DIGITAL SWITCHING SYSTEMS

DMS*-100 FAMILY INTEGRATED SERVICES DIGITAL
NETWORK

FIBER REMOTE SWITCHING CENTER
GENERAL DESCRIPTION
BCS29 AND UP UNLESS REISSUED

* DMS is a trademark of Northern Telecom

CONTENTS

                         FIGURES

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TABLE TITLE   PAGE

1. INTRODUCTION

USING THIS MANUAL

1.01   This document contains both an overview of the Fiber RSC
        configuration and the guidelines for provisioning and set-
ting up the Administration and Maintenance interface.   Read the
first three chapters to obtain an understanding of how the con-
figuration allows the host ISDN office to be remotely located.
Read the remaining chapters to obtain the step-by-step procedures
that ensure that the Fiber RSC is correctly provisioned and main-
tained.

PURPOSE OF THE FRSC

1.02   With Integrated Services Digital Network (ISDN), the Oper-
        ating Company can provide, using a single interface, both
voice and data services to its customers. Refer to 297-2401-100
for a description of the ISDN protocols and the types of services
offered. Included is a description of the LGCI-LCMI configura-
tion, which is used to offer services from a local office.

1.03   Due to distance limitations of the host network links, the
        LGCI-LCMI configuration cannot offer ISDN services to
remote sites. The Fiber RSC (FRSC) allows the Operating Company
to place the LGCI-LCMI configuration at a remote site by trans-
parently extending the host network links with the use of optical
fiber transmission facilities.

SOFTWARE IDENTIFICATION

1.04   Software applicable to a specific DMS-100 Family office is
        identified by a BCS release number and by Northern Telecom
(NT) product engineering codes (PEC).   The significance of the
BCS number and the PEC is described in 297-1001-450 (section
450/32) and in the office feature record D-190.

1.05   A display of the BCS number and PEC for the NT feature
        packages available in a specific office can be obtained by
entering the following command string at a MAP.

PATCHER;INFORM LIST;LEAVE

1.06   The information contained in this Practice applies to
        Batch Change Supplement (BCS) 29.   Note, however, that
although the FRSC hardware is available in BCS29, the FRSC con-
figuration will work with an ISDN host office that contains a
previous BCS release.

REFERENCES

1.07   References listed as prerequisites are essential for an
        understanding of this Practice. Those listed as inform-
ative contain detailed information concerning other items men-
tioned in this Practice, but are not essential. References are
inserted at the appropriate places in the text.

Note: The documents listed may exist in more than one version.
See 297-1001-001 to determine the release code of the version
compatible with a specific release of software.

Prerequisite References

DOCUMENT
NUMBER   TITLE
_____

297-1001-100   System Description
297-1001-450   Provisioning
297-2401-100   ISDN System Description
297-2401-102   Operations, Administration and Maintenance Refer-
               ence Manual
297-2401-103   Peripheral Modules Description

Informative References

DOCUMENT
NUMBER   TITLE
_____

297-1001-001   Master Index of Practices
241-1001-150   Equipment Identification and Ordering Information
241-1001-500   DPN Maintenance Management
321-3211-201   FMT-150 B/C/D Installation Procedures
321-3211-203   FMT-150 B/C/D Initial Test Procedures
321-3211-301   FMT-150 B/C/D Terminal Interface CRT Operations
321-3211-302   FMT-150 B/C/D Monitor and Control Module Faceplate
               Operations
321-3211-501   FMT-150 B/C/D Fault-Locate and Maintenance Proce-
               dures

2. OVERVIEW OF THE FRSC

THE LGCI-LCMI CONFIGURATION

2.01   Figure 1 on page 10 gives a block diagram view of the
         LGCI-LCMI configuration as it applies to a local office.
Refer to the following sections of the following documents to
better understand this configuration and its capabilities:

*   297-2401-100, Section "Components of the Exchange Termination
     for BRA". This section gives a physical description of the
     LGCI and LCMI.

*   297-2401-102,   Section "Providing Service." This section
     explains the audiences involved in setting up and testing the
     different loops.

*   297-2401-102, Section "Trouble Reporting and Clearing." This
     section explains the trouble indicators of the LGCI-LCMI and
     provides procedures to clear the trouble.

*   297-2401-103, Sections "ISDN Line Concentrating Module" and
     "ISDN Line Group Controller." These two sections provide a
     functional description of the LCMI and LGCI.

