

DIGITAL TRANSMISSION SYSTEM
828AF DIGITAL MULTIPLEXER
GENERAL DESCRIPTION

1. GENERAL

- 1.01 This section is a cover sheet for the Telco Systems Fiber Optics Corporation Digital Transmission System 828AF Digital Multiplexer General Description. This section is reproduced with permission of Telco Systems Fiber Optics Corporation and is the equivalent of Telco practice 830-102-001, Issue 2.
- 1.02 Whenever this section is reissued the reason(s) for reissue will be listed in this paragraph.
- 1.03 This section describes the basic functions and features of the 828AF Digital Multiplexer.
- 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 For information concerning equipment and parts availability contact Telco Systems, Order Administration Department, in Norwood, Massachusetts, at:
- 1-800-44-SALES
1-617-551-0300
- 2.02 To order additional copies of this practice, use TELC 365-407-849SW as the section number.

PROPRIETARY

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3. REPAIR/RETURN

3.01 For defective modules and assemblies contact the Repair and Return Department at the following number:

8:00 a.m. - 5:00 p.m. (617) 551-0300 - Ext. 2778

Attachment: Telco Systems Fiber Optics Corporation
Digital Transmission System
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1. SCOPE

A. General

1.01 This section describes the basic functions and features of the 828AF Digital Multiplexer. Figure 1-1 shows the 828AF with its front cover installed. Figure 1-2 illustrates the unit with front cover removed to display the circuit card layout and unit-level design of the 828AF.

1.02 This section was reissued to include information on increased applications of the 828AF, including DS-3 Optical Extension application, DS-2 Fiber-Optic Hubbing application, and TELTRAC extension application.

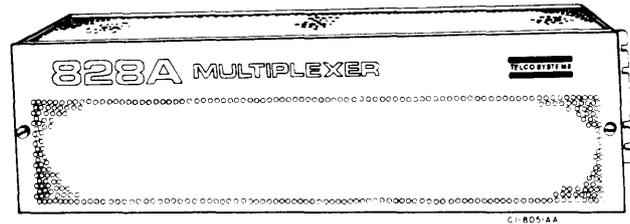


Figure 1-1. 828AF Digital Multiplexer

2. MANUAL ORGANIZATION

2.01 This manual contains the following sections:

SECTION 1. GENERAL DESCRIPTION - provides an overview of the 828AF operation with emphasis on features and functions incorporated into equipment design.

SECTION 2. THEORY OF OPERATION - presents a detailed discussion of 828AF equipment subsystems and circuit card operation to block diagram level.

SECTION 3. ORDERING INFORMATION - provides guidelines for subassembly and circuit card ordering.

SECTION 4. SPECIFICATIONS - details unit-level physical and electrical specifications.

SECTION 5. INSTALLATION - provides instruction on unit installation, cabling, and equipment configuration.

SECTION 6. INITIAL OPERATION TESTING - details all procedures required for circuit card optioning, unit turn-up, and equipment testing and alignment.

SECTION 7. MAINTENANCE - details all procedures required for unit-level maintenance including fault isolation, card and module replacement, and the procedures necessary for return and repair of equipment.

SECTION 8. SPECIAL TEST CARDS - provides a description of the Manual Control Interface card and its various functions.

SECTION 9. DRAWINGS - provides equipment reference drawings, motherboard wiring schematics, and assembly prints to be used as an aid for detailed troubleshooting or installation, as required.

3. GENERAL INFORMATION

A. Safety Precautions

3.01 As with any product, care must be exercised when working near the -48 Vdc power source and connections. Potentially high electrical currents might flow if the -48 Vdc terminals of TB-1 are inadvertently shorted to ground. Terminals TB-2,

TB-3, and TB-4 of the 828AF, and Terminal TB-2 of the Fuse and Alarm Panel should be connected to the site ground system to reduce T1 line noise and provide electrical protection.

3.02 All cards and modules contained in the 828AF unit, with the exception of the Power Supply modules, are designed to enable removal or installation without defusing the equipment.

3.03 Circuit cards can be damaged by electrostatic discharge. Before handling any circuit cards, connect your wrist to an equipment frame ground, using an approved antistatic wrist strap (EMX031-1). Ensure that all circuit cards removed from the equipment are properly stored in antistatic packing material (PKG033-1). When working with circuit cards, always place the card on an electrically grounded approved antistatic mat.

