

FD-2240A  
6.3MB OPTICAL LINE TERMINATING MULTIPLEXER  
GENERAL DESCRIPTION

1. GENERAL

- 1.01 This section is a cover sheet for the NEC America, Inc., FD-2240A 6.3MB Optical Line Terminating Multiplexer General Description. This section is reproduced with permission of NEC America, Inc., and is equivalent to NEC practice NECA 365-407-100, Issue 3.
- 1.02 Whenever this section is reissued the reason(s) for reissue will be listed in this paragraph.
- 1.03 This section provides a general description of the FD-2240A 6.3MB Optical Line Terminating Multiplexer (6.3MB O-LTM).
- 1.04 If corrections are required in the attached document, use Form-3973 as described in Section 000-010-015.
- 1.05 If equipment design and/or manufacturing problems should occur, refer to Section SW 010-522-906 for procedures on filing an Engineering complaint.

2. ORDERING PROCEDURE

- 2.01 To order additional copies of this practice, use NECA 365-407-804SW as the section number.

3. REPAIR/RETURN

- 3.01 Malfunctioning units may be returned to NEC America, Inc., for repair.

Attachment: NEC America, Inc.  
FD-2240A 6.3MB Optical Line  
Terminating Multiplexer  
General Description

PROPRIETARY

Not for use or disclosure outside Southwestern Bell  
Telephone Company except under written agreement.

**FD-2240A 6.3MB OPTICAL LINE TERMINATING MULTIPLEXER  
GENERAL DESCRIPTION**

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## 1. INTRODUCTION

1.01 This practice provides a general description of the FD-2240A 6.3MB Optical Line Terminating Multiplexer (6.3MB O-LTM). Included are equipment configurations, features and specifications.

1.02 Issue 3 of this practice supersedes Issue 2 of NECA 365-407-100. The practice provides expanded coverage and corrects errors and omissions in the superseded document.

1.03 Whenever this practice is reissued, the reason for reissue will be listed in this paragraph.

1.04 The FD-2240A 6.3MB O-LTM, shown in Figures 1-1 through 1-3, is a multi-purpose 6.312 Mb/s digital transmission terminating equipment.

1.05 For high speed interface (HS INF) unit of the FD-2240A, 6M OPT INF unit and DS2 INF unit are prepared in order to accommodate optical line and bipolar DS2 line respectively.

1.06 The Description for the shelf of the FD-2240A O-LTM is given in the NECA 365-407-101.

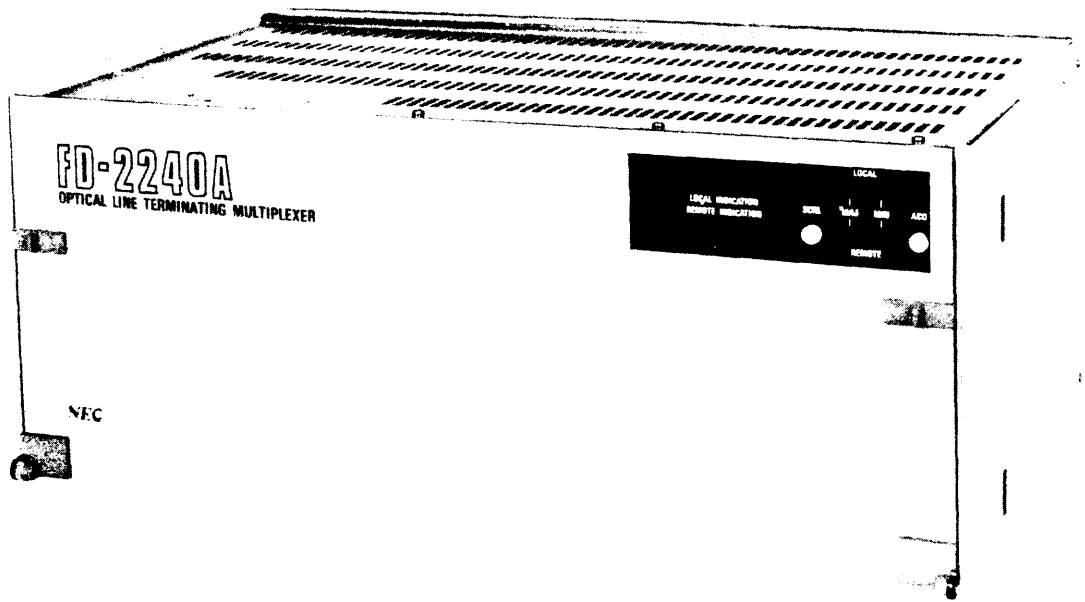


Figure 1-1 FD-2240A 6.3MB Optical Line Terminating Multiplexer, Front View (Cover Close)

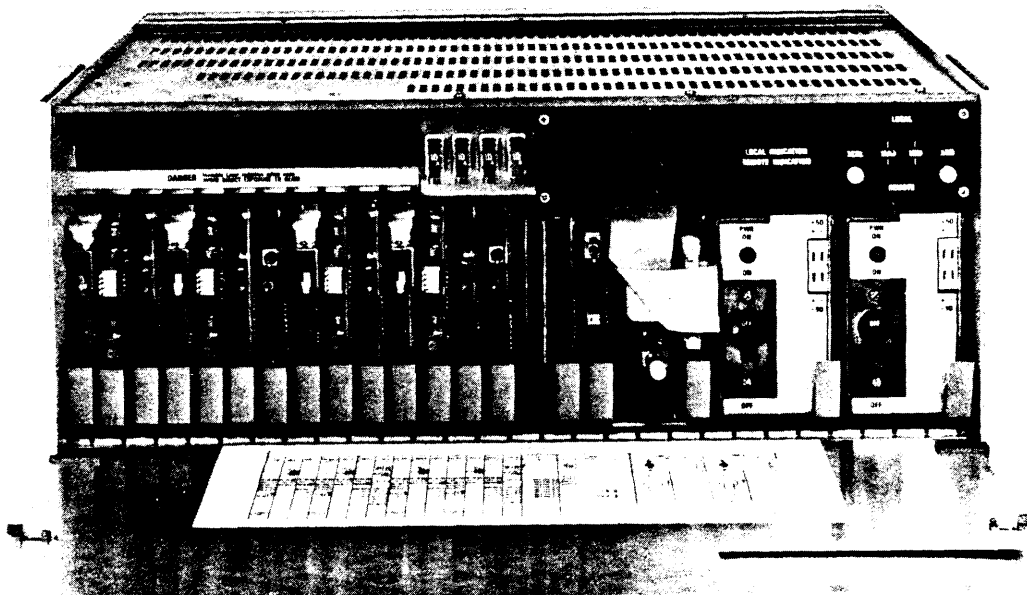


Figure 1-2 FD-2240A 6.3MB Optical Line Terminating Multiplexer, Front View (Cover Open)

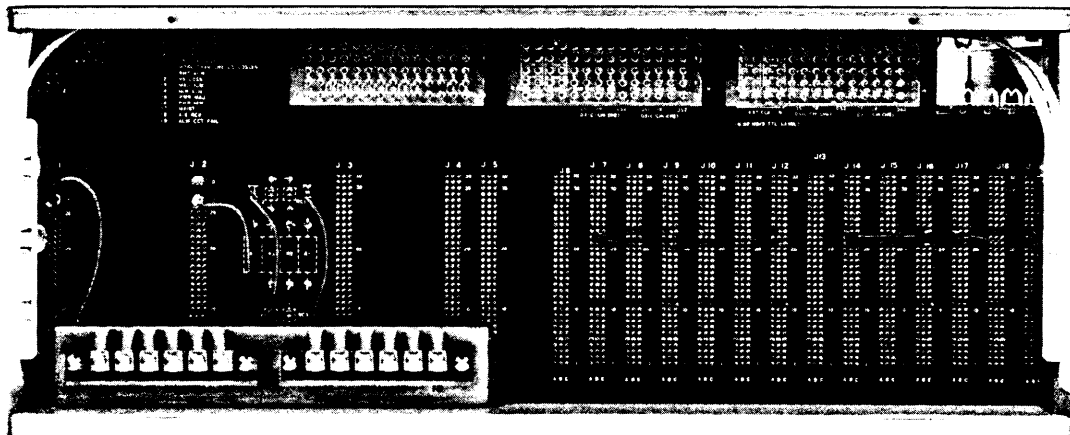


Figure 1-3 FD-2240A 6.3MB Optical Line Terminating Multiplexer, Rear View

## 2. EQUIPMENT FEATURES

### A. AT & T Compatibility

2.01 The FD-2240A is fully compatible with the specifications of AT&T Technical Reference PUB 43803 on Facility Maintenance Features Required for Interoffice Digital Transmission Equipment, Technical Advisory (TA) No. 34 (Compatibility Bulletin No. 119) Issue 3 on Interconnection Specifications for Digital Cross-Connects at DS1, DS1C and DS2 Rates, and TA No. 50, Issue 5 on M12 Multiplex Compatibility Specifications.

### B. System Flexibility

2.02 The FD-2240A can easily be configured as an O-LTM or an M12 MUX. If requirements should change after the equipment has been installed, the FD-2240A can easily be reconfigured by replacing plug-in units in the shelf.

### C. Protection System

2.03 When the FD-2240A is configured as an O-LTM, the high speed optical interface units, MUX and DMUX units which include low speed channel sections, and optical transmission line can be protected on a one-for-one basis. When the FD-2240A is configured as a MUX, the high speed interface units and MUX and DMUX units can be also protected on a one-for-one basis.

2.04 The DC power units operate in parallel to duplicate the power supplied, therefore, the service is not affected even if a power unit fails. As only one AC power unit can be installed in the shelf of this equipment, protection for output low voltage cannot be in this case.

### D. Monitoring Function

2.05 The FD-2240A features a monitoring function which constantly monitors equipment operation. The online units, offline units, monitoring circuit, and optical transmission line are monitored. Unit monitoring is performed at

the 1.544 Mb/s level using bit-by-bit signal comparison processed in the MUX and DMUX units. Both online and offline optical transmission line monitoring is performed by bit error rate.

#### E. Remote Loopback

2.06 The FD-2240A provides a remote loopback function which loops the DS1 or DS1C channels and DS2 level of OPT INF at the distant end. The remote loopback feature of the FD-2240A enhances the maintainability of any communication system.

#### F. Alarm and Display

2.07 The alarm and display methods of the FD-2240A are completely compatible with Bell System PUB 43803. All alarm status information originating in the FD-2240A is shown on alphanumeric displays under microprocessor control.

#### G. Orderwire System

2.08 The FD-2240A provides an optional orderwire system. The orderwire system, which easily interfaces with the FD-2240A, transmits and receives one 128 Kb/s data using overhead bits inserted in the main bit stream. The overhead bits are inserted using the Code Mark Inversion (CMI) Code Rule Violation method.

#### H. Supervisory Function

2.09 The FD-2240A is equipped with an optional Supervisory (SV) unit to provide a surveillance function without extra transmission lines. With the SV unit, the FD-2240A installed in a central office displays alarm and status information of the FD-2240A on customer premises at remote station. The surveillance function enhances FD-2240A maintenance and reliability through this centralized supervisory capability.