ISDN Basic Rate Access Lines

```
C-side                                                    P-side
                                                                     
                   ┌─┐        ┌─┐        ┌─┐  <  ISDN line  >
                   │ │        │DCH│       │ │        NT1
                   │ │        ├─┤        │ │                    I
                   │ │        │I│C│       │ │       ┌──┐        S
          DS-30    │ │        │S│o│  DS-30A  │ │  =======│  │────   D
          Links    │ │        │D│n│  Links   │LCMI│       │  │        N
                   │N│        │N│t│       │ │       └──┘
                   │e│        │ │r│       │ │     U-loop S/T-bus    T
                   │t│        │L│o│       │ │                       e
┌─────────┐        │w│        │i│l│       │ │       ┌──┐            r
│ Central │        │o│        │n│l│       │ │  =======│  │──┐       m
│ Control │────────│r│        │e│e│       │ │       │  │  │       i
│ Complex │        │k│        │ │r│       │ │       └──┘  │       n
└─────────┘        │ │        │G│ │       │ │                     a
                   │ │        │r│ │       │ │        NT1          l
                   │ │        │o│ │       └─┘                     s
                   │ │        │u│ │      DS-1
                   │ │        │p│ │      Link
                   │ │        └─┘
          ┌──────┐ │ │              ┌─────────┐
          │Other │ │ │              │ Packet  │
          │ PM   │─│ │              │ Handler │
          └──────┘ └─┘              └─────────┘
```
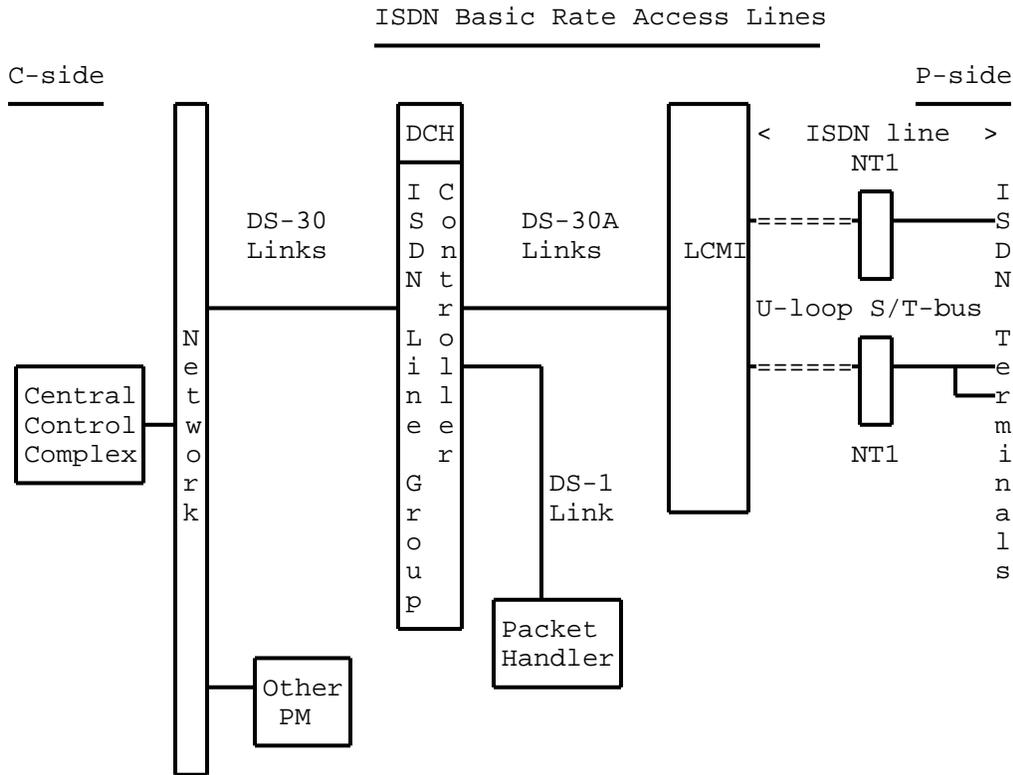
Fig. 1 - The LGCI-LCMI Configuration

HOW THE FRSC INCLUDES THE LGCI-LCMI CONFIGURATION

2.02   Figure 2 on page 12   gives block diagram of the FRSC.
        Refer to this figure while reading these paragraphs.

Note: Figure 2 on page 12 shows neither the location of the
packet handler (which may be located at either the host or the
remote), nor link provisioning.   Refer to Connections to the
Packet Handler on page 28 for more information.

2.03   Placing the LGCI-LCMI configuration at a remote site is
        done by extending the DS-30 links to the LGCI at a remote
site over a DS-1 transmission system. With the FRSC, the follow-
ing conversions occur:

1.   The DS-30 format network ports are converted at the Host Link
     Extension (HLE) Frame into the DS-1 format.

2.   The DS-1 format signals are routed to the optical equipment
     where they are converted to the DS-3 format and then to fiber

protocol to be transmitted from the Host to the Remote over optical transmission facilities.

3. The DS-3 signals are converted back to the DS-1 format by the Optical Equipment.

4. The DS-1 signals are routed to the RFLE.

5. The DS-1 signals are converted back to the DS-30 format by the RFLE.

6. The DS-30 signals are routed to the LGCI, where they are processed as if they had come directly from the network ports.