B. References

3.04 Since the 828AF may interface to a FOX-2R or FOX-2 wall-mount unit, as part of a DS-2 optical extension span, Channel Bank, M560 Fiber-Optic Multiplexer (via a DOX, Dual Optical Transceiver, card for DS-3 optical extension), TELTRAC, or another 828AF, other reference material may be

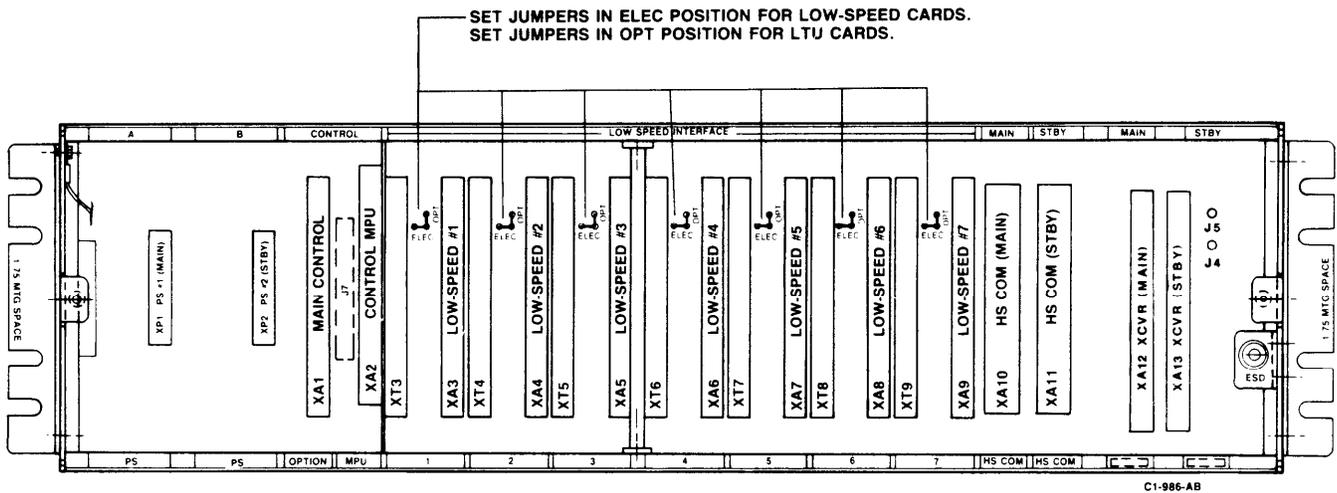


Figure 1-2. 828AF Digital Multiplexer (Cover Removed)

required for system-level installation and test. The following is a list of Operation and Maintenance manuals and practices that may be useful in the planning or installation phases of the 828AF unit in conjunction with other Telco Systems transmission products.

TELCO SYSTEMS FIBER OPTICS CORPORATION:

FOX-2 DS-2 Optical Extension
Operation and Maintenance Manual

FOX-2R DS-2 Optical Extension
Operation and Maintenance Manual

M560/FOX-3 Fiber-Optic Multiplexer
Operation and Maintenance Manual

TELTRAC Users Manual

TELTRAC Configuration Manual

TELCO SYSTEMS NETWORK ACCESS CORP:

DCB-24 Channel Bank:

Description/Installation/
Maintenance Practice

Section 2424-00-101

Installation/Maintenance Practice
Section DCB-24-200

DDI-24 Digital Drop/Insert System:

Description Practice

Section 2400-00-101

Installation Practice
Section 2400-00-200

**TPS-4002 Digital Time slot
Processing System**

System Practice

Section 4002-100

NDI-2000 Network Digital Interface

Sections 2010-00-100,

2020-00-100, and 2030-00-101

4. PRODUCT OVERVIEW

A. Unit Description

4.01 The 828AF is a self-contained multiplexer capable of combining DS-1, DS-1C, and/or DS-2 electrical signals in any combination up to the equivalent of 28 DS-1 channels into a single DS-3, 1:1 protected optical signal, and demultiplexing a DS-3 optical signal into its DS-1, DS-1C, or DS-2 electrical components. The unit is constructed as a single 23-inch rack-mountable cage which can be installed in standard equipment racks or within custom cabinetized systems. The 828AF can be employed as a point-to-point DS-3 optical transmission system, or as part of a DS-3 optical extension from an M560 Fiber-Optic Transmission system through use of the M560 DOX card. Equipped with LTU (Line Terminating Unit) cards in the low-speed section, the 828AF can be used as a DS-2 fiber-optic hub, which interfaces to remote FOX-2/FOX-2R units via up to six optical data channels. Each DS-2 optical channel, coded as a 12.624 Mb/s data stream, also accommodates an overhead channel for MPU-to-MPU (Microprocessor Unit) communications. The 828AF carries up to 672 64 kb/s channels per unit, in any combination of DS-1, DS-1C, and/or DS-2 signals up to the equivalent of 28 DS-1 channels.