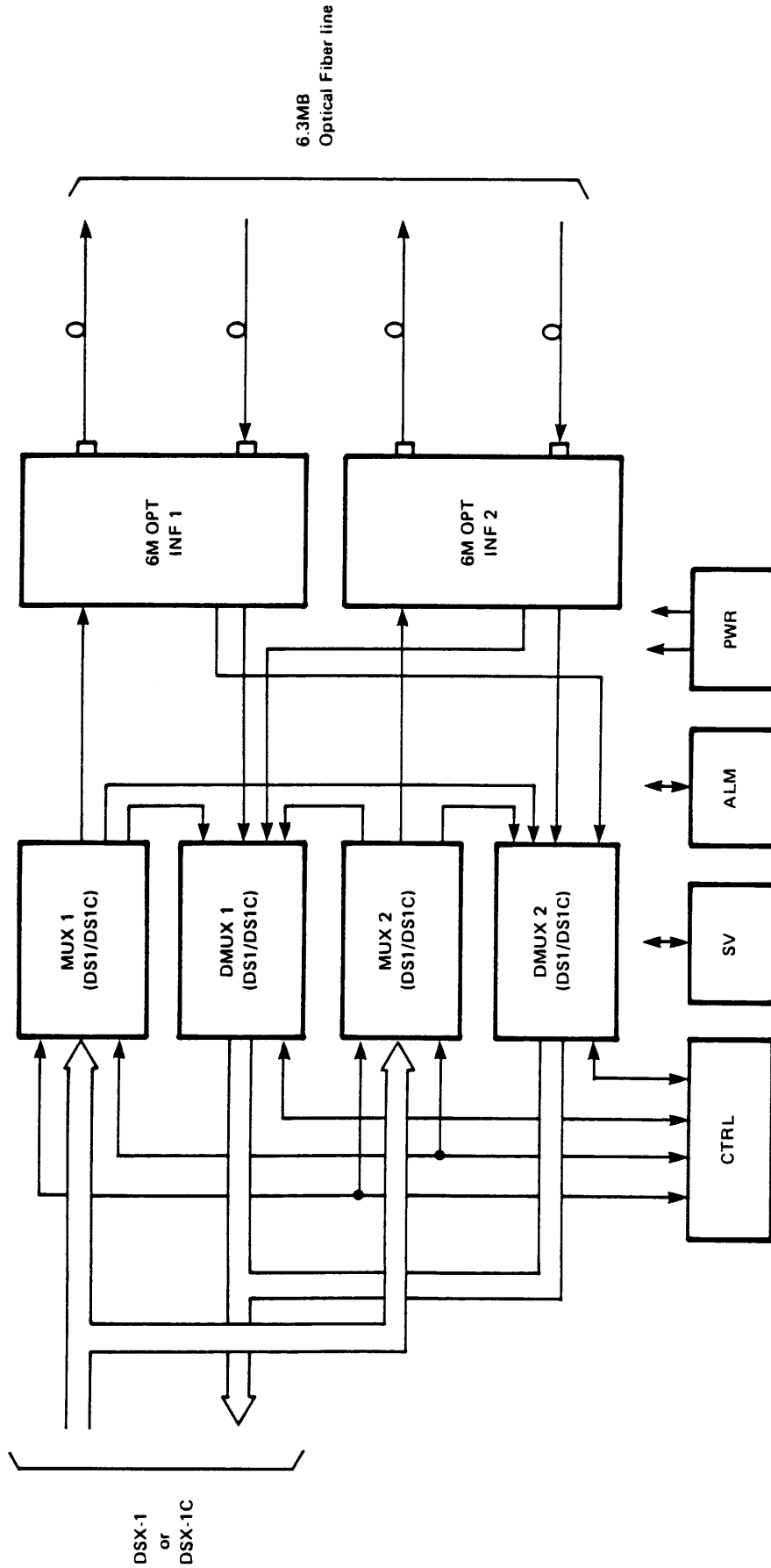
3. DESCRIPTION

3.01 The FD-2240A is an equipment to multiplex DS1 (or DS1C) data signal to DS2 data signal and demultiplex DS2 signal to DS1 (or DS1C) signal. This equipment is available for configuration of not so large scale communication network.

3.02 The FD-2240A is designed to be mounted in a standard EIA 19-inch relay rack.

3.03 The FD-2240A is available for up to 4 systems in non-redundant configuration or up to 2 systems in redundant configuration. Selection of redundant or non-redundant configuration can be done by strapping position on the unit.

3.04 Figures 3-1 and 3-2 show simplified block diagrams of the FD-2240A with OPT INF unit and with DS2 (BP) INF unit. Either OPT INF unit or DS2 (BP) INF unit is available for this equipment.



NOTE: This figure illustrates a system in redundant mode.

Figure 3-1 FD-2240A Simplified Block Diagram (With OPT INF Unit)

A. O-LTM Configuration

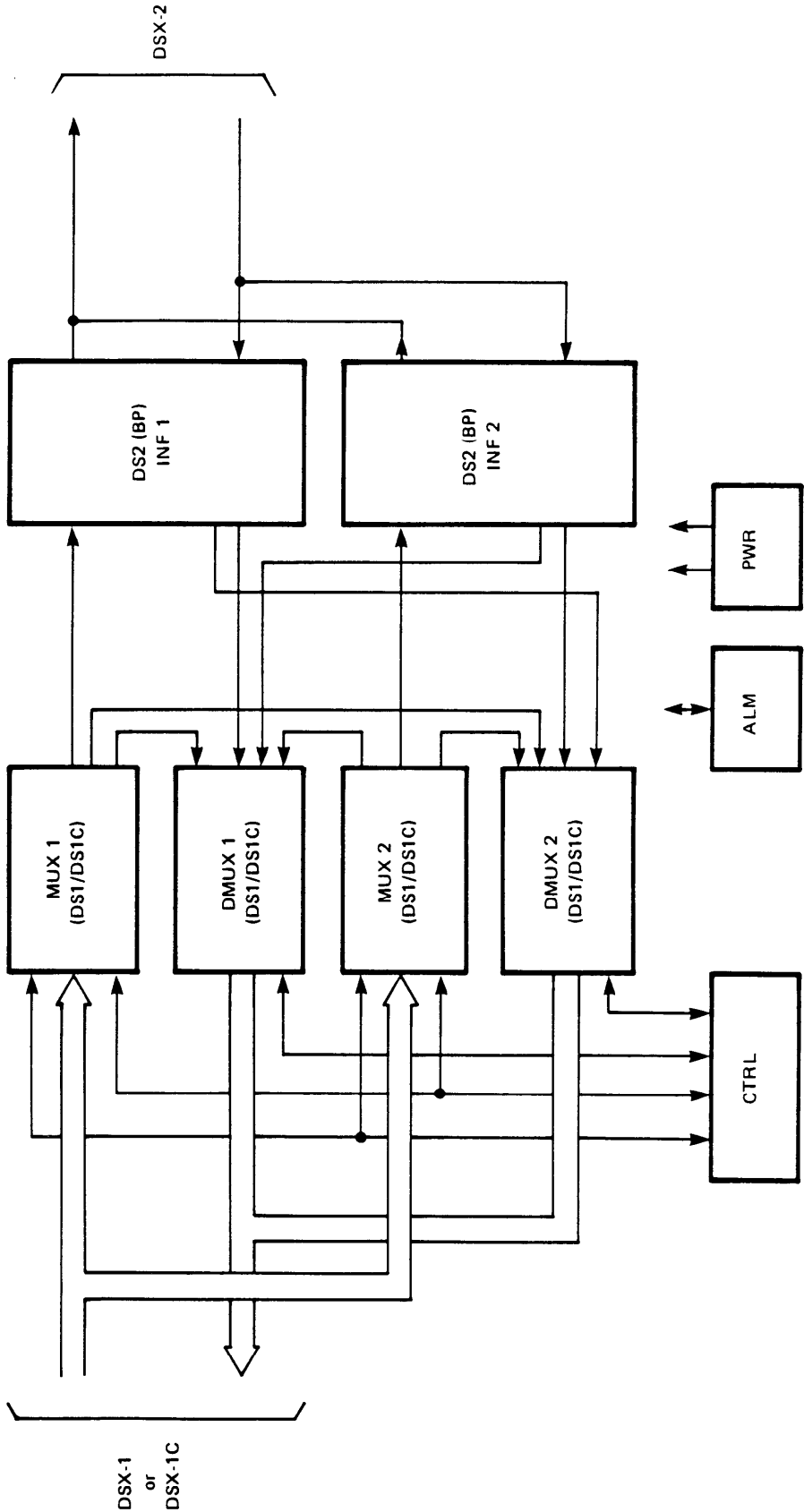
3.05 The O-LTM configuration combines low speed 1.544 Mb/s or 3.152 Mb/s serial data signals into a single 6.312 Mb/s electrical signal. The 6.312 Mb/s electrical signal is then converted to a 6.3 Mb/s optical signal and transmitted over optical fiber lines. The remote O-LTM receives the optical signal, converts it to an electrical signal, and demultiplexes the electrical signal to the original low speed signals.

3.06 In O-LTM configuration, channel sections in MUX and DMUX units provide low speed side interface. Channel sections are available for DS1 and DS1C bipolar interface. Interleaving and positive stuffing techniques are utilized to produce the high speed 6.312 Mb/s signal.

3.07 Two types of MUX units are available, MUX DS1 and MUX DS1C. The MUX DS1 unit includes four DS1 bipolar interfaces which convert DS1 signals to 1.544 Mb/s unipolar signals. The MUX DS1C unit includes two DS1C bipolar interfaces which convert DS1C signals to 1.544 Mb/s unipolar signals. These 1.544 Mb/s data signals are multiplexed to a single unipolar 6.312 Mb/s data signal. The Optical Interface (OPT INF) unit converts the uniplar 6.312 Mb/s data signal to an optical signal (line code is CMI) and sends it to the optical fiber transmission line.

3.08 Receive side signal processing is performed in reverse order of that done on the transmit side. The OPT INF unit converts the optical signal to unipolar data. The DMUX unit demultiplexes the 6.312 Mb/s unipolar data to four 1.544 Mb/s data signals. The 1.544 Mb/s data signals are then converted to bipolar signals.

3.09 As shown in Figure 3-1, O-LTM configuration equipment can provide redundant protection. The protection arrangement utilizes redundant optical transmission over separate fiber lines. The protection switching functions shown are performed by the Control (CTRL) unit.



NOTE: This figure illustrates a system in redundant mode.

◆ Figure 3-2 FD-2240A Simplified Block Diagram (With DS2 INF Unit) ◆

## B. MUX Configuration

3.10 The MUX configuration equipment multiplexes DS1 or DS1C low speed signals to a 6.312 Mb/s bipolar DS2 signal and transmits the DS2 signal. It also receives and demultiplexes the DS2 signal to the low speed signals multiplexed at the distant end. Figure 3-2 shows MUX configuration equipment operation.

3.11 In MUX configuration equipment, MUX unit and DMUX unit operations are the same as O-LTM configuration equipment except that the DS2 Interface (DS2 INF) unit replaces OPT INF.

3.12 The protection switching functions shown in Figure 3-2 are performed by the CTRL unit. The CTRL unit performs both low speed and high speed side switching.

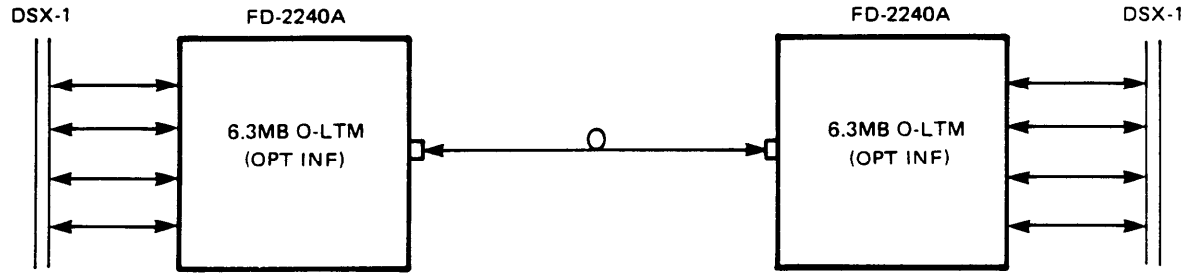
## C. System Applications

3.13 The FD-2240A is available for the communication circuit network with not so large capacity. And this equipment is used either in an independent communication system or in an branch circuit of main trunk line with a large transmission capacity.

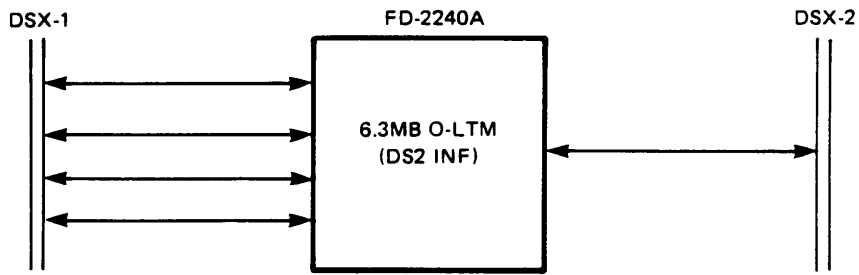
3.14 Transmission capacity of the FD-2240A, when full systems are installed, is 16 DS1 data signals or 8 DS1C data signals in non-redundant configuration and 8 DS1 signals or 4 DS1C signals in redundant configuration. The FD-2240A multiplexes the input signals of each system into one 6.3 Mb/s data signal and sends it to line side.

3.15 There are two types of high speed interface unit for the FD-2240A, one is OPT INF unit and another is DS2 INF (BP) unit. In accordance with the usage, either unit is used.

