

## 1800A-L1 DATA CONTROL UNIT DESCRIPTION AND OPERATION

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### 1. GENERAL

**1.01** This section contains the physical and functional descriptions of the 1800A-L1 (Local) Data Control Unit (referred to as LCU) which is used with the 1200A-type Data Multiplexr (DM) in a Data Multiplex System (DMS). See Fig. 1.

**1.02** This section is reissued to include current descriptive and operational information for the 1800A-L1 data control unit.

**1.03** The 1800A-L1 LCU (Fig. 2) provides controls, testing, and monitoring functions for the DMS. It is connected to the 1200A-type DM to form a master DM.

**1.04** The LCU serves as a control unit and status indicator for the DMS. Controls are provided to make channel assignments and to activate loopbacks for testing. Indicators are provided which display fault indications, asynchronous channel activity, and the status of the interface leads for any selected asynchronous channel. Other indicators display the channel parameters (speed, code, destination for a selected channel, and whether the autobaud feature is selected in that channel).

**1.05** The LCU may be desk top or shelf mounted and is connected to the 1200A-type DM via

a B25A (50 conductor) cable supplied with the LCU.

### 2. PHYSICAL DESCRIPTION

**2.01** The 1800A-L1 LCU derives its power (+5 Vdc at 2 amps) from the 1200A-type DM via the B25A connector cable. The B25A cable supplied with the LCU is 15 feet long. The cable may be extended beyond 15 feet in length but in total may not exceed 50 feet in length. The LCU is 10.6 inches wide, 8.1 inches deep, 3.3 inches high, and weighs approximately 5 pounds.

**2.02** The 1800A-L1 LCU will operate in an environment of 40 to 120°F, with a relative humidity of less than 95 percent.

### 3. FUNCTIONAL DESCRIPTION

**3.01** Once the DM system is physically set up (data sets, data service units, transmission facilities, DMS, basic configurations, and synchronous speeds are installed); control, monitoring, testing, and trouble isolation can be accomplished through the 1800A-L1 LCU connected to the master DM.

**3.02** The LCU is used to enter or change channel parameter information without requiring hardware changes in the DMS.

**3.03** The master DM continuously performs an in-service test in each channel by circulating test bits through remote DMs. Failure of this test is indicated by a flashing channel activity lamp. The channel activity lamps indicate which channels are transmitting data from master DM to remote DM by a constant light. The activity lamps for assigned channels not equipped with channel cards at the master DM are also lighted constantly.

**3.04** The MODE switch controls the LCU's mode of operation. These modes are run (RN), low speed change (LS), frame change (FR), remote

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test (RT) and test (TM). Only the buttons required for the selected mode of operation are active as shown in Table A. This feature prevents service or system disruption by the operation of nonrelated buttons. The channel activity and interface lamps on the LCU are unaffected by the MODE switch position.

**3.05** In the RN mode, the only button active (other than LAMP TEST) is channel select (CHAN) so no changes can be entered in the system. The channel parameters are displayed on the LCU along with the state of the interface leads for the selected channel.

**3.06** The LS mode is used for entering channel parameter information. The appropriate asynchronous channel is selected; the speed and code (character structure) are selected; autobaud or no autobaud is entered; and the channel destination (RMUX) is selected.

**3.07** If the next channel in sequence requires the same settings, the information can be entered in the LS mode by depressing the repeat previous information channel button (CH+1). The channel number is automatically advanced by one, and the channel parameter information is stored.

**3.08** In the FR mode, the upper three frame buttons (RMUX/FR/LOOP 1, 2, or 3) are used to generate frame 1, 2, or 3. Depressing

one of these buttons causes the master DM to build the corresponding frame and send it to the remote DM. When this procedure is completed, the frame indicator above the button goes off. The procedure is repeated for each frame required. When attempting to build a frame, if the synchronous line capacity is exceeded or all asynchronous channels assigned to a synchronous line are set for zero speed within a frame, the frame indicator will flash. Depressing the lower button turns off the light and signals the microprocessor in the master DM to stop attempting to build a frame.

**3.09** In the RT mode, the control of the LCU function is transferred to the remote data control unit (referred to as RCU) located at a multiplexer test facility (MTF) or at a customer premises (Fig. 3).

**3.10** In the TM mode, various asynchronous and synchronous channel loopback tests can be initiated. In each test, a fixed data word is generated in the master DM and inserted in the selected asynchronous channel, looped at a distant point, and compared by the master DM. If the test fails, the ERROR lamp (located above RST button) lights momentarily and the alphabetic characters indicating the test begin flashing on and off. The characters continue to flash until the RST button is depressed. If errors are no longer detected, the alphabetic characters will be constantly lighted after the RST button is depressed.

TABLE A

LCU BUTTON OPERATION

MODE IDENTIFICATION	MODE	NET	CHAN	SPEED	AUTO	CODE	RMUX/FR/LOOP			CH+1	RST ERROR	TM	TEST LAMPS
							1	2	3				
RUN MODE	RN	—	X	—	—	—	—	—	—	—	—	—	X
LOW SPEED CHANGE	LS	—	X	X	X	X	X	X	X	X	—	—	X
FRAME CHANGE	FR	X	X	—	—	—	X	X	X	—	—	—	X
REMOTE TEST	RT	—	—	—	—	—	—	—	—	—	—	—	X
TEST MODE	TM	—	X	—	—	—	X	X	X	—	X	X	X