4.02 The low-speed interface cards contain all circuitry necessary to interface with DS-1, DS-1C, or DS-2 electrical signals, or 3B6B encoded DS-2 optical signals; and multiplex them to the DS-2 level with full 1:1 redundancy of the M12 MULDEM (DS-1 to DS-2 Multiplexer/Demultiplexer) circuitry.

4.03 The M23 MULDEM (DS-2 to DS-3) circuitry within 828AF HS COM card time-division multiplexes the seven DS-2 outputs of the Low-Speed Interface cards into a single DS-3 data stream, which is used to modulate a single-mode laser or LED transmitter of the high-speed XCVR (Transceiver) circuitry. The M23 MULDEM also demultiplexes the recovered electrical signal from the received DS-3 optical data stream to provide DS-2 channels to the low-speed interface cards.

4.04 High-speed transceiver circuitry converts the DS-3 electrical output from the M23 MULDEM into a DS-3 optical signal, and the received DS-3 optical signal into a DS-3 electrical data and timing signals.

4.05 The Control MPU card monitors all cards and modules within the 828AF, and illuminates the corresponding fault indicators in event of a failure. Hardware failures result in LED indications on the faulty card. The micro-processor also monitors the quality of transmission, calculates the DS-3 BER (Bit Error Rate), and illuminates an LED when the BER exceeds a predetermined threshold. Through the use of lockout software, sympathetic alarms that may illuminate are masked or "locked" out. This prevents multiple alarms, and assists in fault isolation.

B. Features

Equipment Size

4.06 A single 828AF measures 23-inches wide by 6-inches high by 11.5-inches deep, allowing up to ten units to be mounted in a standard 7-foot rack, with a Fuse and Alarm Panel and appropriate air baffles.

State-of-the-Art Technology

4.07 Circuit cards used in the 828AF employ the latest VLSI technology, including the use of programmable gate arrays, thin-film, and surface-mount technology for superior reliability and lower power consumption.

Transmission Capacity

4.08 The 828AF is capable of carrying the equivalent of 28 DS-1 channels. With the proper Low-Speed Interface card, traffic can be accepted as a DS-1 (1.544 Mb/s), DS-1C (3.152 Mb/s), or DS-2 (6.312 Mb/s) signal or any combination thereof.

Selectable Low-Speed Interface

4.09 Each 828AF unit can be equipped for T1, T1C, or T2 channel interface by installing the appropriate Low-Speed Interface card.

4.10 User selectable AMI (Alternate Mark Inversion) or B8ZS (Bipolar with 8 Zero Substitution) can be optioned on a per T1 channel basis via a four-pole front-mounted DIP switch on the T1 Low-Speed Interface card (CCA161G1).

Equipment Protection

4.11 All power, low-speed and high-speed multiplexing, line coding, and optical interface circuitry can be 1:1 protected. The T1 and T1C Low-

Speed Interface cards employ integrated 1:1 circuit protection, while the other cards are protected by a redundant card. The Control MPU card initiates automatic switching to the STBY circuitry when a hardware failure occurs, or when the predetermined BER switching threshold is exceeded. For maintenance purposes, the multiplexer can be switched manually via the Control MPU card, the Manual Control Interface card, or an external monitoring system such as the TELTRAC (Telco Telecommunications Remote Alarm and Control) system.

Remote Alarm Reporting

4.12 Through mux-to-mux (Multiplexer-to-Multiplexer) communication, remote monitoring and control functions are possible. Mux-to-mux communication is carried by a user-definable X-bit in one of the DS-2 data channels. A local 828AF is capable of reporting the presence of a MAJOR or MINOR alarm in a multiplexer at the far end. This is accomplished by illuminating the BAY indicator alarm on the local 828AF Fuse and Alarm Panel. If the 828AF system has been appropriately configured and is equipped with RAC-II (Remote Alarm Card II) cards, the REMOTE indicator on the ACX025 Fuse and Alarm Panel will also be illuminated to indicate that the fault is at the remote end. Remote switching and status reporting are possible if the 828AF is equipped with a Manual Control Interface card or with TELTRAC.

Separate Fuse and Alarm Panel

4.13 A separate Fuse and Alarm Panel (see Figure 1-3) mounted in the rack provides individually fused power lines for up to twelve units. In addition to power distribution, the panel provides wire-wrap pin blocks for alarm reporting, and TELTRAC interface connectors. On the ACX025 Fuse and Alarm Panel, BAY, FUSE, ACO (Alarm Cutoff), INT FUSE, and REMOTE alarm indicator lights are provided for visible indications (See Figure 1-3). Form A relays are provided for visual and audible MAJOR and MINOR alarms. Form C FUSE, ACO, and REMOTE closures are available as separate closures.