2.04 Note that redundancy is provided by having equipment support both planes of the Network module.

```
    ┌───────────┐        ┌─┐              ┌─┐       ┌───────────┐
    │ \    /    │        │S│   ┌─────┐    │D│       │           │
    │  \  /     │        │L│   │     │    │S│       │  FIBER    │
    │   NETWORK │────────│C│───│ HLE │────│X│───────│ EQUIPMENT │──────┐
    │  /  \     │        │C│   │     │    │ │       │           │      │
    │ /    \    │        └─┘   └─────┘    └─┘       └───────────┘      │
    └───────────┘                                                      │
                     └──────────┘   └──────────┘                       │
                        DS-30           DS-1                           │
    HOST OFFICE                                                        │
    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -    │
                                                                       │
                         DS-3                                          │
    ┌──────────────────────────────────────────────────────────────┐  │
    │                     OPTICAL FIBER                              │──┘
    │
    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
    │                             ┌──┐
    │                             │DF│───────────┬─────────────┐
    │                             └──┘           │             │
    │  ┌───────────┐   ┌─┐   ┌─────┐   ┌─┐    ┌──────┐    ┌──────┐  ┌───┐
    │  │  FIBER    │   │D│   │     │   │S│    │      │    │      │  │   │
    └──│ EQUIPMENT │───│S│───│RFLE │───│L│────│ LGCI │────│ LCMI │──│NT1│
       │           │   │X│   │     │   │C│    │      │    │      │  │   │
       └───────────┘   └─┘   └─────┘   │C│    └──────┘    └──────┘  └───┘
                                       └─┘
                  └──────────┘     └──────────┘  └──┘
                      DS-1            DS-30       DS-30A
    REMOTE OFFICE
    - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```
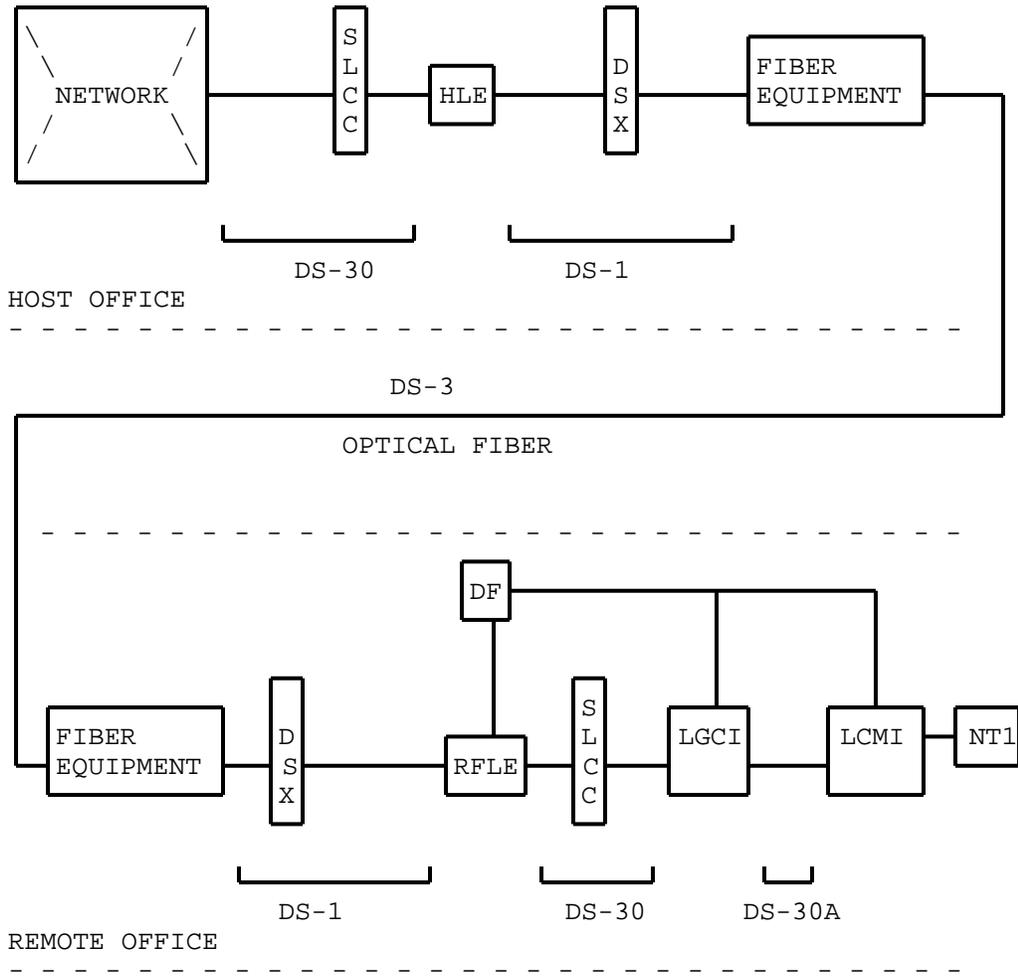
REMARKS

SLCC = Speech Link Connecting Concentrating
HLE = Host Link Extension Equipment
DF   = Distribution Frame
DSX = DS Cross-Connect
RFLE = Remote Fiber Link Extension
NT1 = Network Termination 1

Fig. 2 - The Fiber RSC Configuration

3. SYSTEM COMPONENTS

3.01   This part provides a physical and (where relevant) func-
        tional view of the major FRSC components.

HOST LINK EXTENSION (HLE) - NTBX65BA

3.02   The main function of the HLE is to convert each DS-30
        stream into two DS-1 streams (and the reverse).   This is
explained in detail in Functional View on page 16.

<u>Physical View</u>

3.03   Refer to Figure 3 on page 14 for a block diagram of the
        HLE frame. Included are the PECs for shelves and shelf
locations.

3.04   Refer to Figure 4 on page 15 for a diagram of a shelf of
        the HLE. Included are the PECs for individual cards and
their locations.