X — button active

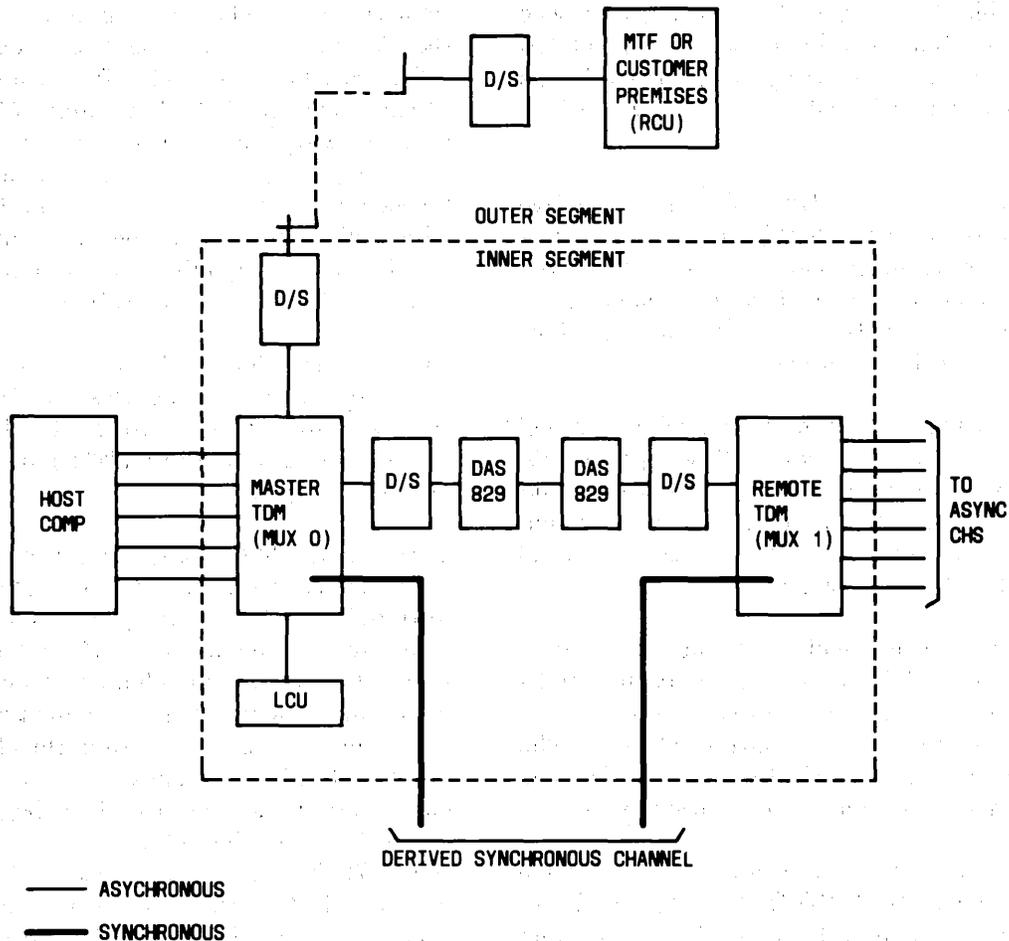


Fig. 3—Typical DMS Network

**3.11** The configuration (NET) buttons select one of the two transmission configuration (network layout) options (Fig. 4) that are installed in the DM.