In place of relay contact closures, the ACX043 Fuse and Alarm Panel provides wire-wrap pin blocks which interface with the eight opto-isolator inputs and output contacts of RAC-II cards in the 828AF units in the bay (see Figure 1-4).

External Alarm Reporting

4.14 Each 828AF is equipped with two relays (MAJOR and MINOR) used to report the corresponding alarms to the Fuse and Alarm Panel. From the Fuse and Alarm Panel, these alarms can be connected to on-premises customer alarm reporting equipment. During maintenance procedures the audible alarms may be silenced or cut off.

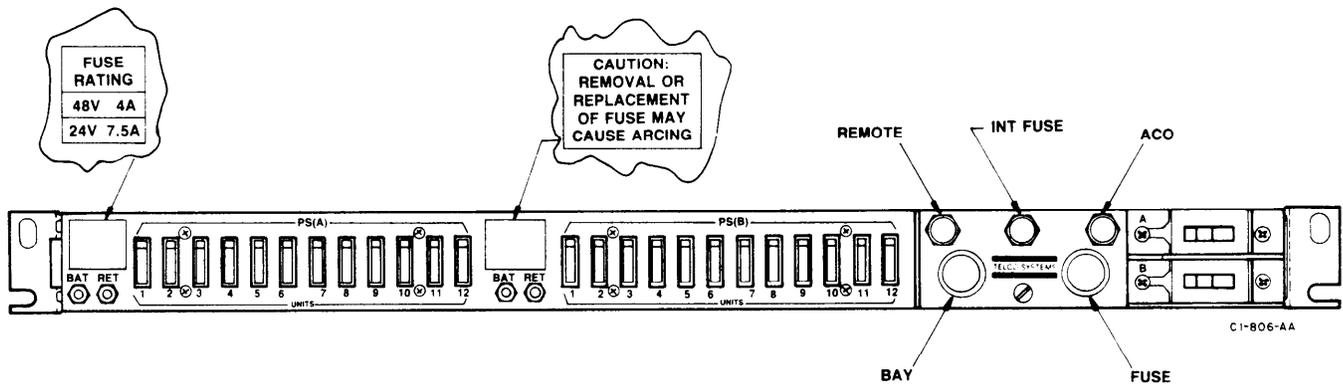


Figure 1-3. ACX025 Fuse and Alarm Panel

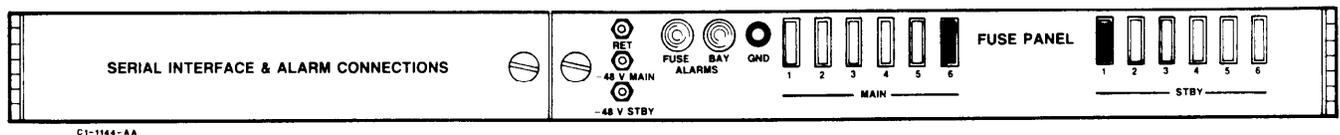


Figure 1-4. ACX043 Fuse and Alarm Panel

Maintenance Interface Card

4.15 The Maintenance Interface card (see Figure 1-5) provides for off-line testing of spare T1 or T1C Low-Speed Interface cards before placing them in service. Test data is inserted into the spare cards through test jacks built into the Maintenance Interface card. The card provides for either T2 loopback of the test data or bridging to on-line traffic in the RX direction. The Maintenance Interface card is also used to disable the MPU data bus during MPU replacement procedures. Through use of the Maintenance Interface card, changeout of T1, T1C, and Control MPU cards is possible without disrupting traffic.

Manual Control Interface Card

4.16. The Manual Control Interface card is an I/O (Input/Output) board, allowing immediate and direct access to the Control MPU card. This access is used to initiate test functions, and provide status through interrogation of the local and remote terminals.

Remote Monitoring System

4.17 The Control MPU card can interface with a TELTRAC network. TELTRAC provides comprehensive network remote alarm and status reporting. In addition, diagnostic fault isolation and remote controlled switching are provided.