```
                  ┌─────────────────┐
                  │                 │
                  ├──┬──────────────┤
                  │  Cage Filler    │       ┐  REQUIRED
                  │  (NT0X84AA)     │       │
                  │                 │       │
                  │                 │       ┘
           65 ────┼──┬──────┬──┬────┤       ┐
                  │2 │      │  │2   │       │
                  │X │ RLE  │RLE│X   │       │
                  │7 │      │  │7   │       │  PROVISIONABLE
                  │0 │      │  │0   │       │
           51 ────┼──┴──────┴──┴────┤       ┘
                  │     FSP         │       ┐  REQUIRED
                  │  (NTNX26HB)     │       ┘
           45 ────┼──┬──────┬──┬────┤       ┐
                  │2 │      │  │2   │       │
                  │X │ RLE  │RLE│X   │       │
                  │7 │      │  │7   │       │  PROVISIONABLE
                  │0 │      │  │0   │       │
           32 ────┼──┴──────┴──┴────┤       ┘
                  │2 │      │  │2   │       ┐
                  │X │ RLE  │RLE│X   │       │
                  │7 │      │  │7   │       │  REQUIRED
                  │0 │      │  │0   │       │
           18 ────┼──┴──────┴──┴────┤       ┘
                  │  COOLING UNIT   │       ┐
                  │  (NT3X90AA      │       │
                  │     or AB       │       │  PROVISIONABLE
                  │     or AC)      │       │
            4 ────┼─────────────────┤       ┘
                  ├──┬──────────────┤
                  │                 │
                  └─────────────────┘
```
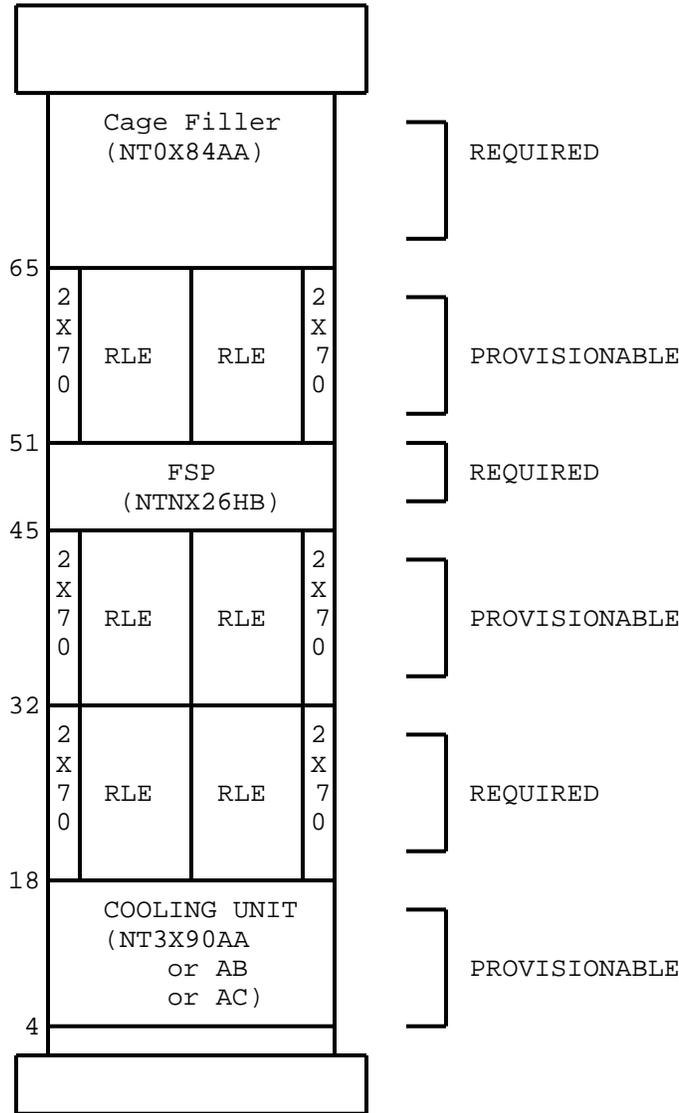
Fig. 3 - The HLE Frame

3.05   Note that Shelf 18 is required for the minimum configura-
       tion. This shelf is made up of two Remote Line Extension
(RLE) groups. Each group supports up to eight DS-30 links for one
plane of the network, so a fully configured shelf, as shown in
Figure 4 on page 15, supports up to eight duplicated DS-30 links
to the network.

HLE SHELF