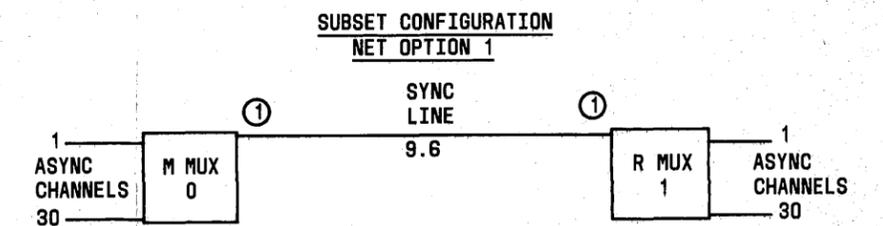
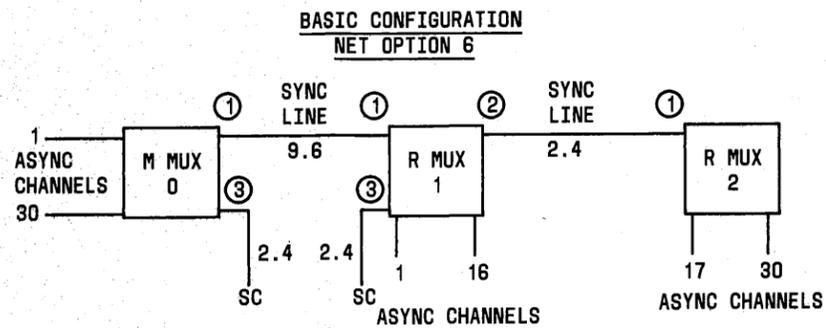
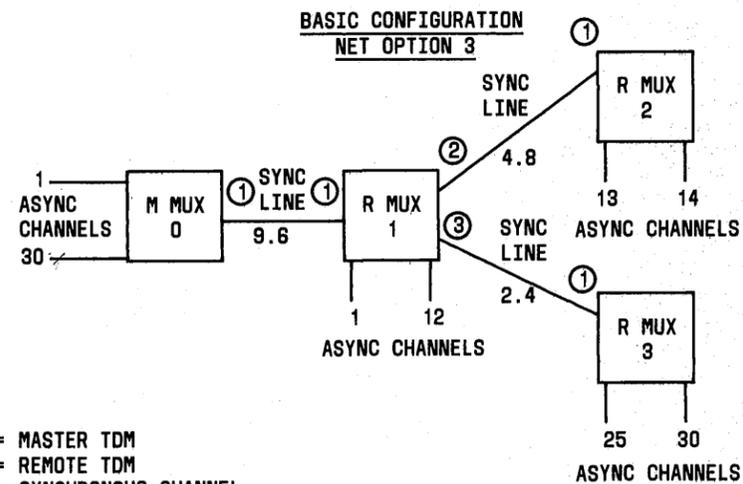
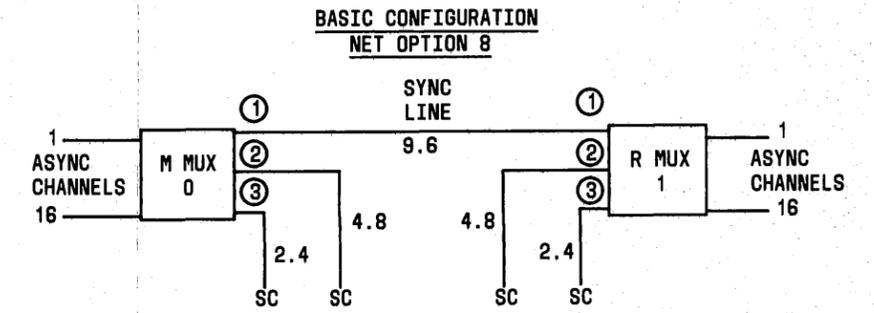
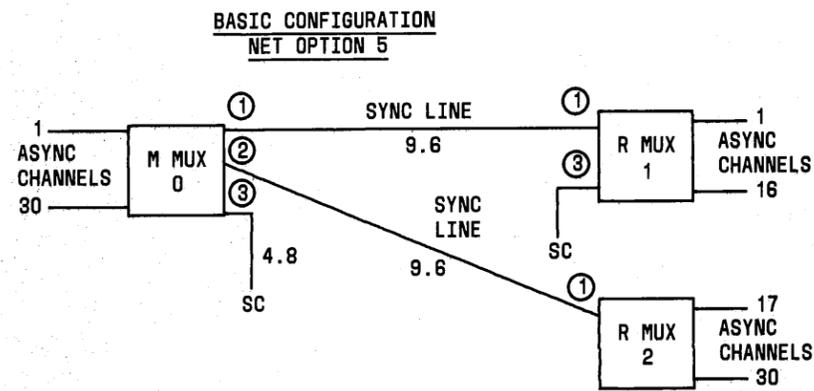
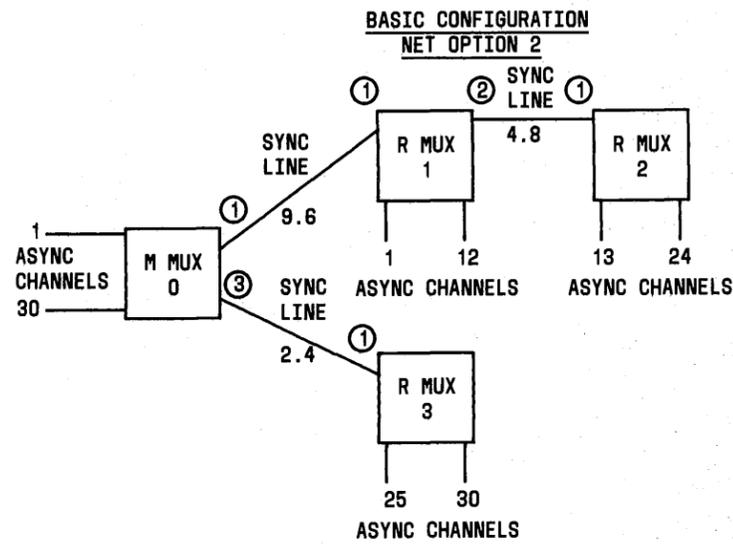
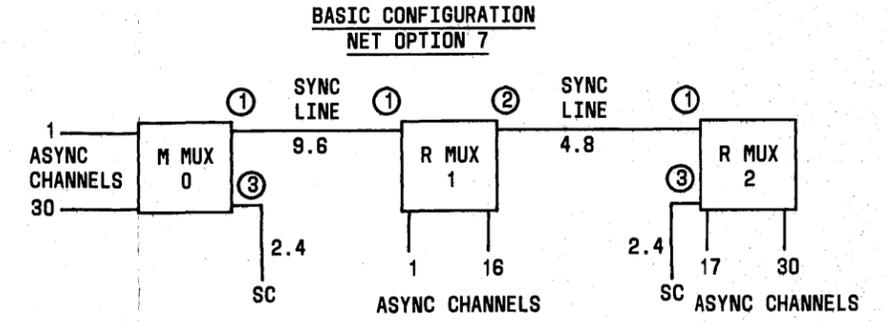
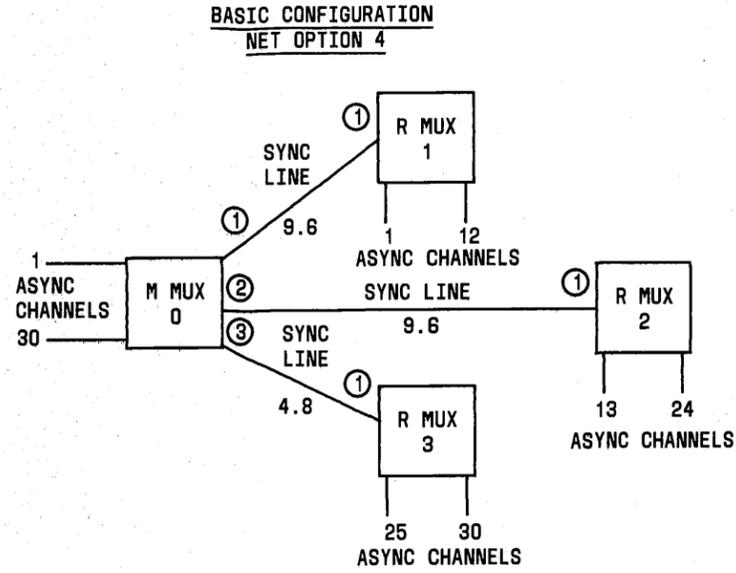
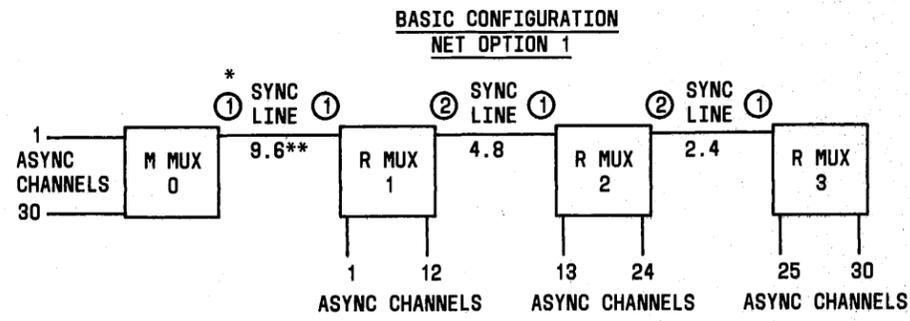
**3.12** The channel (CHAN) buttons select one of the asynchronous channels (up to the maximum of 32 channels) for monitoring, testing, or changing channel element information.