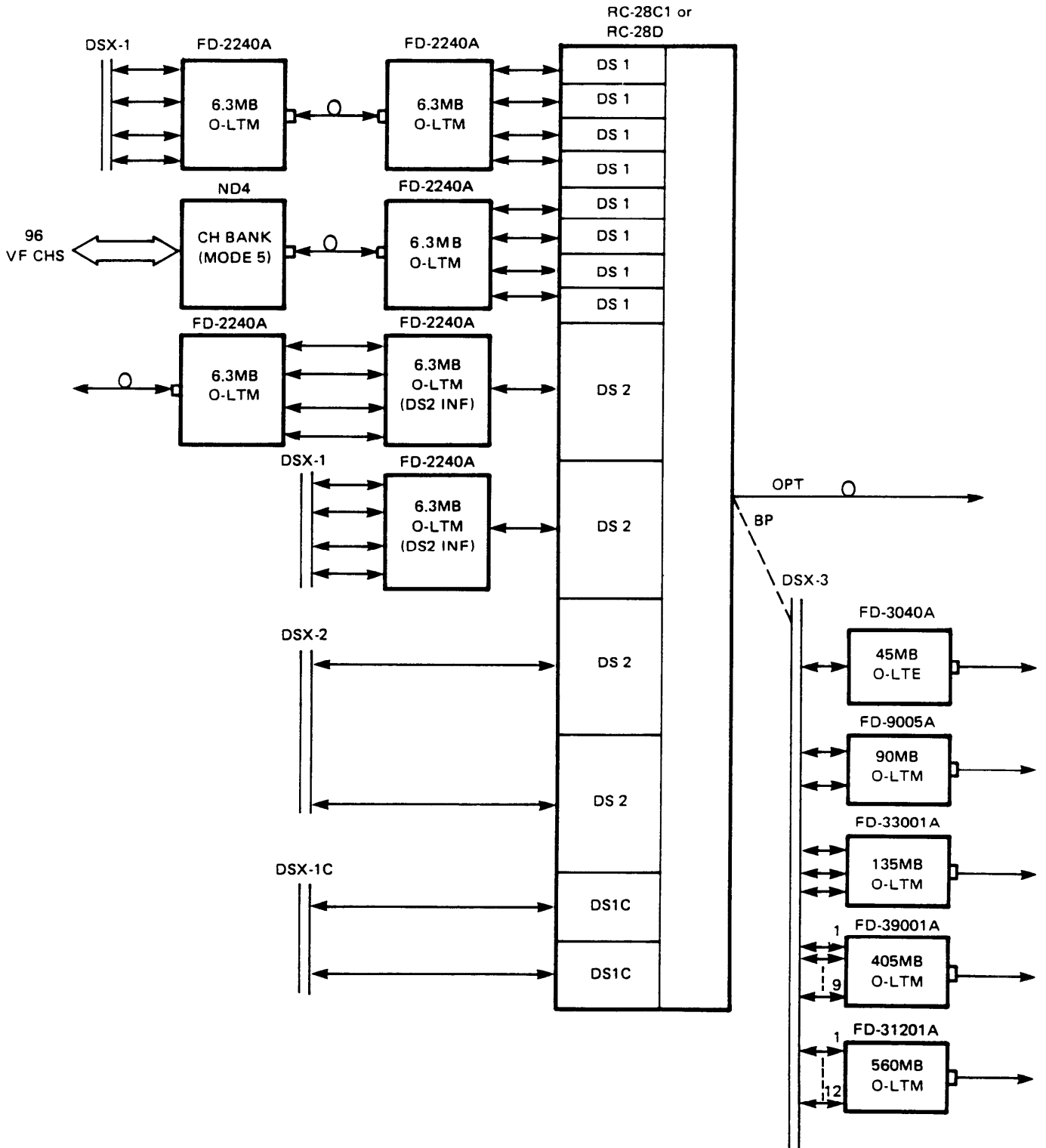
3.16 System applications of the FD-2240A are shown in Figures 3-3 through 3-5.



◆ Figure 3-3 Optical Line System ◆



◆ Fig. 3-4 M12 MUX System ◆



◆ Figure 3-5 Interfacing to Other NEC Equipment ◆

D. Plug-in Units

3.17 The plug-in units for up to 4 systems can be installed in the FD-2240A. Figures 3-6 and 3-7 show unit location of this equipment.

3.18 The units are classified into three types such as low speed interface, high speed interface and common unit. Low speed interface type contains MUX and DMUX unit and high speed type involves 6M OPT INF and DS2 INF unit. CTRL, ALM, SV and PWR unit belong to common type.

3.19 By combination of various types of unit (as listed in Tables 3-1 and 3-2), the FD-2240A is available for versatile use.



D. Plug-in Units

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3.18 The units are classified into three types such as low speed interface, high speed interface and common unit. Low speed interface type contains MUX and DMUX unit and high speed type involves 6M OPT INF and DS2 INF unit. CTRL, ALM, SV and PWR unit belong to common type.

3.19 When mounting the control (CTRL) unit in this equipment, the following combinations of CTRL, MUX and DMUX units should be considered depending on O-LTM configuration (OPT INF) or MUX (DS2 INF) configuration, and which CTRL unit (X0316 or X7387) is mounted:

- (1) O-LTM configuration (OPT INF) with DC input power (Applicable to MUX, DMUX)

<u>CTRL UNIT</u>	<u>MUX UNIT</u>	<u>DMUX UNIT</u>	<u>DCV</u>
X0316 (0A00/0A01)	X0300 (0A00)	X0301 (0A00/0A01)	-48V
X0316 (0A00/0A01)	X0300 (0B00)	X0301 (0B00)	-24V
X7387 (0A00)	X0300 (0A02)	X0301 (0A02)	-48V
X7387 (0A00)	X0300 (0B02)	X0301 (0B02)	-24V
X7387 (0A00)	X0300 (0A02)	X0301 (0A00/0A01)	-48V
X7387 (0A00)	X0300 (0B02)	X0301 (0B00)	-24V

- (2) MUX configuration (DS2 INF) with DC input power (Applicable to MUX, DMUX)

<u>CTRL UNIT</u>	<u>MUX UNIT</u>	<u>DMUX UNIT</u>	<u>DCV</u>
X0316 (0B00)	X0300 (0A00)	X0301 (0A00/0A01)	-48V
X0316 (0B00)	X0300 (0B00)	X0301 (0B00)	-24V
X7387 (0B00)	X0300 (0A02)	X0301 (0A02)	-48V
X7387 (0B00)	X0300 (0B02)	X0301 (0B02)	-24V
X7387 (0B00)	X0300 (0A02)	X0301 (0A00/0A01)	-48V
X7387 (0B00)	X0300 (0B02)	X0301 (0B00)	-24V

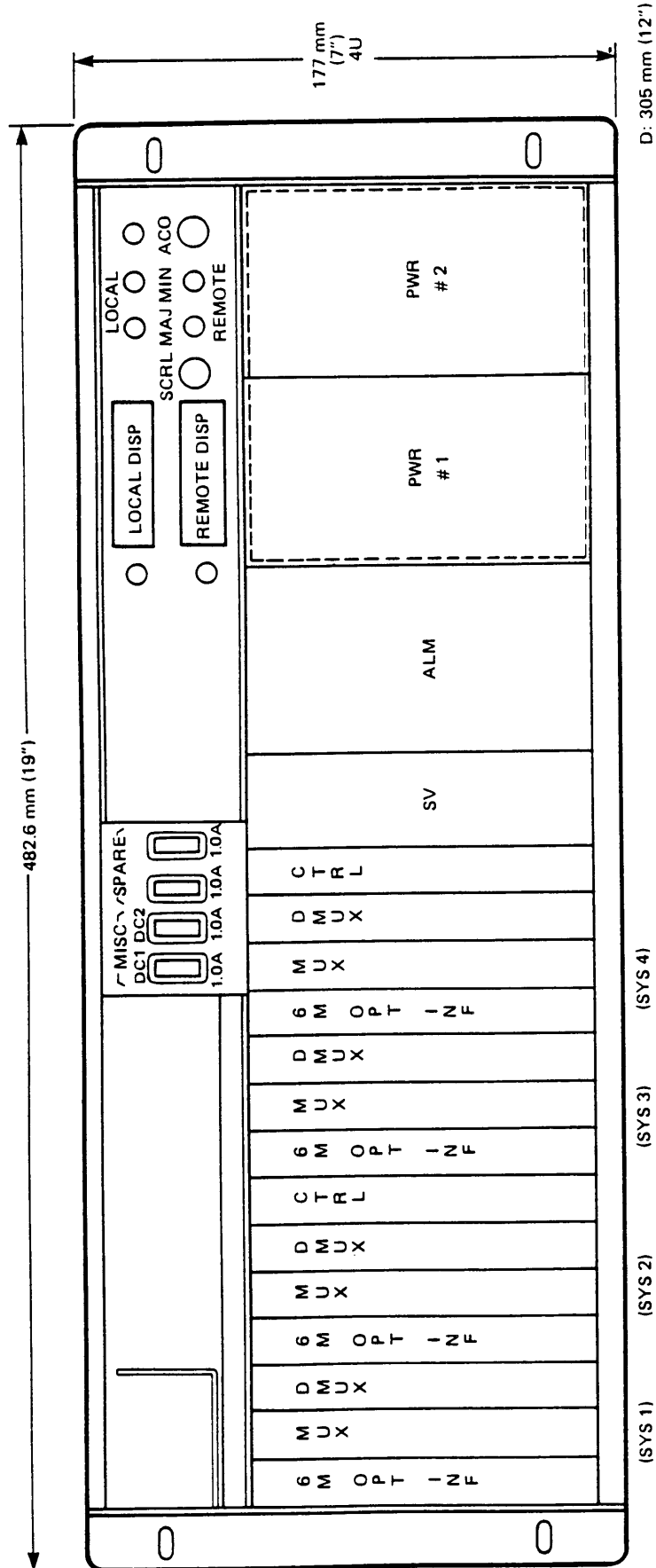
(3) O-LTM Configuration (OPT INF) operating at 117 VAC

<u>CTRL UNIT</u>	<u>MUX UNIT</u>	<u>DMUX UNIT</u>
X0316 (0A00/0A01)	X0300 (0A00)	X0301 (0A00/0A01)
X7387 (0A00)	X0300 (0A02)	X0301 (0A02)
X7387 (0A00)	X0300 (0A02)	X0301 (0A00/0A01)

(4) MUX Configuration (DS2 INF) operating at 117 VAC

<u>CTRL UNIT</u>	<u>MUX UNIT</u>	<u>DMUX UNIT</u>
X0316 (0B00)	X0300 (0A00)	X0301 (0A00/0A01)
X7387 (0B00)	X0300 (0A02)	X0301 (0A02)
X7387 (0B00)	X0300 (0A02)	X0301 (0A00/0A01)

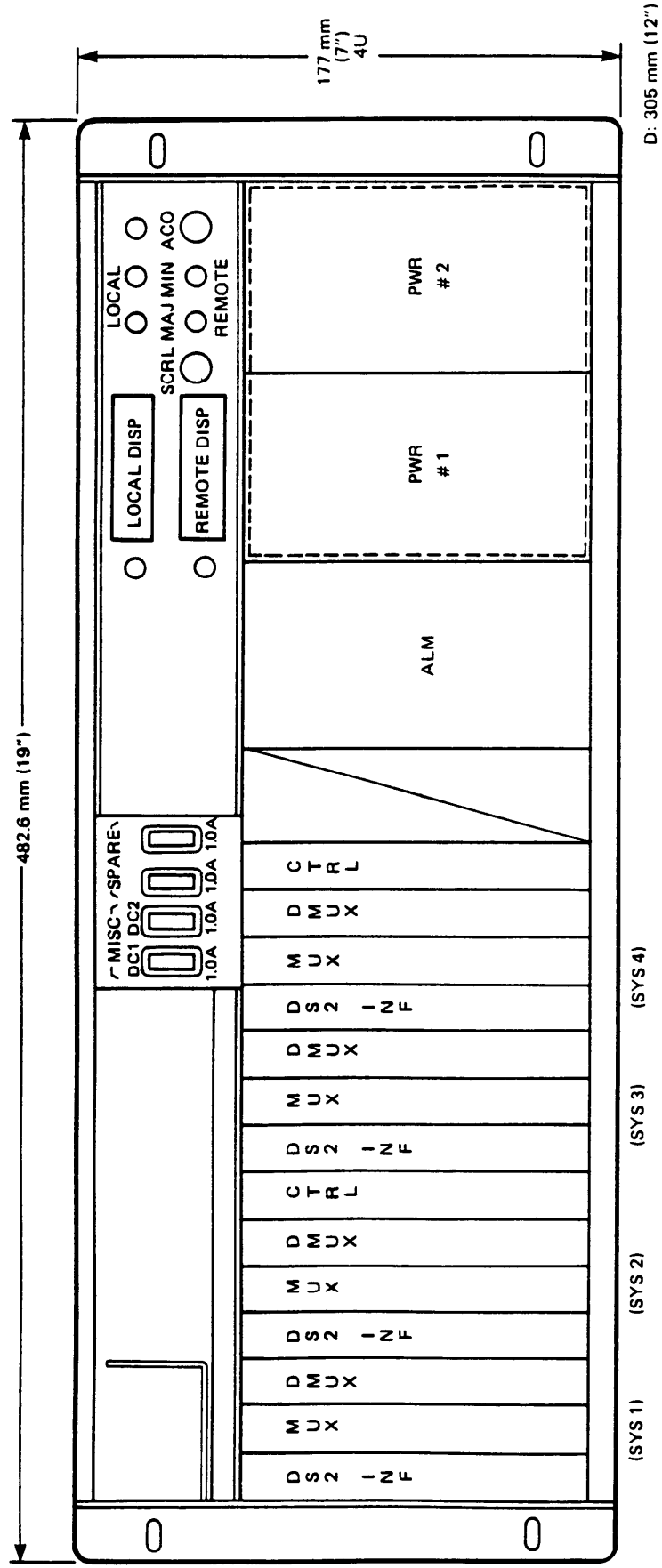
3.20 By combination of various types of unit (as listed in Table 3-1 and 3-2), the FD-2240A is available for versatile use.