```
         Plane 0                              Plane 1

    ┌──────────────────────────────────────┐  ┌──────────────────────────────────────┐
┌───┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬─┬───┐
│ P │C│D│D│D│D│D│D│D│D│D│F│D│D│D│D│D│D│D│D│D│D│ P │C│
│ O │O│S│S│S│S│S│S│S│S│S│I│S│S│S│S│S│S│S│S│S│S│ O │O│
│ W │N│3│6│1│1│1│1│1│1│1│L│1│1│1│1│1│1│1│1│6│3│ W │N│
│ E │V│0│0│ │ │ │ │ │ │ │L│ │ │ │ │ │ │ │ │0│0│ E │V│
│ R │E│ │ │ │ │ │ │ │ │ │E│ │ │ │ │ │ │ │ │ │ │ R │E│
│   │R│ │ │ │ │ │ │ │ │ │R│ │ │ │ │ │ │ │ │ │ │   │R│
│   │T│ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │   │T│
│   │E│ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │   │E│
│   │R│ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │ │   │R│
└───┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴─┴───┴─┘
 0  0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2
 1  2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7
```
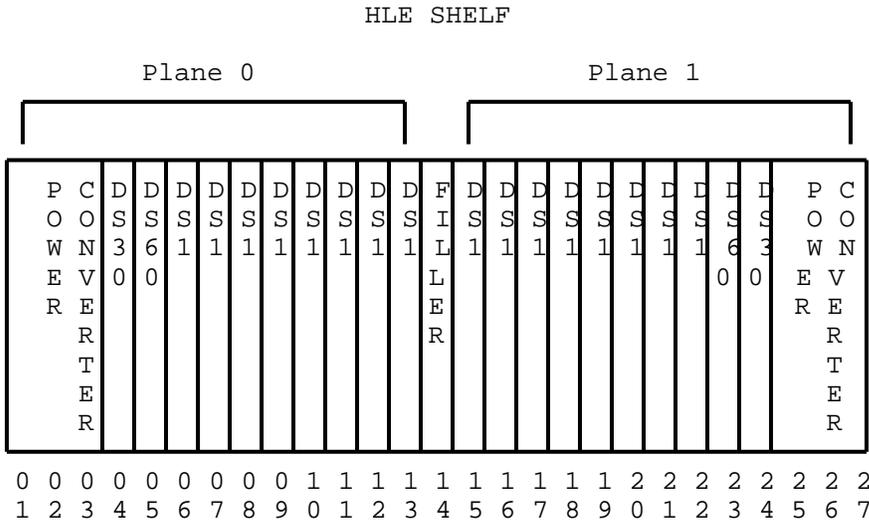
Fig. 4 - Host Link Extension (HLE) Shelf

TABLE A
HOST LINK EXTENSION SHELF

SLOT	ABBR	NT PEC	REMARKS
01-03, 25-27			NT2X70AE Power Converter
04, 24	DS-30	NT6X40AA	DS-30 Interface
05, 23	DS-60	NTBX56AA	DS-60 Formatter
06-13, 15-22		DS-1	NT6X50AA DS-1 Interface
14		NT0X50AA	Filler
05, 23 (rear)			NTBX5702 Paddleboard

3.06   Note that the Paddleboard, mounted at the rear of the
       NTBX56AA card, is used to monitor the channels on the RLE.
This card has two RS232 connections to which OAM interfaces (a
printer or a Personal Computer) are attached. Figure 5 on page
16 shows the physical layout. Refer to Part 5 on page 29   for
how to set up and use the printers.

```
                              TOGGLE SWITCHES

                              Fault Override

   BACKPLANE
   CONNECTORS                 Control

                              Reset


                              RS232 CONNECTORS


                              Local



                              Far End
```

Fig. 5 - BX5702 Paddle Card

Functional View

3.07   The HLE's main function is to map a DS-30 link onto two
       DS-1 channel formats. These DS-1 channels are routed to
DS-1 cards, which provide the physical interface to the fiber
transmission equipment. Figure 6 on page 17 shows how the con-
version occurs.