**3.13** The speed (SPEED) buttons select one of the allowable channel speeds (0, 75, 110, 134.5, 150, 300, 600, and 1200) in bits per second (bps) to be entered for the selected channel. Channel speed 75 can also be used for 74.2 bps. When a speed is selected, the standard character structure code (information/stop bit code) for that speed is also selected.

**3.14** The autobaud (AUTO) buttons enable or remove this optional feature from the selected channel (the autobaud feature permits use of a variety of terminals with different speeds).

**3.15** The code (CODE) buttons select the character structure code (information/stop bit code). They are used when a nonstandard code is to be used with the selected channel speed. Care must be taken that a nonstandard code does not lead to a higher than acceptable character rate.

**3.16** The destination (RMUX/FR/LOOP) buttons have a multiple use depending upon the position of the MODE switch (3.04). In the LS mode, the destination buttons are used to enter the frame number or remote multiplexer (RMUX) that the displayed channel is assigned. In the FR



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

Fig. 4—Network Configurations (Sheet 1 of 2)

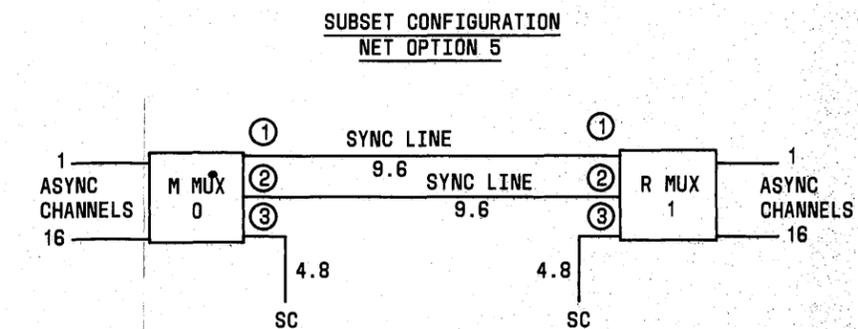
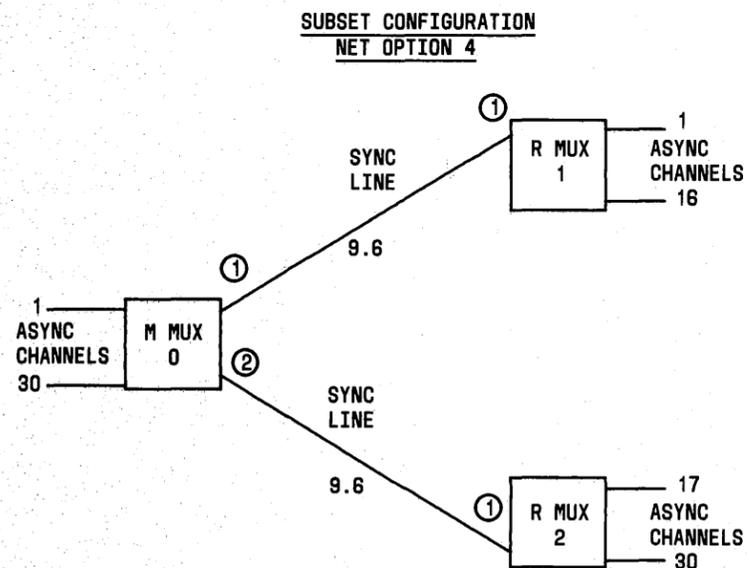
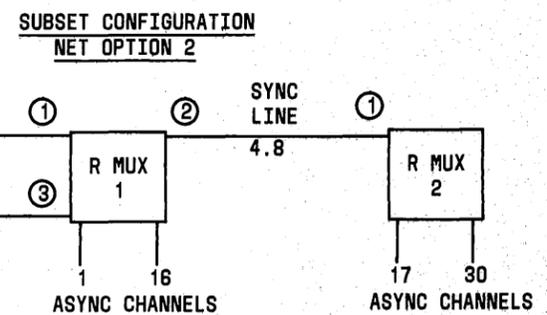
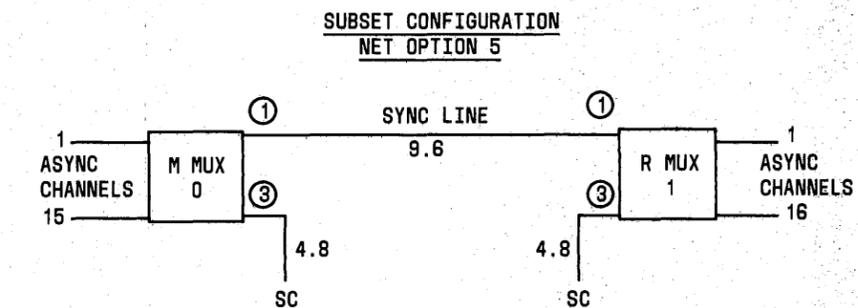
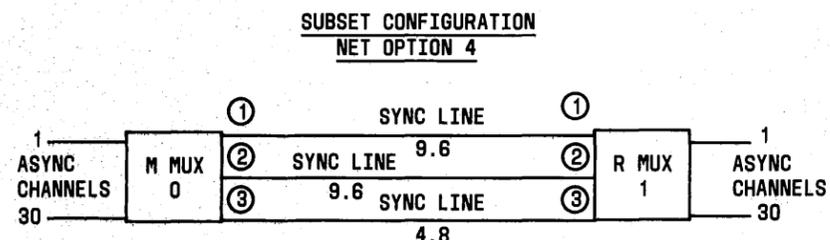
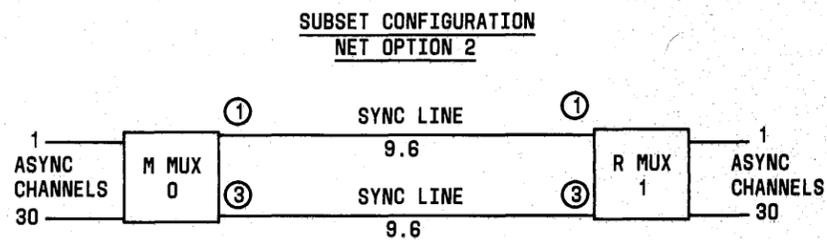
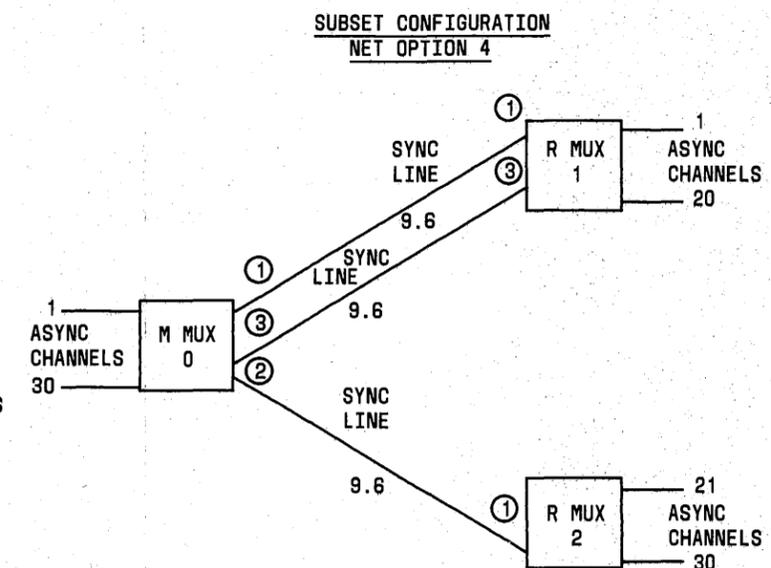
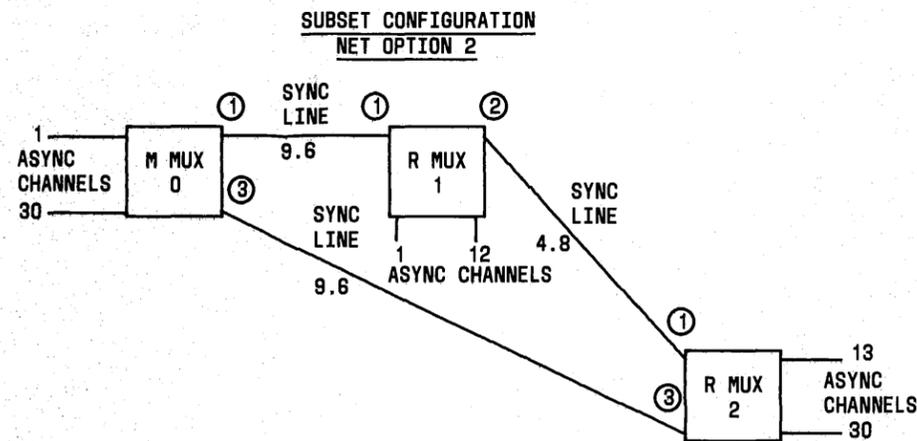
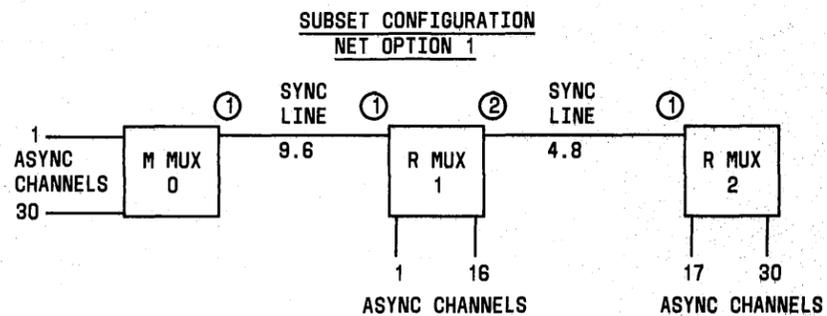


Fig. 4—Network Configurations (Sheet 2 of 2)

mode, the destination buttons are used to instruct the controller to build new frames (FR) (assign time slots to the asynchronous channels in the synchronous data stream) from the asynchronous channel information. In the TM mode, the destination buttons initiate various synchronous channel loopbacks (loop) in combination with TM button positions.

**3.17** The CH+1 button (upper) allows the channel program elements of the next channel to be entered quickly if they are the same as the previous channel. This button only functions in the LS mode. The lower buttons located under CH+1 is presently nonfunctional in the 1800A-LI(LCU). It is reserved for use in the 1800B-LI (RCU).