4 identical systems/shelf or 2 systems with 1 x 1 configuration/shelf

- NOTE: 1. CTRL unit is not required for non-redundant configuration.  
 2. The space surrounded by broken line is for AC power unit insertion.

Figure 3-6 Physical Configuration of FD-2240A (DS1/DS1C - 6.3MB OPT)



4 identical systems/shelf or 2 systems with 1 x 1 configuration/shelf

- NOTE: 1. CTRL unit is not required for non-redundant configuration.  
 2. The space surrounded by broken line is for AC power unit insertion.

Fig. 3-7 Physical Configuration of FD-2240A (DS1/DS1C - DS2)

◆ Table 3-1 ◆  
Component Unit List of DC Power Supply

Shelf and Unit	Equipment Composition High speed Interface System Composition	Redundant				Non-Redundant								Remarks
		OPT INF		BP INF		OPT INF				BP INF				
		1	2	1	2	1	2	3	4	1	2	3	4	
		SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	
SHELF	E8980A	1	1	1	1	1	1	1	1	1	1	1	1	
MUX	X0300A	2	4	2	4	1	2	3	4	1	2	3	4	-48V, DS1,
	X0300A2													-24V, DS1
	X0300B													
	X0300B2													
DMUX	X0301A	2	4	2	4	1	2	3	4	1	2	3	4	-48V, DS1,
	X0301A1													-24V, DS1
	X0301A2													
	X0301B													
	X0301B2													
6M OPT INF	X0306E	2	4	-	-	1	2	3	4	-	-	-	-	LED-PIN, LW, MM
	X0306F	2	4	-	-	1	2	3	4	-	-	-	-	LED-PIN, LW, SM
	X0306F1													
	X0307B	2	4	-	-	1	2	3	4	-	-	-	-	LD-APD, LW, MM
	X0307C	2	4	-	-	1	2	3	4	-	-	-	-	LD-APD, LW, SM
	X0307C1													
DS2 INF	X0308A	-	-	2	4	-	-	-	-	1	2	3	4	-48V
	X0308A1													-24V
	X0308B													
CTRL	X0316A	1	2	-	-	-	-	-	-	-	-	-	-	* OPT INF
	X0316A1													
	X7387A													
	X0316B													
	X3787B													
ALM	X0314A	1	1	1	1	1	1	1	1	1	1	1	1	-48V, Parallel
	X0314A1													-24, Parallel
	X0314B													
	X0314AA													-48V, Serial
	X0314AB													-24, Serial
SV	X0315A	1	1	-	-	1	1	1	1	-	-	-	-	
PWR	X0319A	2	2	2	2	2	2	2	2	2	2	2	2	-48V
	X0319B													-24V

◆\*: Refer to Paragraph 3.19 (1) ◆  
◆\*\*: Refer to Paragraph 3.19 (2) ◆

Table 3-2  
Component Unit List of AC Power Supply

Shelf and Unit	Equipment Composition	Redundant				Non-Redundant								Remarks
	High speed Interface	OPT INF		BP INF		OPT INF				BP INF				
	System Composition	1	2	1	2	1	2	3	4	1	2	3	4	
		SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	SYS	
SHELF	E8980A	1	1	1	1	1	1	1	1	1	1	1	1	
MUX	X0300A	2	4	2	4	1	2	3	4	1	2	3	4	
	X0300A2													
DMUX	X0301A	2	4	2	4	1	2	3	4	1	2	3	4	
	X0301A1													
	X0301A2													
6M OPT INF	X0306E	2	4	-	-	1	2	3	4	-	-	-	-	
	X0306F	2	4	-	-	1	2	3	4	-	-	-	-	
	X0306F1													
	X0307B	2	4	-	-	1	2	3	4	-	-	-	-	
	X0307C	2	4	-	-	1	2	3	4	-	-	-	-	
X0307C1														
DS2 INF	X0308A	-	-	2	4	-	-	-	-	1	2	3	4	
	X0308A1													
CTRL	X0316A	1	2	-	-	-	-	-	-	-	-	-	-	
	X0316A1													
	X7387A													
	X0316B	-	-	1	2	-	-	-	-	-	-	-	-	
X7387B													** DS2 INF	
ALM	X0314A	1	1	1	1	1	1	1	1	1	1	1	1	
	X0314A1													
	X0314AA	1	1	1	1	1	1	1	1	1	1	1	1	
SV	X0315A	1	1	-	-	1	1	1	1	-	-	-	-	
PWR	X1914A	1	1	1	1	1	1	1	1	1	1	1	1	

◆\*: Refer to Paragraph 3.19 (3)◆

◆\*\*: Refer to Paragraph 3.19 (4)◆

#### 4. SPECIFICATIONS SUMMARY

4.01 The following are specifications summary of the FD-2240A.

##### A. System Parameters

4.02 FD-2240A system parameters are as follows:

- System capacity : Max. 4 systems in non-redundant or 2 systems in redundant
- Channel capacity : 4 x DS1 or 2 x DS1C per line
- Clock : Internally or externally supplied (TTL level)
- Average reframe time : Less than 7 ms at DS2 level
- High speed interface : 6.312 Mb/s optical or bipolar (DS2)

##### B. DSX-1 Interface

4.03 FD-2240A DS1 input/output ports meet the Bell System DSX-1 cross-connect specifications.

- Line rate : 1.544 Mb/s  $\pm$ 130 ppm
- Line code : Bipolar with at least 12.5% average ones density and no more than 15 consecutive zeros or Bipolar with eight-zero substitution (B8ZS)
- Impedance : 100  $\pm$ 5% ohms resistive, balanced
- Cable compensation
  - Output port : Step equalizers for up to 200 m (655 ft) of 22 to 24 AWG ABAM cable to DSX-1 cross-connect
  - Input port : None
- Pulse shape : An isolated pulse fits the template shown in Figure 4-1. The pulse amplitude is between 2.4 and 3.6 volts and scaled by a constant factor to fit the template.

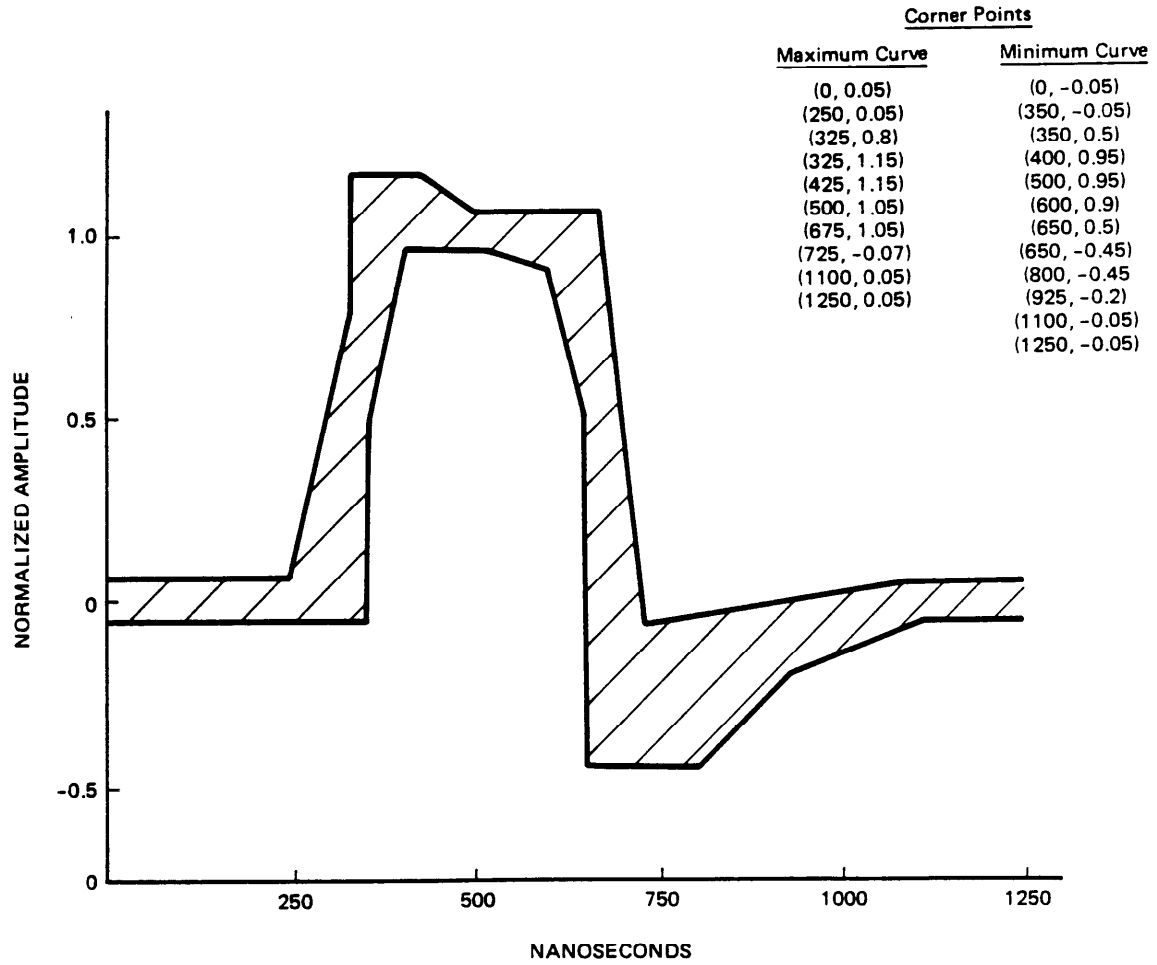


Figure 4-1 DSX-1 Isolated Pulse Template



- Power Level : For an all-ones transmitted pattern, the power in a 2 kHz band about 772 kHz is 12.6 to 17.9 dBm and the power in a 2 kHz band about 1544 kHz is at least 29 dB lower
- Pulse imbalance : Ratio of power in positive and negative pulses is  $0 \pm 0.5$  dB
- Connection terminal : Wire wrapping, 70 pin terminal
- Utilized cable : AWG 24 to 26 pair cable

### C. DSX-1C Interface

4.04 FD-2240A DS1C input/output ports meet the Bell System DSX-1C cross-connect specifications.

- Line rate : 3.152 Mb/s  $\pm 30$  ppm
- Line code : Bipolar with at least 12.5% ones density over any 150 consecutive bits
- Impedance :  $100 \pm 5\%$  ohms resistive, balanced
- Nominal pulse shape : Rectangular
- Nominal pulse amplitude : 3.0 volts
- Pulse width :  $159 \pm 20$  nsec at 50% amplitude
- Rise and fall times : Less than 50 nsec from 20 to 80% amplitude; difference between rise and fall is 20 nsec or less
- Overshoot : Less than 10% of amplitude
- Zero level : Less than 0.1 of peak pulse amplitude
- Power level : 16.53 dBm  $\pm 2$  dB for an all-ones signal measured over 10 MHz bandwidth about 1.576 MHz
- Pulse imbalance : The ratio of power in positive and negative pulses is  $0 \pm 0.5$  dB
- Connection terminal : Wire wrapping 70 pin terminal
- Utilized cable : AWG 22 to 24 pair cable

D. DSX-2 Interface

4.05 FD-2240A DS2 input/output ports meet the Bell System DSX-2 cross-connect specification.

- Line rate : 6.312 Mb/s  $\pm$ 33 ppm
- Line code : Bipolar with six-zero substitution
- Impedance : 110  $\pm$ 5% ohms resistive, balanced
- Cable compensation
  - Output port : Step equalizers for up to 305 m (1,000 ft) of 22 to 24 AWG ABAM cable to DSX-2 cross-connect
  - Input port : Fixed 457 m (1,500 ft) equalizer and AGC circuit with 152 m (500 ft) of AWG 22 to 24 cable performance
- Pulse shape : An isolated pulse fits the template shown in Figure 4-2. The pulse amplitude is scaled by a constant factor to fit the template
- Power level : For an all-ones transmitted pattern, the power in a 2 kHz band about 3.156 MHz is 0.2 to 7.3 dBm and the power in a 2 kHz band about 6.312 MHz is at least 20 dB below that in a 2 kHz band about 3.156 MHz
- Connection terminal : Wire wrapping 70 pin terminal
- Utilized cable : AWG 22 to 24 pair cable