```
                                            ┌───┐  DS-1   T
                                            │ 6 │─────────O
                                            │ X │
                                            │ 5 │
                                            │ 0 │
                  ┌───┐          ┌───┐ DS-60│ A │  DS-1   O
                  │ 6 │          │ B │──────│ A │─────────P
 S                │ X │          │ X │      └───┘         T   E
 L       8        │ 4 │    4     │ 5 │        *           I   Q
 C   ────/────────│ 0 │────/─────│ 6 │     up to  *       C   U
 C     DS-30      │ A │  DS-60   │ A │     8 DS-1 *       A   I
                  │ A │          │ A │     cards  *       L   P
                  └───┘          └───┘        *           T   M
                                              *           R   E
                                            ┌───┐ DS-60   A   N
                                            │ 6 │──────   N   T
                                            │ X │  DS-1   S
                                            │ 5 │─────────M
                                            │ 0 │         I
                                            │ A │  DS-1   S
                                            │ A │─────────S
                                            └───┘         I
                                                         O
                                                         N
```
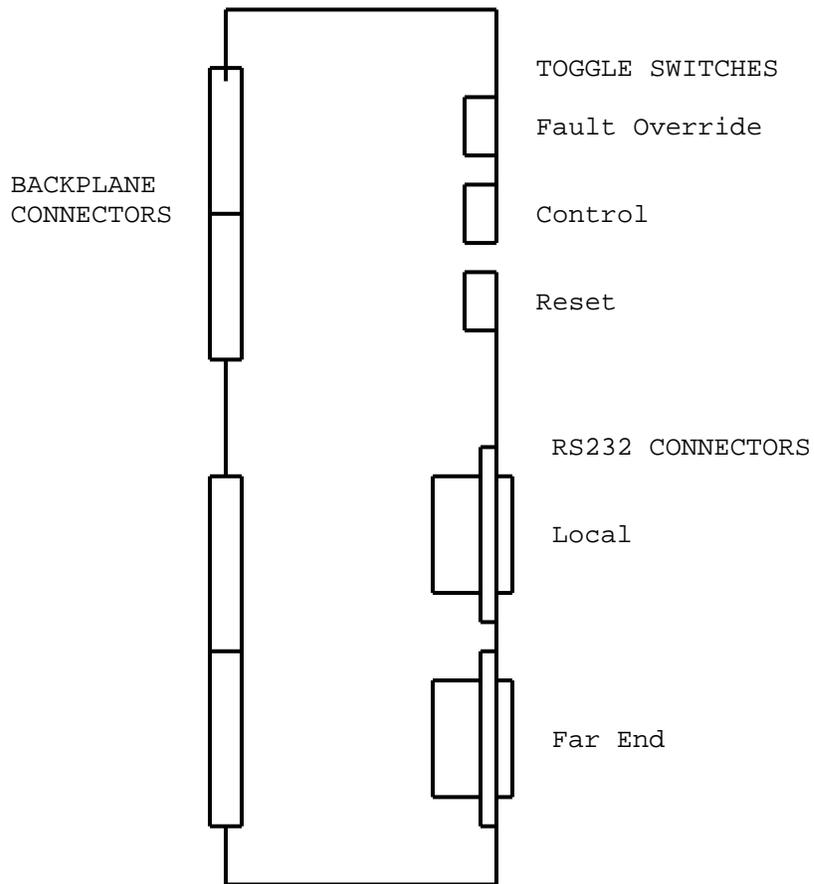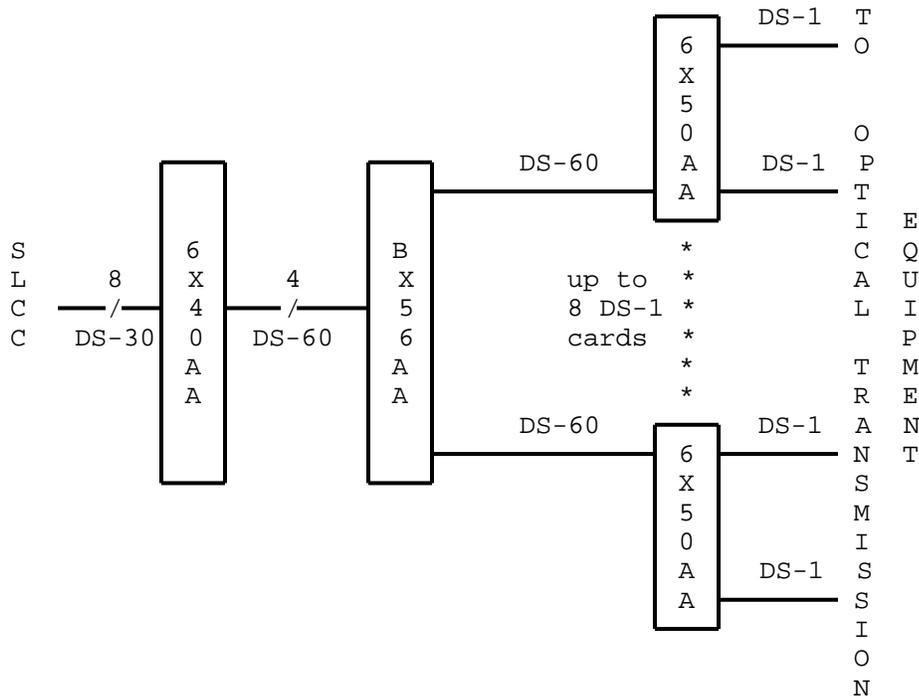
Fig. 6 – Functional View of the HLE

3.08   The 6X40AA converts the 8 DS-30 (2.56 Mb/S) stream from
        the network ports into 4 DS-60 (5.12 Mb/S) streams.   The
BX56AA maps the DS-30 bits at the DS-60 level into DS-1 bit
streams that are usable by the 6X50AA.   Each DS-30 stream is
mapped onto two DS-1 streams.

REMOTE FIBER LINE EXTENSION (RFLE) – NTBX65BA

<u>Physical View</u>

3.09   Figure 7 on page 18 shows in block form the RFLE shelf.
        Note that the RFLE can contain an MTM shelf.