**3.18** The test mode (TM) buttons select a particular test to be implemented. The reset (RST) ERROR button (upper ERROR button) allows a test error indication to be cleared. The lower ERROR button is presently nonfunctional.

**3.19** The LAMPS TEST button lights all displays on the LCU. The LAMPS OFF button turns off all displays except the fault (FAULT) and MODE displays.

**3.20** The FAULT display flashes if there is a synchronous fault in the system.

**3.21** The CHANNEL ACTIVITY displays light the asynchronous channel number for approximately 3 seconds whenever data is being transmitted in the direction from the master DM to the remote DM and turn off whenever data is interrupted for approximately 3 seconds. They are also on constantly for any assigned channels that are not equipped with channel cards at the master DM. During the circulating bit test if the test bit fails, the channel activity displays flash at 1/2 sec on - 1/2 sec off intervals.

**3.22** The INTERFACE display indicates the status of the interface leads of the displayed channel number.

#### 4. OPERATION

**4.01** The LCU (Fig. 2) is used by the customer at the master DM location for controlling the DMS. Alphanumeric readouts are provided to assist the customer in determining status of each button.

**4.02** There are eight basic configurations available for the networks (Fig. 4). Net A button selects the first and NET B button selects the second of two possible network configuration options installed in the master DM. There are limitations on switching between the network configurations. Only NET options 1&5, 1&6, or 1&7 may be used as NET A and NET B when dual NET options are considered on installation. If the customer does not anticipate switching between the two options, the desired option is installed for both. The selected option is displayed above the NET buttons. Additional equipment arrangements as subsets of the basic configurations are also shown in Fig. 4.

**Note:** The configurations shown in Fig. 4 are typical network arrangements with maximum synchronous line speeds and asynchronous channel capacities. The synchronous line speeds and asynchronous channel capacities could be different from the ones shown depending on the environment in which the network is used.

**4.03** The asynchronous channel number (1 through 32 displayed above the CHAN buttons) is increased or decreased one count by momentarily depressing the upper or lower CHAN button, respectively. The count goes up to 32 and increasing one count from channel 32 produces channel number 1. Decreasing the count from channel 1 produces channel number 32. If the CHAN button is held for more than 1 second, an internal clock automatically increases or decreases at the rate of approximately two counts per second.

**4.04** The speed of the selected channel (displayed above the SPEED buttons) is increased or decreased one count by momentarily depressing the upper or lower button respectively. The allowable speeds are 0, 75, 110, 134.5 (displayed 134), 150, 300, 600, and 1200 (displayed 1.2) bps in the order shown. The 0 speed is used to busy-out a channel. Speed 75 may also be used for 74.2 bps. As the speed is entered, the standard character structure code for that speed is also automatically entered and displayed above the CODE buttons. The standard code for 150, 300, 600, and 1200 speeds is an 8-information bit, 1-stop bit code (displayed 81). The standard code for 134.5 speed is a 7-information bit, 1-stop bit code (displayed 71). The code for 110 speed is an 8-information bit, 2-stop bit code (displayed 82). The code for 75 speed is a 5-information bit, 1.5-stop

bit code (displayed 52). At 0 speed, the code is irrelevant, but 51 is displayed.

**4.05** The selected channel can be conditioned as an autobaud channel in the DM by depressing the upper AUTO button. The letter A (displayed above the AUTO buttons) indicates that the information has been entered. The lower AUTO button is depressed to remove the autobaud condition previously entered. An autobaud condition can only be entered if the speed setting is 300 or 1200 bps. (The 1200 bps speed setting is not functional at this time.) Depressing the upper AUTO button will have no effect at any other speed.

**4.06** If the transmission scheme for the selected channel requires a nonstandard code, the code can be selected and entered by momentarily depressing the upper or lower CODE button. The code display will be increased (upper button) or decreased (lower button) one count each time the switch is depressed. The codes displayed are 51, 52, 61, 62, 71, 72, 81, 82, in the order shown. The first digit is the number of information bits and the second, the number of stop bits in the code.

**Caution:** *Care must be taken that a nonstandard code does not lead to a higher than acceptable character rate. Asynchronous channel characters are sent from multiplexer to multiplexer at a rate 11.1 percent greater than the nominal character rate of the channel. If certain codes are used at a given bit rate, the nominal character rate will be exceeded by more than 11.1 percent and data characters will be lost.*

**4.07** In the LS mode, the RMUX/FR/LOOP buttons are used to enter the remote DM destination (RMUX) that the selected channel is assigned. The number is entered by depressing the appropriate upper button(s) and the corresponding display is lighted above button position 3. Depressing the appropriate lower button(s) removes the previously entered destination.

**4.08** In the FR mode, the upper RMUX/FR/LOOP buttons are used to build new frames (assign time slots to the asynchronous channels in the synchronous data stream) from the asynchronous channel information entered in the LS mode. For

example, in generating a new frame to remote multiplexer 1, the upper portion of button 1 is depressed and 1 is displayed above button 3. The 1 remains displayed for the period necessary to assign time slots and transmit to multiplexer 1. After transmission to the remote multiplexer, the lamp turns off. The entire process takes only a few seconds. If the frame cannot be built (the sum of the asynchronous and derived synchronous data rates are too high for the speed assigned to the synchronous line), the displayed 1 flashes. The operator must remove (set to 0 speed) or lower the speed of the asynchronous channels assigned to frame 1 or increase the synchronous speed. If synchronous line speed is increased, the operator must know that the synchronous data sets are compatible with the required synchronous line speed. In addition, the port circuit card option associated with the data set must be changed as required to the new speed setting. If an attempt is made to frame an asynchronous channel that has zero speed and there are no other asynchronous channels with nonzero speeds assigned to the synchronous line, the flashing condition also occurs.