E. High Speed Optical Interface

4.06 FD-2240A high speed optical input/output ports meet the following specifications:

- Line rate : 6.312 Mb/s  $\pm$ 33 ppm
- Line code : Code mark inversion (CMI)
- Optical sources and detectors : Refer to Table 4-1

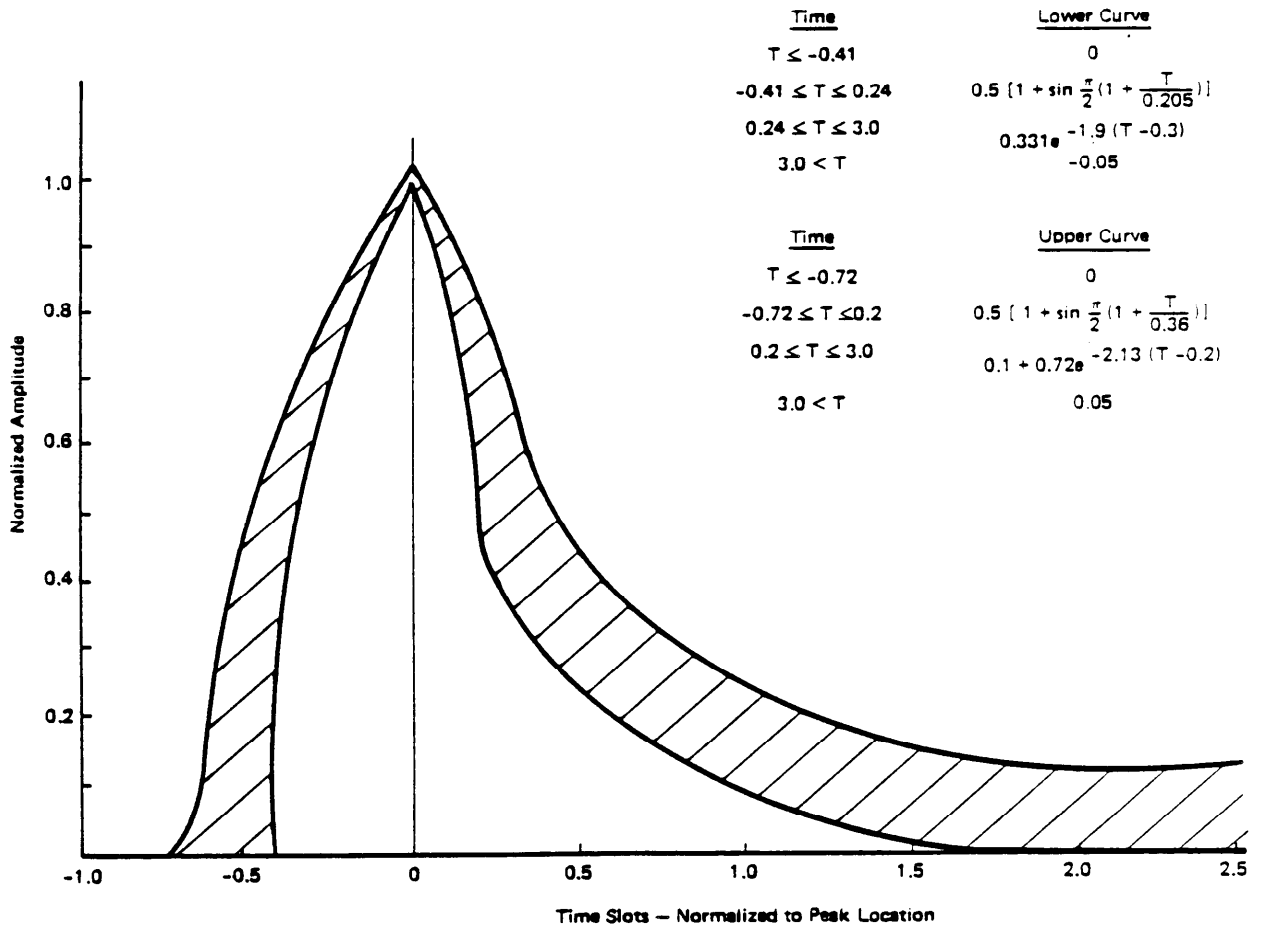


Figure 4-2 DSX-2 Isolated Pulse Template

Table 4-1 Optical Sources and Detectors

6M OPT INF UNIT	Wavelength Range (nm)	Optical Source	Optical Detector	Mode
X0306E	1280 - 1330	LED	PIN	Multi mode
X0307B	1290 - 1330	Laser Diode	Ge-APD	Multi mode
X0306F/F1	1280 - 1330	LED	PIN	Single mode
X0307C/C1	1290 - 1330	Laser Diode	Ge-APD	Single mode

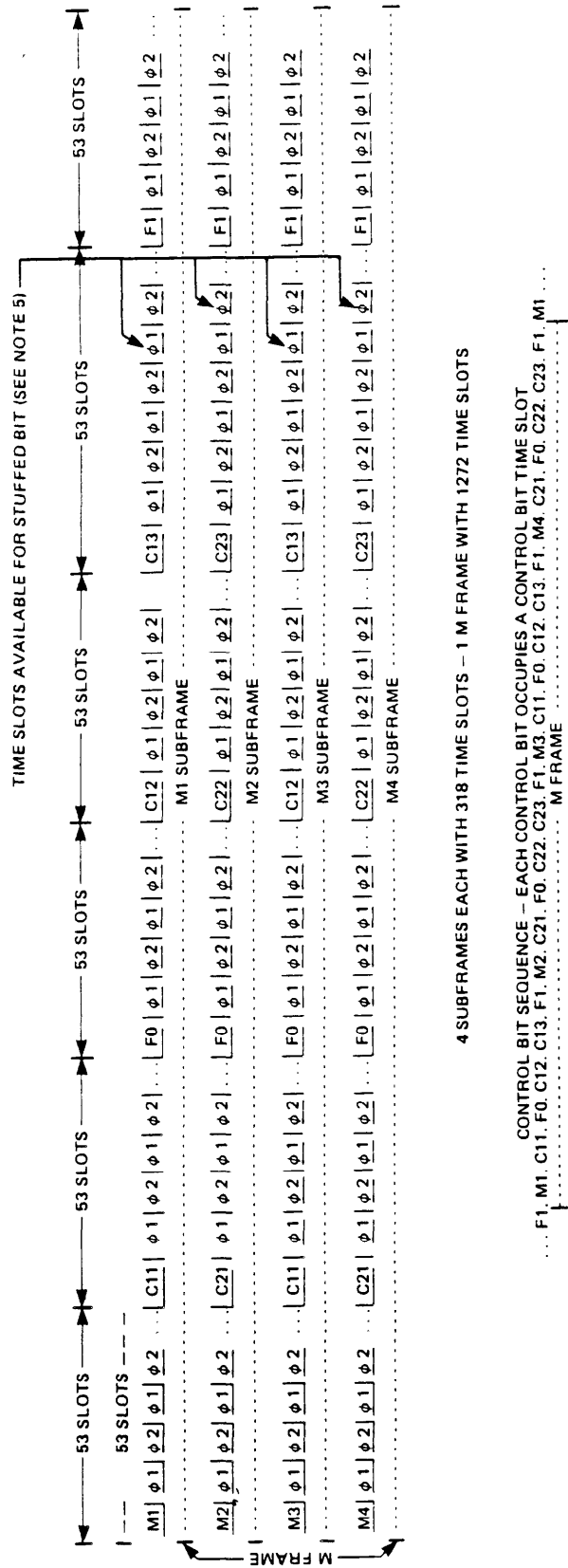
- Wavelength range : 1280 - 1330 nm (long wavelength LED)  
1290 - 1330 nm (long wavelength, LD)  
1280 - 1330 nm (single mode, LED)  
1290 - 1330 nm (single mode, LD)
- Optical output power
  - Laser diode (LD) optical source
    - Peak power : Long wavelength multimode ; +4.5 dBm or greater  
Long wavelength single mode ; +2.5 dBm or greater
    - Average power : Long wavelength multimode ; +1.5 dBm or greater  
Long wavelength single mode ; -0.5 dBm or greater
    - Equipment output power (average power) : Long wavelength multimode ; 0 dBm or greater  
Long wavelength single mode ; -2.0 dBm or greater
  - LED optical source
    - Peak power : Long wavelength multimode ; -14.0 dBm or greater  
Long wavelength single mode ; -30.5 dBm or greater

- Average power : Long wavelength  
multimode ; -17.0 dBm or greater  
Long wavelength  
single mode ; -33.5 dBm or greater
  
- Equipment output power  
(average power) : Long wavelength  
multimode ; -19.5 dBm or greater  
Long wavelength  
single mode ; -36.0 dBm or greater
  
- Minimum receiving level  
(average power) : Bit error rate =  $10^{-9}$ 
  - APD optical detector
    - Equipment input power : Long wavelength  
multimode ; -44.0 dBm or less  
Long wavelength  
single mode ; -44.0 dBm or less
  
  - APD input power : Long wavelength  
multimode ; -44.5 dBm or less  
Long wavelength  
single mode ; -44.5 dBm or less
  
- PIN optical detector
  - Equipment input power : Long wavelength  
multimode ; -49.5 dBm or less  
Long wavelength  
single mode ; -49.5 dBm or less
  
- PIN input power : Long wavelength  
multimode ; -50.0 dBm or less  
Long wavelength  
single mode ; -50.0 dBm or less

- Optical connector : NEC D4 type receptacle
- Optical fiber : 50/125 micron for multi mode
- : 10/125 micron for single mode

F. Frame Structure

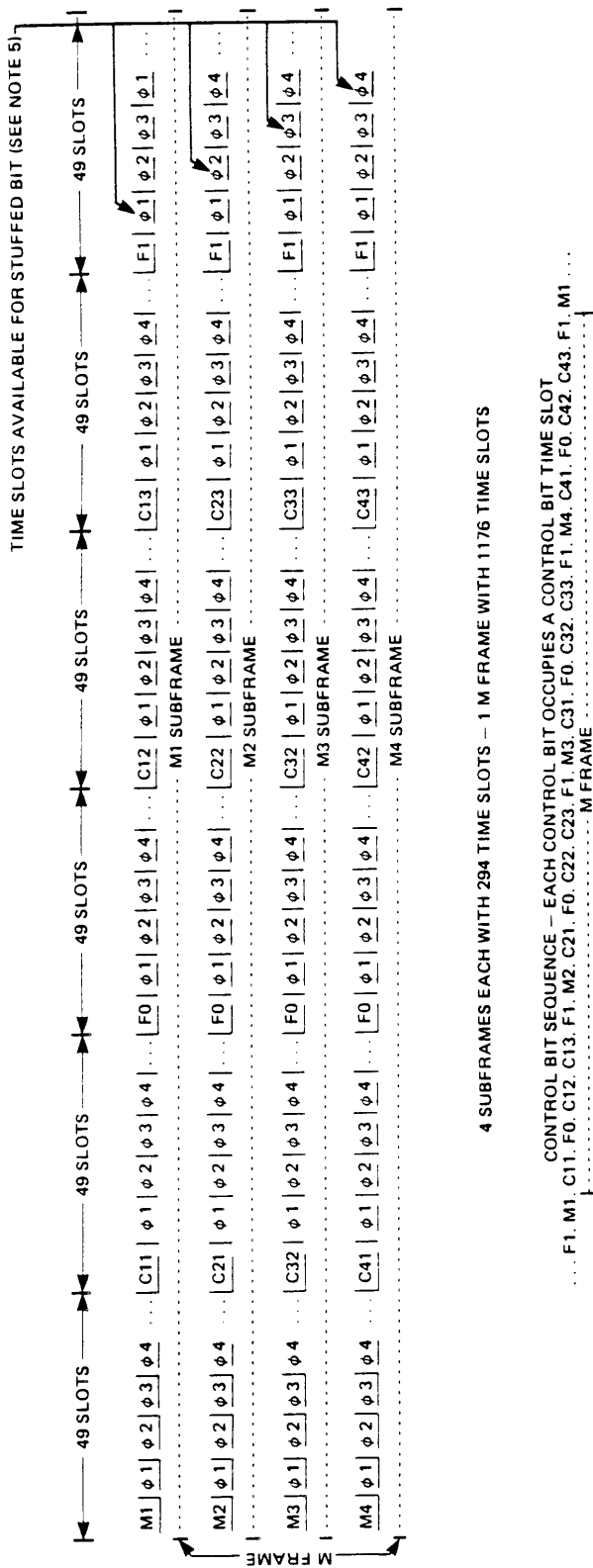
4.07 Figures 4-3 and 4-4 show frame structures for DS1C and DS2 data stream.