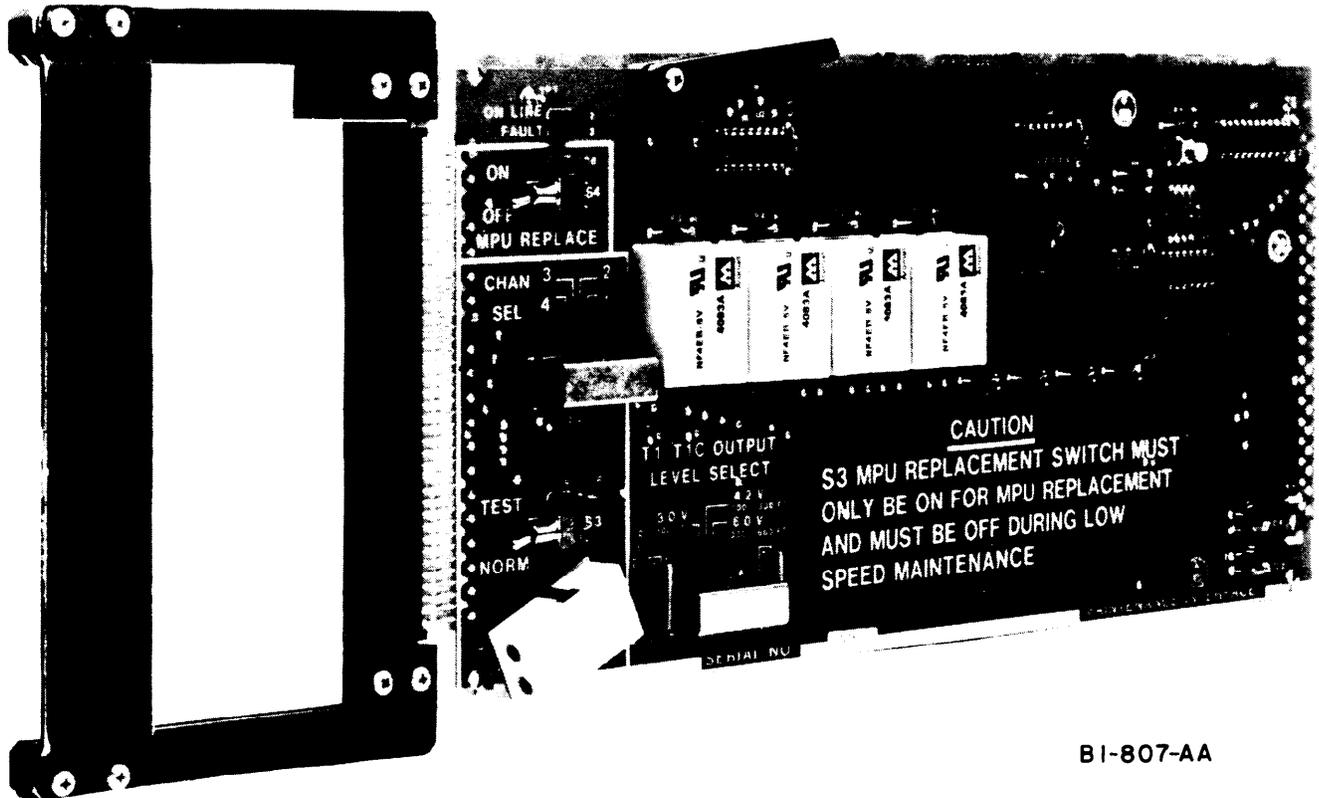


Figure 1-5. Maintenance Interface Card

5. SYSTEM APPLICATIONS

5.01 The following section explores system application possibilities of the 828AF to address specific network requirements.

A. Multiplexer Terminal

5.02 Figure 1-6 illustrates the 828AF in a fiber-optic terminal application. Incoming DS-1, DS-1C, or DS-2 data streams are multiplexed to the DS-3 level. The DS-3 optical signal is interfaced to a fiber cable span and transmitted as a 45 Mb/s optical carrier.