**4.09** In the TM mode, the RMUX/FR/LOOP buttons initiate various synchronous port loopbacks in combination with TM switch positions. Depressing the upper button 1 RMUX/FR/LOOP initiates a loopback of synchronous port 1. If the TM position is RL, a loopback test at the master multiplexer output is effected. If the TM position is RA and the data set or data service unit is equipped to respond to the interface signals, a loop on the line side of the data set or data service unit at the master DM is initiated. If the TM position is RB, a digital loop at the data set at port 1 of multiplexer 1 is effected. See Fig. 5 for the loopback to each position. In each case an asynchronous channel in frame 1 must be entered, and a test word is inserted into the time slot of that channel and compared to the return word.

**Caution:** *In order to perform loopback tests, an asynchronous channel, associated with the synchronous port, must be selected.*

**4.10** Depressing the CH+1 button allows input to the next higher channel to be entered quickly. This procedure may be used if the next higher channel has the same channel parameters (autobaud, speed, code, destination) as the channel

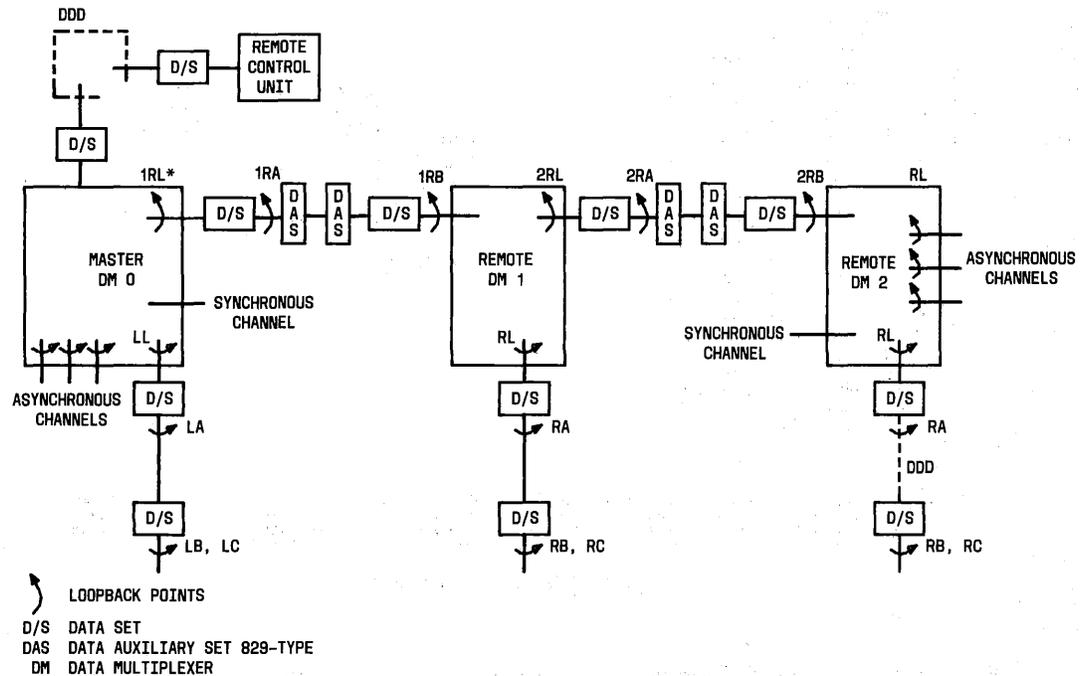


Fig. 5—DMS Loopback Points

displayed on the panel. The channel number is increased 1 and the remainder of the display is unchanged indicating that the previous channel data has been stored in the newly selected channel. This button functions in the LS mode only. The lower button under CH+1 is presently nonfunctional.

**4.11** A single alphabet character (A thru N) is lighted at the FLT display to indicate a synchronous line failure in the system. These failures are out of sync (OOS), carrier fail (CF) conditions in either direction of transmission of any of the three synchronous links, or an equalizer mode which affects signal quality (SQ) in either direction of transmission on synchronous line 1, 2, or 3. Figure 6 defines the various fault codes.

**4.12** When a test is being conducted (identified by a 2-letter display above the TM button), the test selected is increased or decreased one position by momentarily depressing the upper or lower button, respectively. The test positions are; blank (no test), LL, LA, LB, LC, RL, RA, RB,

RC, and RX in that order. The first letter of the display refers to the local (master) or remote DM. When the second letter is an L, an internal multiplexer loop is automatically implemented. When the second letter is an A, B, or C, an external equipment loop is implemented. The X indicates that an automatic internal loopback is implemented for use with external test equipment or customer-provided terminal.

**4.13** A channel can be selected either before or after going to the TEST mode. When the MODE switch is moved to TEST mode position, the no-test state (blank TM display) is automatically set. The channel to be tested must be selected before depressing TM button to enter a test state.