```
        ┌─────────────────────┐
        │                     │
        ├─────────────────────┤
        │     MTM Shelf       │──┐
        │    (NT2X58CA)       │  ├─ PROVISIONABLE
        │                     │──┘
    65  ├──┬───────┬───────┬──┤
        │2 │       │       │2 │──┐
        │X │       │       │X │  │
        │7 │ RLE   │ RLE   │7 │  ├─ PROVISIONABLE
        │0 │       │       │0 │  │
        │  │       │       │  │──┘
    51  ├──┴───────┴───────┴──┤
        │      FSP            │─── REQUIRED
        │    (NTNX26HB)       │
    45  ├──┬───────┬───────┬──┤
        │2 │       │       │2 │──┐
        │X │       │       │X │  │
        │7 │ RLE   │ RLE   │7 │  ├─ PROVISIONABLE
        │0 │       │       │0 │  │
        │  │       │       │  │──┘
    32  ├──┼───────┼───────┼──┤
        │2 │       │       │2 │──┐
        │X │       │       │X │  │
        │7 │ RLE   │ RLE   │7 │  ├─ REQUIRED
        │0 │       │       │0 │  │
        │  │       │       │  │──┘
    18  ├──┴───────┴───────┴──┤
        │   COOLING UNIT      │──┐
        │   (NT3X90AA         │  │
        │       or AB         │  ├─ PROVISIONABLE
        │       or AC)        │  │
     4  ├─────────────────────┤──┘
        │                     │
        └─────────────────────┘
```
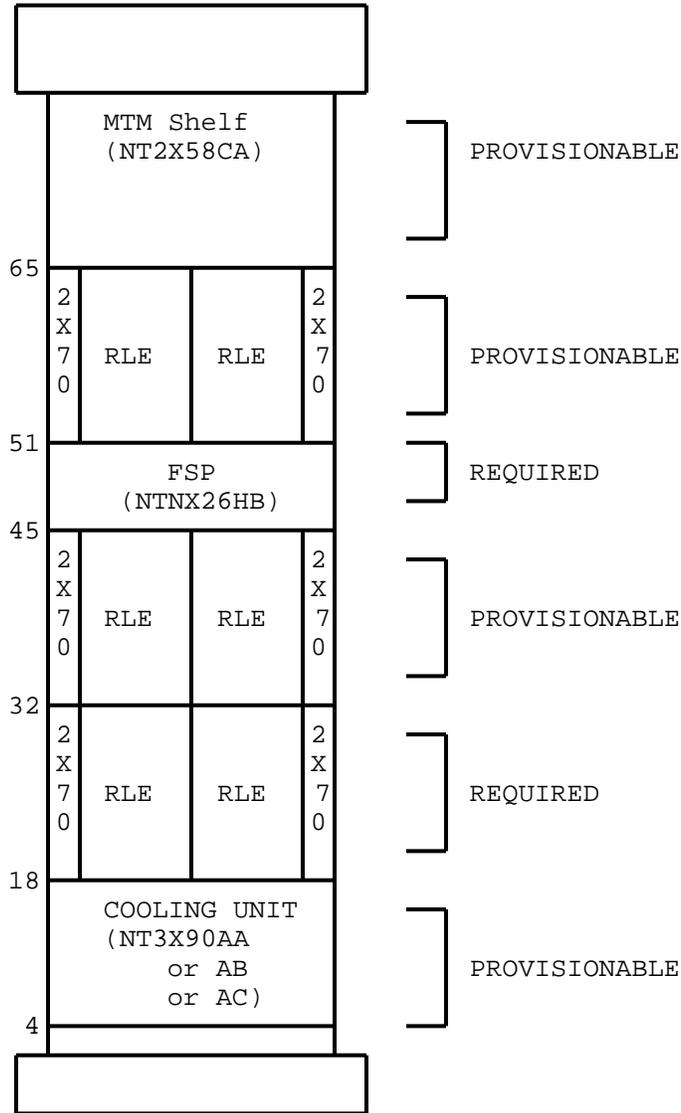
Fig. 7 - The RFLE Frame

3.10   The RLE for the RFLE contains the same card set as the
         HLE.   Refer to Figure 4 on page 15.

Functional View

3.11   The RFLE performs the same function as the HLE, with a
        reverse of DS-30 to DS-1 mapping that was done at the host
office by the HLE.

MAINTENANCE TRUNK MODULE (MTM)

3.12   The MTM shelf is used to provide the same maintenance
        functions for the LGCI and LCMI as those for the host
site. The provisionable cards include the Line Test Unit (LTU),
Scan cards with the Scan Detect cards, Metallic Test Access (MTA)
cards, and Incoming/Outgoing Trunk cards.   Figure 8 shows the
basic configuration.