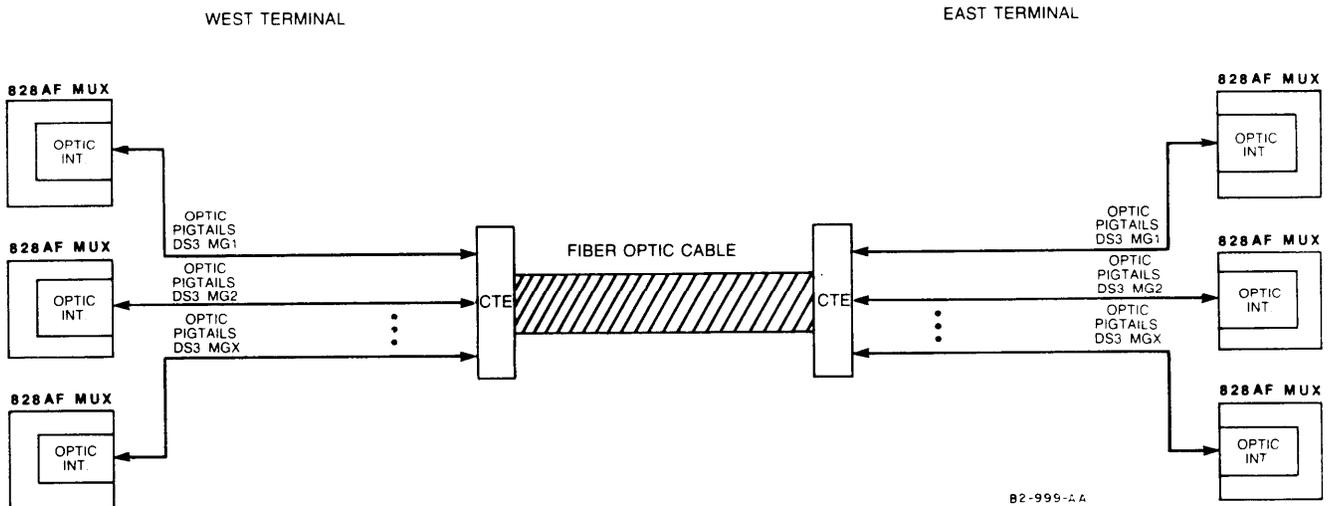


Figure 1-6. 828AF Digital Multiplexer Fiber-Optic Terminal Application

B. DS-3 Optical Extension

5.03 Figure 1-7 illustrates the 828AF in a DS-3 optical extension application. Individual DS-3 channels demultiplexed from an incoming 560 Mb/s trunk can be optically coded as 45 Mb/s

optical spans for remote site interface to 828AF/828AFXT multiplexers. This cost-effective system application eliminates the need for back-to-back 45 Mb/s terminals to provide DS-3 optical hubbing.