DS1C NOTE:

1. THE INFORMATION BITS GENERATED FROM INPUT 1 AND THE STUFFED BITS USED TO SYNCHRONIZE INPUT 1 ARE ENTERED INTO THE SLOTS DESIGNATED AS  $\phi 1$ .  
THE INFORMATION BITS GENERATED FROM INPUT 2 AND THE STUFFED BITS USED TO SYNCHRONIZE INPUT 2 ARE ENTERED INTO THE SLOTS DESIGNATED AS  $\phi 2$ .
2. THE M FRAME ALIGNMENT BITS ARE ENTERED INTO THE SLOTS DESIGNATED AS F0 AND F1. THE F0 BITS IN THE F0 SLOTS ARE TO BE ZEROS (0); THE BITS IN THE F1 SLOTS ARE TO BE ONES (1).
3. THE MULTIFRAME ALIGNMENT BITS ARE TO BE ENTERED INTO THE SLOTS DESIGNATED AS M1, M2 AND M3. THE BITS TO BE ENTERED INTO THE SLOTS ARE AS FOLLOWS, IN M1 A ZERO, IN M2 A ONE AND IN M3 A ONE, GIVING AN 011 SIGNAL.
4. THE SLOT DESIGNATED AS M4) IS THE LOCATION FOR THE CONDITION INDICATOR X BIT. THIS BIT MAY BE USED TO TRANSMIT MAINTENANCE INFORMATION BETWEEN MULTIFRAMES.
5. THE STUFF INDICATOR BITS ARE ENTERED INTO THE SLOTS DESIGNATED AS C11, C12, C13, ETC. THE BITS ENTERED INTO THE 3 C SLOTS IN EACH SUBFRAME ARE USED TO INDICATE THE SOURCE OF THE BIT PLACED IN THE TIMESLOT AVAILABLE FOR STUFFED BIT IN THAT SUBFRAME. IF ALL THREE OR TWO OUT OF THREE C BITS ARE ONES (1); THE BIT IN THE SLOT FOR STUFFED BITS IS A STUFF BIT (THE INPUT STUFFED IS INDICATED BY THE  $\phi$  DESIGNATION I. E.  $\phi 1$  IS A SLOT FOR STUFFING INPUT ONE, ETC.). IF ALL THREE OR TWO OUT OF THREE C BITS ARE ZEROS (0); THEN THE BIT IN THE SLOTS FOR STUFFED BITS IS AN INFORMATION BIT.

Figure 4-3 DS1C Signal Frame Format



DS2 NOTE:

1. THE INFORMATION BITS FROM INPUTS 1, 2, 3, AND 4 AND THE STUFFED BITS USED TO SYNCHRONIZE EACH OF THE FOUR INPUTS ARE TO BE ENTERED INTO SLOTS DESIGNATED AS  $\phi 1$ ,  $\phi 2$ ,  $\phi 3$  AND  $\phi 4$ .
2. THE M FRAME ALIGNMENT BITS ARE ENTERED INTO THE SLOTS DESIGNATED AS F0 AND F1. THE BITS IN THE F0 SLOTS ARE TO BE ZEROS (0); THE BITS IN THE F1 SLOTS ARE TO BE ONES (1);.
3. THE MULTIFRAME ALIGNMENT BITS ARE TO BE ENTERED INTO THE SLOTS DESIGNATED AS M1, M2, AND M3. THE BITS TO BE ENTERED INTO THE SLOTS ARE AS FOLLOWS, IN M1 A ZERO, IN M2 A ONE AND IN M3 A ONE, GIVING AN 011 SIGNAL.
4. THE SLOT DESIGNATED AS M4 IS THE LOCATION FOR THE CONDITION INDICATOR X BIT. THIS BIT MAY BE USED TO TRANS-MIT MAINTENANCE INFORMATION BETWEEN MULTIPLEXES.
5. THE STUFF INDICATOR BITS ARE ENTERED INTO THE SLOTS DESIGNATED AS C11, C12, C13, ETC. THE BITS ENTERED INTO THE 3 C SLOTS IN EACH SUBFRAME ARE USED TO INDICATE THE SOURCE OF THE BIT PLACED IN THE TIME SLOT AVAILABLE FOR STUFFED BIT IN THAT SUBFRAME. IF ALL THREE OR TWO OUT OF THREE C BITS ARE ONES (1); THE BIT IN THE SLOT FOR STUFFED BITS IS A STUFF BIT. (THE INPUT STUFFED IS INDICATED BY THE  $\phi$  DESIGNATION I. E.  $\phi 1$  IS A SLOT FOR STUFFING INPUT ONE, ETC.). IF ALL THREE OR TWO OUT OF THREE C BITS ARE ZEROS (0); THEN THE BIT IN THE SLOTS FOR STUFFED BITS IS AN INFORMATION BIT.

Figure 4-4 DS2 Signal Frame Format



G. Link Loss Budget

4.08 Link loss budget of the FD-2240A is estimated as listed below: Refer to Figures 4-5 and 4-6.

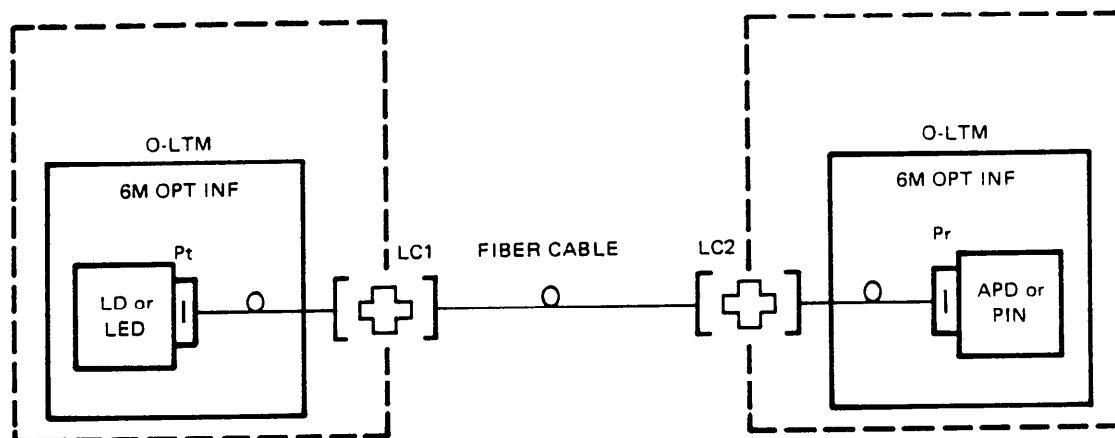
- Operating wavelength
    - Long wavelength multi mode : 1280 - 1330 nm
    - Long wavelength single mode : 1290 - 1330 nm
  - Transmitter power (Pt)
    - LED Long wavelength multi mode : -17.0 dBm or greater (Average)
    - LD Long wavelength multi mode : +1.5 dBm or greater (Average)
    - LED Long wavelength single mode : -33.5 dBm or greater (Average)
    - LD Long wavelength single mode : -0.5 dBm or greater (Average)
  - Receiver sensitivity power (Pr)  
(BER =  $10^{-9}$ )
    - PIN Long wavelength multi mode : -50.0 dBm or less (Average)
    - APD Long wavelength single mode : -44.5 dBm or less (Average)
    - PIN Long wavelength single mode : -50.0 dBm or less (Average)
  - Power penalty of fiber  
band width limitation
    - LED Long wavelength multi mode : 1.0 dB
  - Power penalty of reflection  
noise
    - LD Long wavelength single mode : 0.5 dB
  - Connector loss at O-LTM
    - TX side (LC1) : 1.5 dB
    - RX side (LC2) : 0.5 dB
    - Total (LC1 + LC2) : 2.0 dB
  - Connector loss at FDP/FDF
    - TX side (LC3) : 1.5 dB
    - RX side (LC4) : 1.0 dB
    - Total (LC3 + LC4) : 2.5 dB
- FDP is NEC FD-0127B and FDF is NEC FD-30001A .

- System margin

LED - PIN Long wavelength multi mode	:	7.0 dB
LD - APD Long wavelength multi mode	:	5.0 dB
LED - PIN Long wavelength single mode	:	6.5 dB
LD - APD Long wavelength single mode	:	5.0 dB
LD - PIN Long wavelength single mode	:	5.0 dB

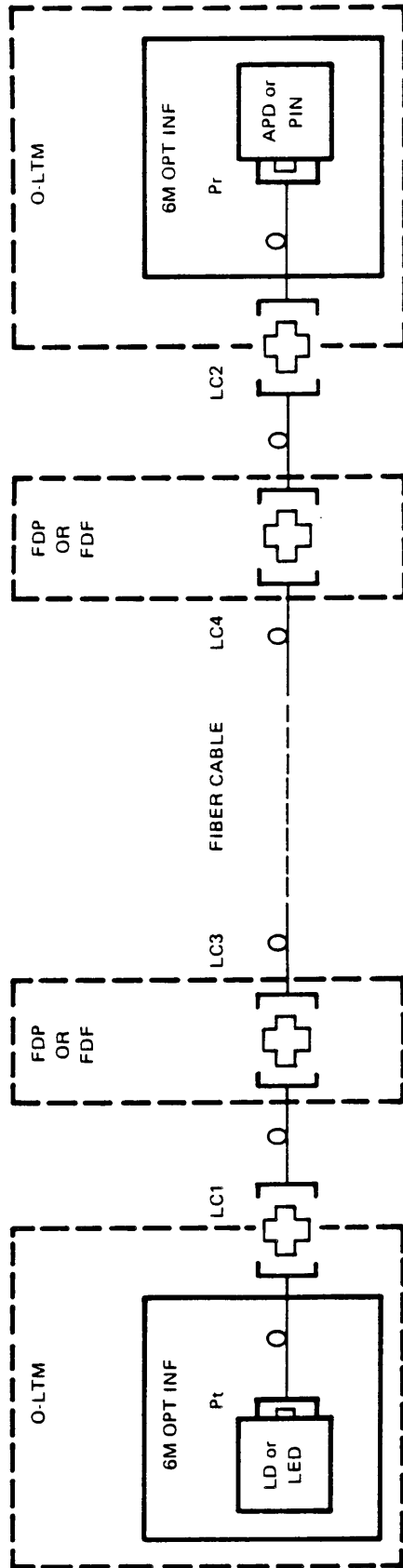
- Total allowable cable loss

		without FDP/FDF	with FDP/FDF
LED - PIN Long wavelength multi mode	:	23.0 dB	20.5 dB
LD - APD Long wavelength multi mode	:	39.0 dB	36.5 dB
LED - PIN Long wavelength single mode	:	8.0 dB	5.5 dB
LD - APD Long wavelength single mode	:	36.5 dB	34.0 dB
LD - PIN Long wavelength single mode	:	42.0 dB	39.5 dB



- APD : Avalanche photodiode
- PIN : Pin photodiode
- LC1 : Equipment connector loss (TX)
- LC2 : Equipment connector loss (RX)
- LD : Laser diode
- LED : Light emitting diode
- O-LTM : Optical line terminating multiplexer
- Pr : Receiver sensitivity at APD or Pin-PD input
- Pt : Transmit output power at LD or LED output

Figure 4-5 Link Loss Parameters Without FDF/FDP



- APD : Avalanche photodiode
- PIN : Pin photodiode
- FDF : Fiber distribution frame (FD-30001A)
- FDP : Fiber distribution panel (FD-0127B)
- LC1 : Equipment connector (TX)
- LC2 : Equipment connector (RX)
- LC3 : FDF/FDP connector loss (TX)
- LC4 : FDF/FDP connector loss (RX)
- LD : Laser diode
- LED : Light emitting diode
- O-LTM : Optical line terminating multiplexer
- Pr : Receiver sensitivity at APD or Pin PD input
- Pt : Transmit output power at LD or LED output

Figure 4-6 Link Loss Parameters with FDF/FDP

H. Office Alarms and Supervisory Interface

4.09 The FD-2240A meets the following specifications:

Parallel Interface

- Output signal : Relay contact closure
  - Maximum current : 200 mA
  - Maximum voltage : 100 Vdc
  - Output alarm item
    - Central office alarm : 4 items
    - Supervisory alarm : 15 items
- Refer to Table 4-2.
- Connection terminal : Wire wrapping pin
  - Used cable : AWG 22 to 24 pair cable

Serial Interface

- Interface : EIA standard RS-422, TBOS protocol
  - Data speed : 2,400 bps
  - Transmission system : Serial data, asynchronous
  - Alarm and status item
    - Central office alarm : 4 items relay contact
    - Supervisory alarm : For local station alarm ; 30 alarm and 31 status items
    - : For remote station alarm; 48 alarms and 8 status items
- Refer to Tables 4-3 through 4-6.
- Scan Display
    - Optical interface : For local station alarm ; 1 display
    - For remote station alarm; 1 display
    - Bipolar interface : For local station alarm ; 1 display
  - Impedance : 100 ohms
  - Connection terminal : Wire wrapping pin
  - Used cable : AWG 22 to 24 twisted pair cable

