C interface for testing asynchronous channels. A 904C DTC position, DATASPEED® 40 test position, etc, can be connected to the asynchronous channels via the RCU. This arrangement permits testing of terminals on the asynchronous channels. While external test equipment is being used, the test circuit in the master DM is idle.

4. REFERENCES

4.01 For additional information relating to the DMS, refer to the following documents:

NUMBER	TITLE
SD-&CD-1D265-01	1200-Type Data Multiplexer
EL 4445	Data Multiplex System—Description
EL 4446	Data Multiplex System—Equipment Description, Ordering and Pricing Information
PUB 49158	Technical Reference on Data Multiplex System
SECTION	TITLE
590-000-120	DATAPHONE® Multiplex Service—Data Multiplex

SECTION	TITLE	SECTION	TITLE
	System—Using 1200A-Type Data Multiplexer—Reference Guide	666-615-101	Data Multiplex System—Using 1200A-Type Data Multiplexer—CSTC and MTF Procedures
590-104-101	1200A-Type Data Multiplexer—Description	682-300-015	Data Multiplex System—Plant Assignments
590-104-103	1800A-L1 Data Control Unit—Description and Operation	880-101-100	Data multiplex system—Transmission Objectives and System Application Engineering Considerations
590-104-104	Data Multiplex System—Using 1200A-Type Data Multiplexer—Station Arrangements	880-101-190	Data Multiplex System—Engineering and Implementation Methods System
666-615-100	Data Multiplex System—Using 1200A-Type Data Multiplexer—Control Center—Description and Operation	999-100-161	Data Multiplex System—How to Operate Manual