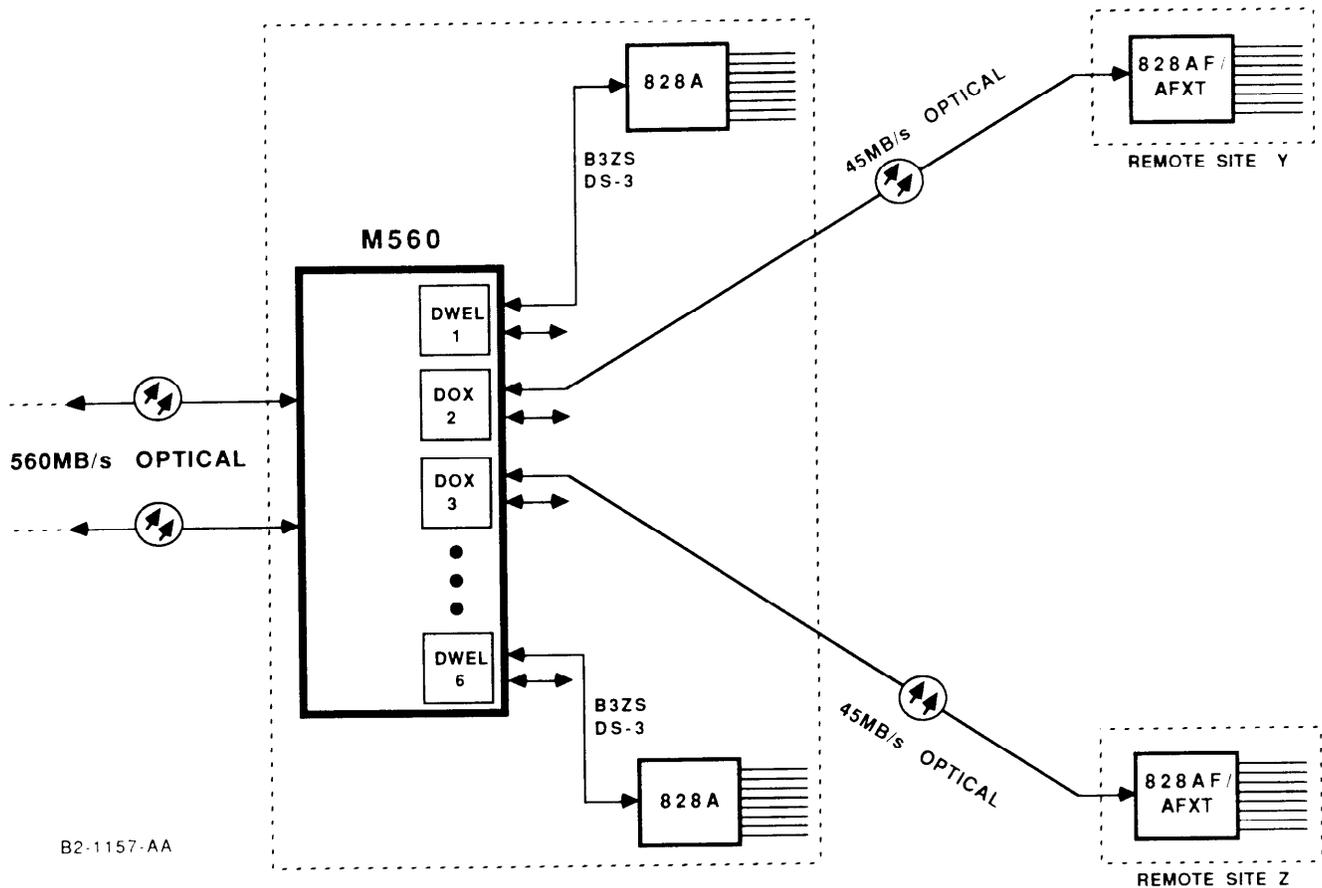


Figure 1-7. 828AF/FOX-3 DS-3 Optical Extension Application

C. DS-2 Fiber-Optic Hubbing

5.04 Figure 1-8 illustrates the 828AF in a DS-2 fiber-optic hubbing application. The optical DS-3 transmission trunk interconnecting a central office and hub distribution center can be subdivided into six DS-2 optical

extensions to provide high-capacity transmission to individual terminal end users. LTU cards in the low-speed section of the 828AF multiplexer, as required, provide independent DS-2 optical spur links from the central hubbing location to remote FOX-2/ FOX-2R units.