Table 4-2  
CO Alarm and SV Alarm Items for Parallel Interface

ALM	NO.	Output Alarm
CO ALM	1	MAJ VIS
	2	MAJ AUD
	3	MIN VIS
	4	MIN AUD
SV ALM	5	SYSTEM 1 FAIL
	6	SYSTEM 2 FAIL
	7	SYSTEM 3 FAIL
	8	SYSTEM 4 FAIL
	9	LOSS OF ONE LS IN
	10	LOSS OF MORE THAN ONE LS IN
	11	RMT ALM
	12	LOSS OF HS
	13	MAJ ALM
	14	MIN ALM
	15	PWR MAJ
	16	PWR MIN
	17	MAINT
	18	AIS RCV
	19	ALM CCT FAIL

Table 4-3  
Serial Alarm and Status Items for Local Station

Char.	Scan Point (Alarm/Status)							
	1	2	3	4	5	6	7	8
000	SYS 1 MUX (A)	SYS 1 HS OUT (A)	SYS 1 HS IN (A)	SYS 1 D MUX (A)	SYS 1 MAJ ERR (A)	SYS 1 LD BIAS (A)	SYS 1,2 CTRL (A)	PWR MAJ (A)
	9	10	11	12	13	14	15	16
001	SYS 2 MUX (A)	SYS 2 HS OUT (A)	SYS 2 HS IN (A)	SYS 2 D MUX (A)	SYS 2 MAJ ERR (A)	SYS 2 LD BIAS (A)	FUSE CD(2) (A)	(U)
	17	18	19	20	21	22	23	24
010	SYS 3 MUX (A)	SYS 3 HS OUT (A)	SYS 3 HS IN (A)	SYS 3 D MUX (A)	SYS 3 MAJ ERR (A)	SYS 3 LD BIAS (A)	SYS 3,4 CTRL (A)	PWR MIN (A)
	25	26	27	28	29	30	31	32
011	SYS 4 MUX (A)	SYS 4 HS OUT (A)	SYS 4 HS IN (A)	SYS 4 D MUX (A)	SYS 4 MAJ ERR (A)	SYS 4 LD BIAS (A)	SV (A)	(U)
	33	34	35	36	37	38	39	40
100	SYS 1 ON LINE (S)	SYS 1 LS CH 1 IN (S)	SYS 1 LS CH 2 IN (S)	SYS 1 LS CH 3 IN (S)	SYS 1 LS CH 4 IN (S)	SYS 1 AIS RCV (S)	SYS 1 RMT ALM (S)	RLB (S)
	41	42	43	44	45	46	47	48
101	SYS 2 ON LINE (S)	SYS 2 LS CH 1 IN (S)	SYS 2 LS CH 2 IN (S)	SYS 2 LS CH 3 IN (S)	SYS 2 LS CH 4 IN (S)	SYS 2 AIS RCV (S)	SYS 2 RMT ALM (S)	MAN SW (S)
	49	50	51	52	53	54	55	56
110	SYS 3 ON LINE (S)	SYS 3 LS CH 1 IN (S)	SYS 3 LS CH 2 IN (S)	SYS 3 LS CH 3 IN (S)	SYS 3 LS CH 4 IN (S)	SYS 3 AIS RCV (S)	SYS 3 RMT ALM (S)	ACO (S)
	57	58	59	60	61	62	63	64
111	SYS 4 ON LINE (S)	SYS 4 LS CH 1 IN (S)	SYS 4 LS CH 2 IN (S)	SYS 4 LS CH 3 IN (S)	SYS 4 LS CH 4 IN (S)	SYS 4 AIS RCV (S)	SYS 4 RMT ALM (S)	(X) (S)

(A) : Alarm (S) : Status (U) : Unassigned (X) : Reserved

NOTE 1: Bit 64th is assigned for administrative function.

2: This display assignment confirms to the STANDARD ATTRIBUTE ASSIGNMENT L128.

♦ Table 4-4 ♦

♦ Serial Supervisory Alarm and Status Indications for Local Station ♦

Bit No.	Alarm/Status	Description
1	SYS 1 MUX	MUX unit failure alarm of SYS 1.
2	SYS 1 HS OUT	High speed output data loss alarm of SYS 1 transmit side.
3	SYS 1 HS IN	High speed input data loss alarm of SYS 1 receive side.
4	SYS 1 DMUX	Demultiplexer circuit, low speed channel or on-line RCV monitoring failure alarm of DMUX unit of SYS 1.
5	SYS 1 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 1.
6	SYS 1 LD BIAS	LD current alarm of 6M OPT INF (X0307) unit of SYS 1.
7	SYS 1, 2 CTRL	Monitoring circuit self-check or CPU failure alarm of CTRL unit of SYS 1 or SYS 2.
8	PWR MAJ	Failure alarm for both DC power unit or AC power unit.
9	SYS 2 MUX	MUX unit failure alarm of SYS 2.
10	SYS 2 HS OUT	High speed output data loss alarm of SYS 2 transmit side.
11	SYS 2 HS IN	High speed input data loss alarm of SYS 2 receive side.
12	SYS 2 DMUX	Demultiplexer circuit, low speed channel or on-line RCV monitoring failure alarm of DMUX unit of SYS 2.
13	SYS 2 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 2.
14	SYS 2 LD BIAS	LD current alarm of 6M OPT INF (X0307) unit of SYS 2.
15	FUSE (DC 2)	MISC (DC 2) fuse blown alarm.
16	(U)	Not used.
17	SYS 3 MUX	MUX unit failure alarm of SYS 3.
18	SYS 3 HS OUT	High speed output data loss alarm of SYS 3 transmit side.



♦Table 4-4♦

♦Serial Supervisory Alarm and Status Indications for Local Station (cont'd)♦

Bit No.	Alarm/Status	Description
19	SYS 3 HS IN	High speed input data loss alarm of SYS 3 receive side.
20	SYS 3 DMUX	Demultiplexer circuit, low speed channel or on-line RCV monitoring failure alarm of DMUX unit of SYS 3.
21	SYS 3 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 3.
22	SYS 3 LD BIAS	LD current alarm of 6M OPT INF (X0307) unit of SYS 3.
23	SYS 3, 4 CTRL	Monitoring circuit self-check or CPU failure alarm of CTRL unit of SYS 3 or SYS 4.
24	PWR MIN	One DC power unit failure alarm.
25	SYS 4 MUX	MUX unit failure alarm of SYS 4.
26	SYS 4 HS OUT	High speed output data loss alarm of SYS 4 transmit side.
27	SYS 4 HS IN	High speed input data loss alarm of SYS 4 receive side.
28	SYS 4 DMUX	Demultiplexer circuit, low speed channel or on-line RCV monitoring failure alarm of DMUX unit of SYS 4.
29	SYS 4 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 4.
30	SYS 4 LD BIAS	LD current alarm of 6M OPT INF (X0307) unit of SYS 4.
31	SV	SV unit failure alarm.
32	(U)	Not used.
33	SYS 1 ON LINE	ON LINE status of SYS 1.
34	SYS 1 LS CH 1 IN	Low speed channel 1 input signal loss status of SYS 1.
35	SYS 1 LS CH 2 IN	Low speed channel 2 input signal loss status of SYS 1.

♦ Table 4-4 ♦

♦ Serial Supervisory Alarm and Status Indications for Local Station (cont'd) ♦

Bit No.	Alarm/Status	Description
36	SYS 1 LS CH 3 IN	Low speed channel 3 input signal loss status of SYS 1.
37	SYS 1 LS CH 4 IN	Low speed channel 4 input signal loss status of SYS 1.
38	SYS 1 AIS RCV	Status of Alarm Indication Signal reception in SYS 1.
39	SYS 1 RMT ALM	Status of remote alarm signal detection in SYS 1.
40	RLB	Status of RLB switch activation in any system.
41	SYS 2 ON LINE	ON LINE status of SYS 2.
42	SYS 2 LS CH 1 IN	Low speed channel 1 input signal loss status of SYS 2.
43	SYS 2 LS CH 2 IN	Low speed channel 2 input signal loss status of SYS 2.
44	SYS 2 LS CH 3 IN	Low speed channel 3 input signal loss status of SYS 2.
45	SYS 2 LS CH 4 IN	Low speed channel 4 input signal loss status of SYS 2.
46	SYS 2 AIS RCV	Status of Alarm Indication Signal reception in SYS 2.
47	SYS 2 RMT ALM	Status of remote alarm signal detection in SYS 2.
48	MAN SW	Status of manual switch activation in any system.
49	SYS 3 ON LINE	ON LINE status of SYS 3.
50	SYS 3 LS CH 1 IN	Low speed channel 1 input signal loss status of SYS 3.
51	SYS 3 LS CH 2 IN	Low speed channel 2 input signal loss status of SYS 3.
52	SYS 3 LS CH 3 IN	Low speed channel 3 input signal loss status of SYS 3.

♦ Table 4-4 ♦

♦ Serial Supervisory Alarm and Status Indications for Local Station (cont'd) ♦

Bit No.	Alarm/Status	Description
53	SYS 3 LS CH 4 IN	Low speed channel 4 input signal loss status of SYS 3.
54	SYS 3 AIS RCV	Status of Alarm Indication Signal reception in SYS 3.
55	SYS 3 RMT ALM	Status of remote alarm signal detection in SYS 3.
56	ACO	Status of Alarm Cut Off switch activation on DISP panel.
57	SYS 4 ON LINE	ON LINE status of SYS 4.
58	SYS 4 LS CH 1 IN	Low speed channel 1 input signal loss status of SYS 4.
59	SYS 4 LS CH 2 IN	Low speed channel 2 input signal loss status of SYS 4.
60	SYS 4 LS CH 3 IN	Low speed channel 3 input signal loss status of SYS 4.
61	SYS 4 LS CH 4 IN	Low speed channel 4 input signal loss status of SYS 4.
62	SYS 4 AIS RCV	Status of Alarm Indication Signal reception in SYS 4.
63	SYS 4 RMT ALM	Status of remote alarm signal detection in SYS 4.
64	(X)	Reserved for administration function.

Table 4-5  
Serial Alarm and Status Items for Remote Station

Char.	Scan Point (Alarm/Status)							
	1	2	3	4	5	6	7	8
000	SYS 1 CTRL (A)	SYS 1 MUX (A)	SYS 1 OPT OUT (A)	SYS 1 OPT IN (A)	SYS 1 DMUX (A)	SYS 1 MAJ ERR (A)	SYS 1 PWR MIN (A)	SYS 1 OFF LINE MON (A)
	9	10	11	12	13	14	15	16
001	SYS 2 CTRL (A)	SYS 2 MUX (A)	SYS 2 OPT OUT (A)	SYS 2 OPT IN (A)	SYS 2 DMUX (A)	SYS 2 MAJ ERR (A)	SYS 2 PWR MIN (A)	SYS 2 OFF LINE MON (A)
	17	18	19	20	21	22	23	24
010	SYS 3 CTRL (A)	SYS 3 MUX (A)	SYS 3 OPT OUT (A)	SYS 3 OPT IN (A)	SYS 3 DMUX (A)	SYS 3 MAJ ERR (A)	SYS 3 PWR MIN (A)	SYS 3 OFF LINE MON (A)
	25	26	27	28	29	30	31	32
011	SYS 4 CTRL (A)	SYS 4 MUX (A)	SYS 4 OPT OUT (A)	SYS 4 OPT IN (A)	SYS 4 DMUX (A)	SYS 4 MAJ ERR (A)	SYS 4 PWR MIN (A)	SYS 4 OFF LINE MON (A)
	33	34	35	36	37	38	39	40
100	SYS 1 MIN ERR (A)	SYS 1 LD BIAS (A)	SYS 1 SV (A)	SYS 1 ALM CCT (A)	SYS 2 MIN ERR (A)	SYS 2 LD BIAS (A)	SYS 2 SV (A)	SYS 2 ALM CCT (A)
	41	42	43	44	45	46	47	48
101	SYS 3 MIN ERR (A)	SYS 3 LD BIAS (A)	SYS 3 SV (A)	SYS 3 ALM CCT (A)	SYS 4 MIN ERR (A)	SYS 4 LD BIAS (A)	SYS 4 SV (A)	SYS 4 ALM CCT (A)
	49	50	51	52	53	54	55	56
110	SYS 1 ON LINE (S)	SYS 1 CH IN (S)	(U)	(U)	SYS 2 ON LINE (S)	SYS 2 CH IN (S)	(U)	(U)
	57	58	59	60	61	62	63	64
111	SYS 3 ON LINE (S)	SYS 3 CH IN (S)	(U)	(U)	SYS 4 ON LINE (S)	SYS 4 CH IN (S)	(U)	(X)

(A) : Alarm (S) : Status (U) : Unassigned (X) : Reserved

NOTE 1: Bit 64th is assigned for administrative function.