**Caution:** Operator must use care in selecting channel in TEST mode. If test state is entered (ie, LL, LA, LB, LC, RL, RA, RB, RC, or RX), an operating asynchronous channel may

DMS FAULT CODES		
CODE	DATA SET POSITION	FAULT ID
A	1A	SQ*
B	1A	CF**
C	1A	OOS***
D	1B	SQ
E	1B	CF
F	1B	OOS
G	2A	CF
H	2A	OOS
I	2B	CF
J	2B	OOS
K	3A	CF
L	3A	OOS
M	3B	CF
N	3B	OOS

\*SQ = SIGNAL QUALITY RETRAIN  
 \*\*CF = CARRIER FAIL  
 \*\*\*OOS = OUT OF SYNC

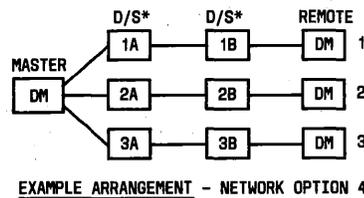


Fig. 6—DMS Fault Codes and Examples of Data Set Positions in Typical Equipment Arrangements

***inadvertently be tested and interrupt customer data transmission.***

Advancing to test position LL produces the local internal loopback of the channel at the master DM. The local channel is placed in a loop condition by the command control which inserts a remote loopback bit on the control word to the interface. A fixed data test word is periodically transmitted to the interface, looped back, received at the interface, and compared with the test word transmitted. Initiating any of the tests causes the error lamp to light for up to several seconds. If the data test word received is identical to the test word transmitted, the error lamp turns off. If not, the lamp over the RST button flashes and the LL characters over the test button flash (1/2 second on - 1/2 second off) until the RST button is depressed. While the test is being performed, a control word signifying a busy channel is sent to the remote DM asynchronous channel interface.

**4.14** In positions LA, LB, and LC the procedure is identical except a different control word is transmitted through the master DM local interface.

If data sets are provided between the master DM and the customer-provided equipment (CPE) and are properly equipped, they respond to the control function to cause digital loopback of the data set at the CPE (LB or LC), or an analog loopback of the data set at the master DM (LA). Position LC is similar except that 3 seconds of space followed by the test word are transmitted through the local interface. See Fig. 5 for the loopbacks at each position.

**4.15** The RL, RA, RB, and RC are the same type loopback tests to a remote DM as LL, LA, LB, and LC loopback tests are to a master DM. The appropriate test and control words are transmitted to the remote DM asynchronous channel interface and the channel busy word is transmitted to the master DM asynchronous channel interface. In the RX position a remote loopback bit is inserted into the control word to the remote asynchronous channel interface, but the rest of the control word is unaffected. Data from external test equipment connected to master DM asynchronous channel Electronics Industries Association (EIA) or similar interface is then looped at the remote DM.



*In the TEST mode, the RX display on the TM switch will not indicate errors because the fixed test word is not being used. The display will remain lighted constantly after the RST button is pushed.*

**4.16** Depressing the LAMPS TEST button lights all displays and all segments of the alphanumeric characters. Depressing the LAMPS OFF button turns off all display lamps except the MODE indicator and, if flashing, the FAULT indicator. The displays may be returned to normal by depressing the LAMPS OFF button a second time.

**4.17** The CHANNEL ACTIVITY indicators light constantly whenever data is being transmitted on the associated asynchronous channel from master DM to remote DM or if no channel card for the assigned channel is in the master DM. If the channel is inactive or unassigned, the indicator is off. If the recirculating test bit for the channel fails, the indicator flashes (1/2 second on - 1/2 second off) until a good test bit is received. Continuous flashing of a group of CHANNEL ACTIVITY indicators accompanies a system fault.

**4.18** The ten INTERFACE indicators show the lead status of the selected channel. The T1 through T5 indicators show the actual states of terminators in the selected asynchronous channel interface at the master DM and the intended states of drivers at the remote DM. The R1 through R5 indicators show actual states of the terminators in the selected asynchronous channel interface at the remote DM and intended states of drivers at the master DM.

**4.19** Table B shows the relationships between interface indicators and EIA Standard RS-232-C interface pins. For example, when a terminal at the master DM enables the data terminal ready (CD) lead, it is detected by the terminator on Pin 20 in the master DM. The master DM generates a control character which causes indicator T2 to light, and transmits the control character to the remote DM, which causes the driver on Pin 6 to turn on. The cable that connects the remote DM to a data set connects Pin 6 in the DM to Pin 20 (data terminal ready) in the data set. When the data set turns on data set ready (CC) lead, an "on" condition is placed on Pin 6 of the data set interface. The cable that connects the data set to the remote DM connects Pin 6 in the data set to

TABLE B

RELATIONSHIPS BETWEEN INTERFACE  
LAMPS AND EIA INTERFACE PINS

INTERFACE LAMP	MASTER TDM (TERMINATOR) PIN NOS.	REMOTE TDM (DRIVER) PIN NOS.	REMOTE TDM (TERMINATOR) PIN NOS.	MASTER TDM (DRIVER) PIN NOS.
T1	4 (CA)	8 (CF)	NA	NA
T2	20 (CD)	6 (CC)		
T3	25 (CN)*	5 (CB)		
T4	11 (LL)*	22 (CE)		
T5	19 (RL)*	13 (TM)*		
R1	NA	NA	4 (CA)	8 (CF)
R2			20 (CD)	6 (CC)
R3			25 (CN)*	5 (CB)
R4			11 (LL)*	22 (CE)
R5			19 (RL)*	13 (TM)*

\* Non-EIA Designations

CN = Terminal Busy  
 LL = Local Loopback  
 RL = Remote Loopback  
 TM = Test Mode  
 NA = Not Applicable

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Pin 20 in the DM. The terminator in the DM interface detects the DSR "on" condition and sends a control character to the master DM. When the master DM receives the control character, indicator R2 is lighted and the driver on Pin 6 in the master DM is turned on. The other pairings of indicators and interface pins operate similarly.

**5. REFERENCES**

**5.01** For additional information relating to the 1800A-L1 Data Control Unit (LCU), refer to the following.

NUMBER	TITLE
SD- & CD-1D265-01	1200A-Type Data Multiplexer
EL4445	Data Multiplex System—Description
EL4446	Data Multiplex System—Equipment Description, Ordering and Pricing Information

SECTION	TITLE
590-000-120	DATAPHONE® Multiplex Service- Data Multiplex System—Using 1200A-Type Data Multiplexer—Reference Guide
590-104-100	Data Multiplex System—Using 1200-Type Data Multiplexer—Description

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