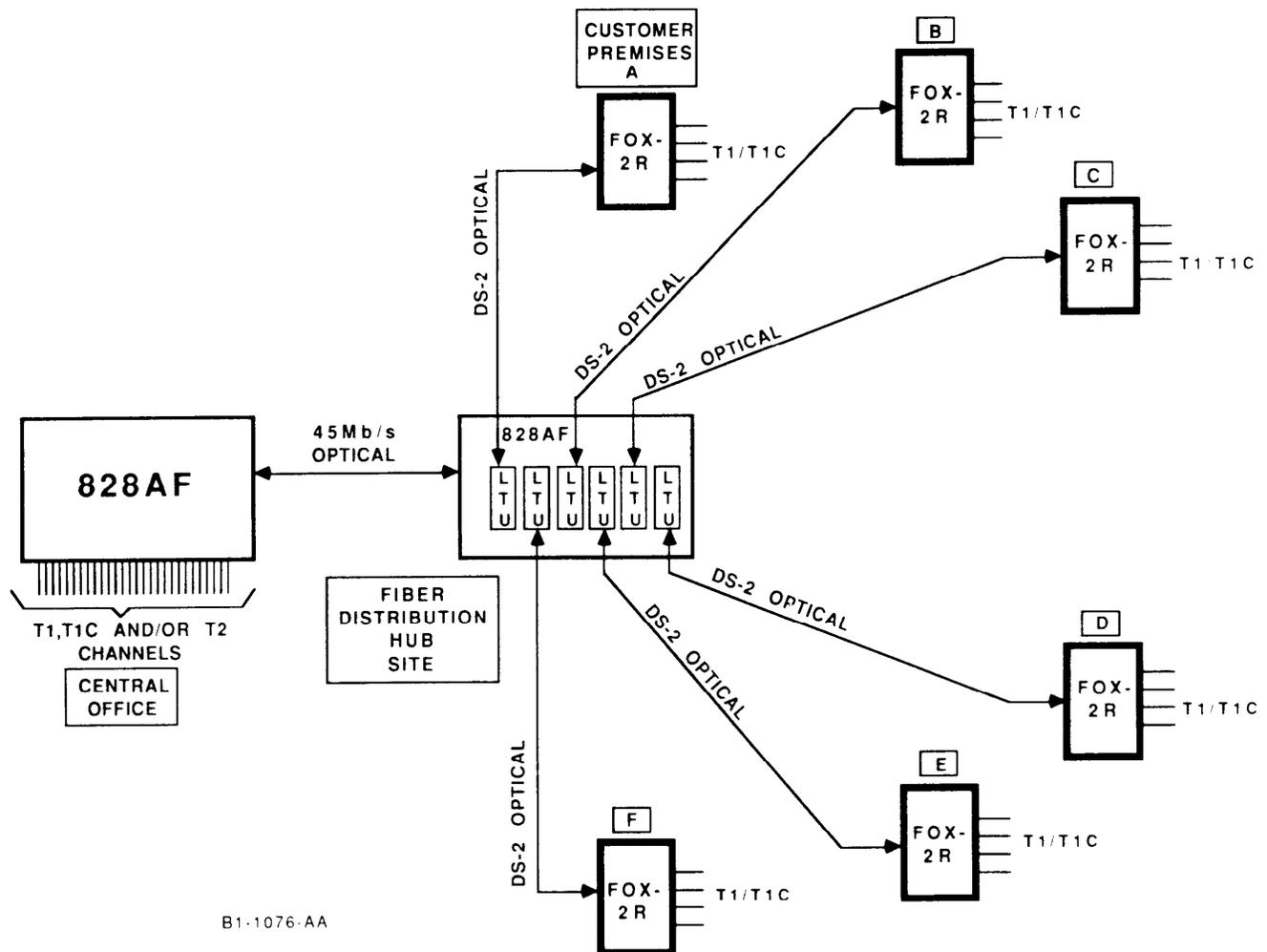
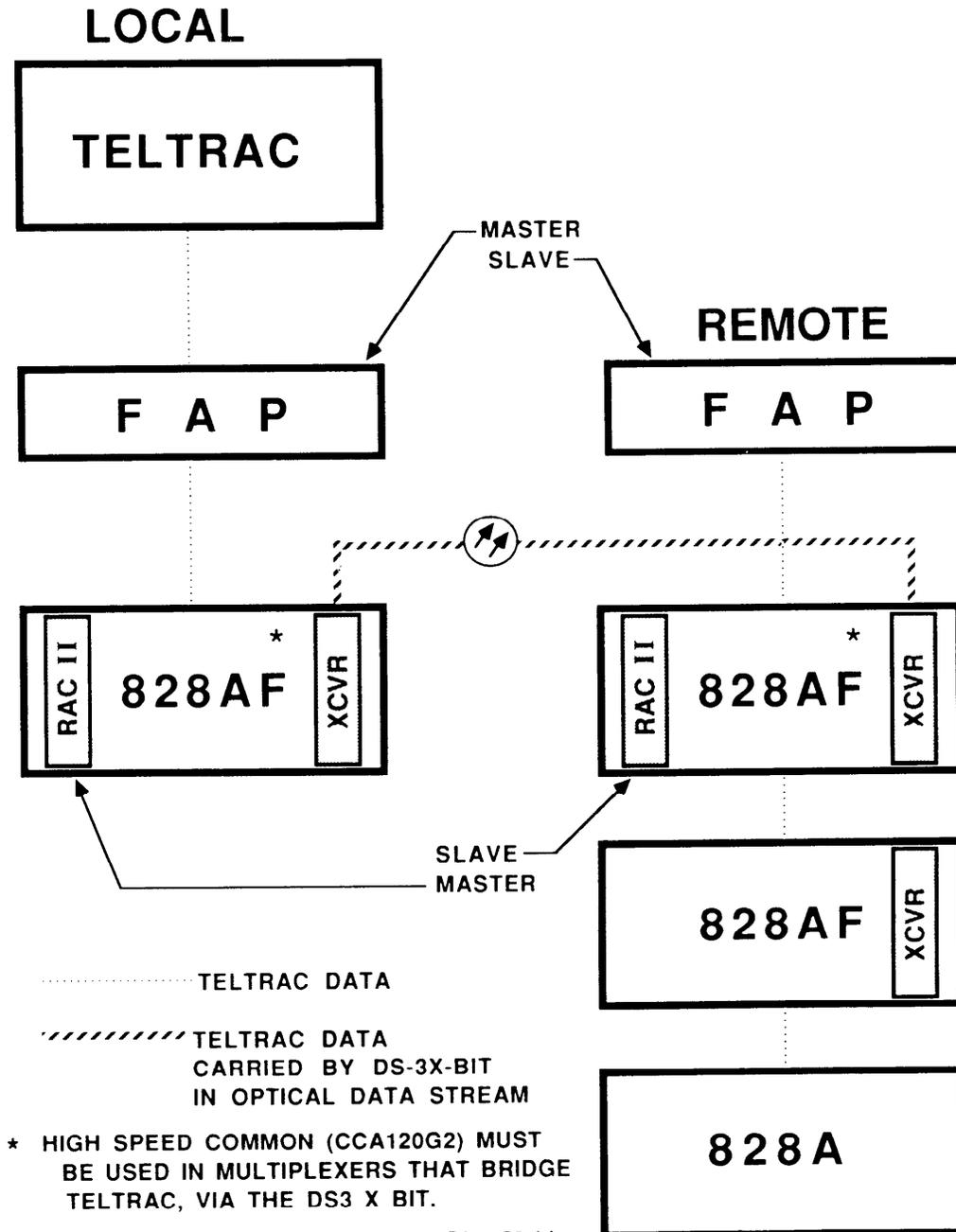


Figure 1-8. 828AF/FOX-2/FOX-2R DS-2 Fiber-Optic Hubbing Application

D. TELTRAC Extension

5.05 Figure 1-9 illustrates the 828AF in a TELTRAC extension application. Use of the RAC-II card enables the TELTRAC signal to be bridged onto

the 828AF optical carrier, utilizing a user-definable DS-3 X-bit, and to be transported to and from the remote site without requiring use of a modem, Service Channel or other communication channel facility.



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Figure 1-9. 828AF TELTRAC Extension Application