2: This display assignment conforms to the STANDARD ATTRIBUTE ASSIGNMENT L128.

Table 4-6

## Serial Supervisory Alarm and Status Indications for Remote Station

Bit No.	Alarm/Status	Description
1	SYS 1 CTRL	Monitoring circuit self-check failure or CPU failure alarm of CTRL unit and MISC (DC 2) fuse blown alarm of SYS 1 at remote station.
2	SYS 1 MUX	MUX unit failure alarm of SYS 1 at remote station.
3	SYS 1 OPT OUT	Optical output signal loss alarm of SYS 1 at remote station.
4	SYS 1 OPT IN	Optical input signal loss alarm of SYS 1 at remote station.
5	SYS 1 DMUX	Demultiplexer circuit failure, low speed channel failure or on-line RCV monitoring failure alarm of DMUX unit of SYS 1 at remote station.
6	SYS 1 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 1 at remote station.
7	SYS 1 PWR MIN	Power supply minor alarm of SYS 1 at remote station.
8	SYS 1 OFF LINE MON	OFF LINE monitoring circuit failure alarm of SYS 1 at remote station.
9	SYS 2 CTRL	Monitoring circuit self-check failure or CPU failure alarm of CTRL unit and MISC (DC 2) fuse blown alarm of SYS 2 at remote station.
10	SYS 2 MUX	MUX unit failure alarm of SYS 2 at remote station.
11	SYS 2 OPT OUT	Optical output signal loss alarm of SYS 2 at remote station.
12	SYS 2 OPT IN	Optical input signal loss alarm of SYS 2 at remote station.
13	SYS 2 DMUX	Demultiplexer circuit failure, low speed channel failure or on-line RCV monitoring failure alarm of DMUX unit of SYS 2 at remote station.
14	SYS 2 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 2 at remote station.

Table 4-6

## Serial Supervisory Alarm and Status Indications for Remote Station (Cont'd)

Bit No.	Alarm/Status	Description
15	SYS 2 PWR MIN	Power supply minor alarm of SYS 2 at remote station.
16	SYS 2 OFF LINE MON	OFF LINE monitoring circuit failure alarm of SYS 2 at remote station.
17	SYS 3 CTRL	Monitoring circuit self-check failure or CPU failure alarm of CTRL unit and MISC (DC 2) fuse blown alarm of SYS 3 at remote station.
18	SYS 3 MUX	MUX unit failure alarm of SYS 3 at remote station.
19	SYS 3 OPT OUT	Optical output signal loss alarm of SYS 3 at remote station.
20	SYS 3 OPT IN	Optical input signal loss alarm of SYS 3 at remote station.
21	SYS 3 DMUX	Demultiplexer circuit failure, low speed channel failure or on-line RCV monitoring failure alarm of DMUX unit of SYS 3 at remote station.
22	SYS 3 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 3 at remote station.
23	SYS 3 PWR MIN	Power supply minor alarm of SYS 3 at remote station.
24	SYS 3 OFF LINE MON	OFF LINE monitoring circuit failure alarm of SYS 3 at remote station.
25	SYS 4 CTRL	Monitoring circuit self-check failure or CPU failure alarm of CTRL unit and MISC (DC 2) fuse blown alarm of SYS 4 at remote station.
26	SYS 4 MUX	MUX unit failure alarm of SYS 4 at remote station.
27	SYS 4 OPT OUT	Optical output signal loss alarm of SYS 4 at remote station.
28	SYS 4 OPT IN	Optical input failure alarm of SYS 4 at remote station.
29	SYS 4 DMUX	Demultiplexer circuit failure, low speed channel failure or on-line RCV monitoring alarm of DMUX unit of SYS 4 at remote station.

Table 4-6

Serial Supervisory Alarm and Status Indications for Remote Station (Cont'd)

Bit No.	Alarm/Status	Description
30	SYS 4 MAJ ERR	Major error detection alarm in high speed receiving data of SYS 4 at remote station.
31	SYS 4 PWR MIN	Power supply minor alarm of SYS 4 at remote station.
32	SYS 4 OFF LINE MON	OFF LINE monitoring circuit failure alarm of SYS 4 at remote station.
33	SYS 1 MIN ERR	Minor error detection alarm in high speed receiving data of SYS 1 at remote station.
34	SYS 1 LD BIAS	LD current alarm of SYS 1 at remote station.
35	SYS 1 SV	SV unit receiving circuit failure alarm of SYS 1 at local station.
36	SYS 1 ALM CCT	Alarm circuit failure alarm of SYS 1 at remote station.
37	SYS 2 MIN ERR	Minor error detection alarm in high speed receiving data of SYS 2 at remote station.
38	SYS 2 LD BIAS	LD current alarm of SYS 2 at remote station.
39	SYS 2 SV	SV unit receive circuit failure alarm of SYS 2 at local station.
40	SYS 2 ALM CCT	Alarm circuit failure alarm of SYS 2 at remote station.
41	SYS 3 MIN ERR	Minor error detection alarm in high speed receiving data of SYS 3 at remote station.
42	SYS 3 LD BIAS	LD current alarm of SYS 3 at remote station.
43	SYS 3 SV	SV unit receive circuit failure alarm of SYS 3 at local station.
44	SYS 3 ALM CCT	Alarm circuit failure alarm of SYS 3 at remote station.
45	SYS 4 MIN ERR	Minor error detection alarm in high speed receiving data of SYS 4 at remote station.
46	SYS 4 LD BIAS	LD current alarm of SYS 4 at remote station.

Table 4-6

## Serial Supervisory Alarm and Status Indications for Remote Station (Cont'd)

Bit No.	Alarm/Status	Description
47	SYS 4 SV	SV unit receive circuit failure alarm of SYS 4 at local station.
48	SYS 4 ALM CCT	Alarm circuit failure alarm of SYS 4 at remote station.
49	SYS 1 ON LINE	ON LINE status of SYS 1 at remote station.
50	SYS 1 CH IN	Low speed input loss status in any channel of SYS 1 at remote station.
51	(U)	Not used.
52	(U)	Not used.
53	SYS 2 ON LINE	ON LINE status of SYS 2 at remote station.
54	SYS 2 CH IN	Low speed input loss status in any channel of SYS 2 at remote station.
55	(U)	Not used.
56	(U)	Not used.
57	SYS 3 ON LINE	ON LINE status of SYS 3 at remote station.
58	SYS 3 CH IN	Low speed input loss status in any channel of SYS 3 at remote station.
59	(U)	Not used.
60	(U)	Not used.
61	SYS 4 ON LINE	ON LINE status of SYS 4 at remote station.
62	SYS 4 CH IN	Low speed input loss status in any channel of SYS 4 at remote station.
63	(U)	Not used.
64	(X)	Reserved for administrative function.



J. Orderwire Equipment Interface

4.10 The FD-2240A orderwire equipment interface meets the following specifications:

- Level : TTL level
- Connection terminal : Wire wrapping 70 pin terminal
- Used cable : AWG 22 to 24 twisted pair cable

K. External Clock Interface

4.11 The FD-2240A external clock interface meets the following specification:

- Clock : 6.312 MHz
- Interface level : TTL level
- Connection terminal : Wire wrapping 70 pin terminal
- Used cable : AWG 22 to 24 pair cable

L. Environmental Requirements

4.12 The FD-2240A operates with no performance degradation over any combination of the following range of external conditions:

- Long-term temperature range
  - DS2 bipolar interface : 0 to 45°C (32 to 113°F)
  - Optical interface with LED : 0 to 45°C (32 to 113°F)
  - Optical interface with LD : 0 to 45°C (32 to 113°F)
- Short-term temperature range : 0 to 50°C (32 to 122°F)  
(less than 72 hours continuously  
and 15 days in one year)
- Humidity : Up to 90% at 35°C (95°F)
- Altitude : -61 to 3,657 m (-200 to 12,000 ft)

## M. Power Supply Specifications

4.13 FD-2240A power supply specifications are as follows:

- Primary power supply voltage : -42 to -56 Vdc, -21 to -27 Vdc, or 117 ±10% Vac
- Power consumption per fully equipped shelf
  - Bipolar or optical interface : 1A maximum current for -48 Vdc input  
2A maximum current for -24 Vdc input
- Battery noise : 55 dBm maximum in any 3.1 kHz band from 3 kHz to 10 MHz
- Battery noise, single frequency : 55 dBm maximum
- Battery hum : 40 dBm maximum
- Battery output : 4 V maximum at a rate of change of 200 V per millisecond

4.14 The noise contributions from the FD-2240A to the office battery supply are as follows:

- Battery line noise : 30 dBm or less in any 3.1 kHz band from 3 kHz to 10 MHz
- Battery line noise, single frequency : 30 dBm or less
- Battery line hum : 19 dBm or less

## N. Mechanical Construction

4.15 The FD-2240A has the following mechanical construction:

- Shelf dimension
  - Height : 177 mm (7 in.)
  - Width : 482.6 mm (19 in.)
  - Depth : 305 mm (12 in.)
- Weight : 16 kg (35.3 lb)
- Wiring access : Rear access for electrical connection  
Front access for optical connection

5. COMMON LANGUAGE EQUIPMENT IDENTIFICATION CODES

5.01 The Common Language Equipment Identification (CLEI) codes for FD-2240A 6.3MB O-LTM are listed in Table 5-1. Bar code labels are located on the unit ejector.

♦ Table 5-1 FD-2240A 6.3MB O-LTM CLEI Codes ♦

UNIT	DESCRIPTION	CLEI CODE	BAR CODE
E8980A	SHELF	M2 MM 5001	CRR#368315
X0300A	MUX UNIT (DS1, -48V)	M2 PMC 112AA	620571-5
X0300B	MUX UNIT (DS1, -24V)	M2 PMC 122AA	636838-2
X0300A2	MUX UNIT (DS1, -48V)	M2 PMC 142AA	642088-9
X0300B2	MUX UNIT (DS1, -24V)	NOT AVAILABLE	NOT AVAILABLE
X0301A	DMUX UNIT (DS1, -48V)	M2 PMD 112AA	621705-5
X0301A1	DMUX UNIT (DS1, -48V)	M2 PMD 112AB	642613-7
X0301B	DMUX UNIT (DS1, -24V)	M2 PMD 122AA	625500-4
X0301A2	DMUX UNIT (DS1, -48V)	M2 PMD 142AA	642091-3
X0301B2	DMUX UNIT (DS1, -24V)	NOT AVAILABLE	NOT AVAILABLE
X0306E	6M OPT INF (1300 nm, MM, LED-PIN)	M2 OTH 631AA	635557-8
X0306F	6M OPT INF (1310 nm, SM, LED-PIN)	M2 OTH 711AA	632512-3
X0306F1	6M OPT INF (1310 nm, SM, LED-PIN)	M2 OTH 711AB	632512-3
X0307B	6M OPT INF (1300 nm, MM, LD-APD)	M2 OTJ 631AA	633138-4
X0307C	6M OPT INF (1310 nm, SM, LD-APD)	M2 OTJ 711AA	635909-3
X0307C1	6M OPT INF (1310 nm, SM, LD-APD)	M2 OTJ 711AB	635909-3
X0308A1	DS2 INTERFACE	M2 LS 3002AB	623458-9
X0314A	ALM UNIT (-48V), PARALLEL	M2 ACB 022AA	623403-7
X0314A1	ALM UNIT (-48V), PARALLEL	M2 ACB 012AB	640803-1
X0314B	ALM UNIT (-24V), PARALLEL	M2 ACB 022AA	623403-7
X0314AA	ALM UNIT (-48V), SERIAL	M2 ACB 142AA	642118-8
X0314AB	ALM UNIT (-24V), SERIAL	NOT AVAILABLE	NOT AVAILABLE
X0315A	SV UNIT	M2 CPS 004AA	626222-9

◆ Table 5-1 FD-2240A 6.3MB O-LTM CLEI Codes ◆

UNIT	DESCRIPTION	CLEI CODE	BAR CODE
X0316A	CTRL UNIT	M2 CPT 004AA	641200-1
X0316A1	CTRL UNIT	M2 CPT 004AB	620213-5
X0316B	CTRL UNIT	F2 CUA 001AA	646150-2
X7887A	CTRL UNIT	NOT AVAILABLE	NOT AVAILABLE
X7887B	CTRL UNIT	NOT AVAILABLE	NOT AVAILABLE
X0319A	PWR UNIT (-48V)	M2 PUT 012AA	622397-0
X0319B	PWR UNIT (-24V)	M2 PUB 022AA	626557-7
X1914A	PWR UNIT (115VAC)	M2 PUB 132AA	640042-7