```
 01 02 03 04 05 06---Provisioned---19 20   21 22

┌──┬──┬──┬──┬──┬──────────────────┬──┬──┬──────┐
│N │N │N │N │  │. . . . . . . . . │N │N │  2   │
│T │T │T │T │  │. . . . . . . . . │T │T │  X   │
│2 │0 │2 │2 │  │. . . . . . . . . │2 │0 │  7   │
│X │X │X │X │  │. . . . . . . . . │X │X │  0   │
│4 │7 │5 │5 │  │. . . . . . . . . │0 │5 │  A   │
│5 │0 │3 │9 │  │. . . . . . . . . │9 │0 │  A   │
│A │A │A │A │  │. . . . . . . . . │A │A │      │
│B │A │A │A │  │. . . . . . . . . │A │A │      │
│  │  │  │  │  │ . . . . . . . . . │  │  │      │
│  │  │  │  │  │ . . . . . . . . . │  │  │      │
│  │  │  │  │  │ . . . . . . . . . │  │  │      │
│  │  │  │  │  │ . . . . . . . . . │  │  │      │
│  │  │  │  │  │ . . . . . . . . . │  │  │      │
│  │  │  │  │  │ . . . . . . . . . │  │  │      │
└──┴──┴──┴──┴──┴──────────────────┴──┴──┴──────┘
```

Fig. 8 - Maintenance Trunk Module Shelf for the RFLE

DS-1 TRANSPORT SYSTEM

3.13   A DS-1 Transport System, provided by the Operating Compa-
        ny, is used to convert the DS-1 stream to fiber protocol
and to send these signals out over fiber links.

3.14   This system must meet certain requirements, which are
        listed in Specifications of the Fiber Transport System on
page 88. The FMT-150B/C system, manufactured by Northern Telecom,
meets these requirements and may be used.

DS-1 CROSS-CONNECT

3.15   The DSX is used to cross-connect the DS-1 links from the
        RFLE and HLE to the fiber equipment.

DISTRIBUTION FRAME (DF)

3.16   The DFs are used to provide access to customer loops and
        to provide the MTM access to alarm wiring.

SPEECH LINK CONNECTING CONCENTRATING (SLCC) FRAME.

3.17   The SLCC is used to provide, in essence, a patch facility
        between   the   LGCI   and   the   RFLE   to   simplify
configuring/reconfiguring of the links.

EQUIPMENT FOR BASIC OAM

3.18   To monitor the RLE shelves, a dedicated printer is
        required for each plane (so two printers are required per
RLE shelf).   These hardcopy terminals record status and error
messages as well as a debug level. Commands issued at this ter-
minal allow the user to perform local testing, link testing (to
the 6X40 and 6X50 cards), and program monitoring. The printers
should be Digital Equipment Corporation (DEC) LA-120DA or the
equivalent.

3.19   The two connectors on the BX5702 to which the printers are
        attached monitor the following:

    RLE Slot   Connector   System
    _____

    5   Top   Local Shelf Plane 0
                  Bottom   Remote Shelf Plane 0
    23   Top   Local Shelf Plane 1
                  Bottom   Remote Shelf Plane 1

EQUIPMENT FOR ENHANCED OAM

3.20   With the enhanced OAM interface, an IBM-compatible per-
        sonal computer is used to monitor and control the system.
Refer to Part 7 on page 43.

LGCI (FIRMWARE CHANGES)

3.21   The configuration of the LGCI is the same for the remote
        site as the host site. Figure 9 on page 22 shows the con-
figuration of the ISDN line group array (LGAI) shelf. Note the
following differences with the standard LGCI:

*   The Message/Tone circuit card, the NT6X69AB, is replaced with the NT6X69MA.   In this configuration, there is <u>no</u> separate tone card.

    <u>Note:</u>   These changes are made to compensate for the remote DS-30 signal delay.

*   The DS-30 Interface card is the 6X40AA.

LGAI NT6X02NB   Front View

```
┌───┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──┬──────┐
│ D │D │D │D │D │D │D │M │M │M │S │S │F │T │F │I │F │M │F │C │F │D │F │F │  P   C │
│ S │S │S │S │S │S │S │P │P │P │P │P │I │S │I │S │I │P │I │S │O │S │I │I │  O   O │
│ 1 │1 │1 │1 │1 │3 │3 │  │M │M │M │  │L │  │L │P │L │C │L │M │R │3 │L │L │  W   N │
│   │  │  │  │  │0 │0 │  │  │  │  │  │L │  │L │  │L │  │L │  │M │0 │L │L │  E   V │
│ o │o │o │o │o │A │A │  │  │  │  │  │E │  │E │  │E │  │L │  │  │  │E │E │  R   E │
│ r │r │r │r │r │  │  │  │  │  │  │  │R │  │R │  │R │  │E │  │  │  │R │R │      R │
│   │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │R │  │  │  │  │  │      T │
│ D │D │D │D │D │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │      E │
│ C │C │C │C │C │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │      R │
│ H │H │H │H │H │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │  │      E │
└───┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──┴──────┘
SLOT  0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2
NO.   1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
```

Slot	ABBR	NT PEC	Remarks
01-5	DS1	6X50AB	DS1 Interface
01-5	DCH	BX02AA	D-channel Handler (see note)
06-7	DS30A	6X48AA	DS30A Interface
08	MP	6X45BA	Master Processor
09-10	MPM	6X47AB	Master Processor Memory
11	SPM	6X46BA	Signaling Processor Memory
12	SP	6X45BA	Signaling Processor
13	—	0X50AA	Filler
14	TS	6X44AA	Time Switch
15	—	0X50AA	Filler
16	ISP	BX01AA	ISDN Signaling Preprocessor
17	—	0X50AA	Filler
18	MPC	6X69MA	Message Protocol Card
20	CSM	6X42AA	CSM Interface
21	FORM	6X41AA	Formatter
22	DS30	6X40AA	DS30 Interface
23	—	0X50AA	Filler
24	—	0X50AA	Filler
25	—	2X70AD	Power Converter

Note: Each LGCI is provisioned with a minimum of two DCH cards,
      one in each LGAI.

Fig. 9 - Card locations in LGAI Shelf

NETWORK (FIRMWARE CHANGES)

3.22   Due to system delays introduced by the HLE, RFLE, and the
        DS-1 transport system, the P-side processor card in the
network module has been changed to extend messaging time-out val-
ues. Following are the changes made to network modules:

*   NT5X13 Network Module

    –   NT3X75AB (instead of NT3X75AA)

*   NT8X10 Network module

    –   NT3X75BB (instead of NT3X75BA)

4. SYSTEM CONFIGURATION

4.01   This part provides additional information on connections
        between components.

CONNECTIONS FOR THE HLE

<u>To the FSP</u>

4.02   The FSP of the HLE is for power and grounding and for
        including the HLE in the office alarm system. Figure 10
is a physical view of the FSP that includes the endpoints of spe-
cific connections.
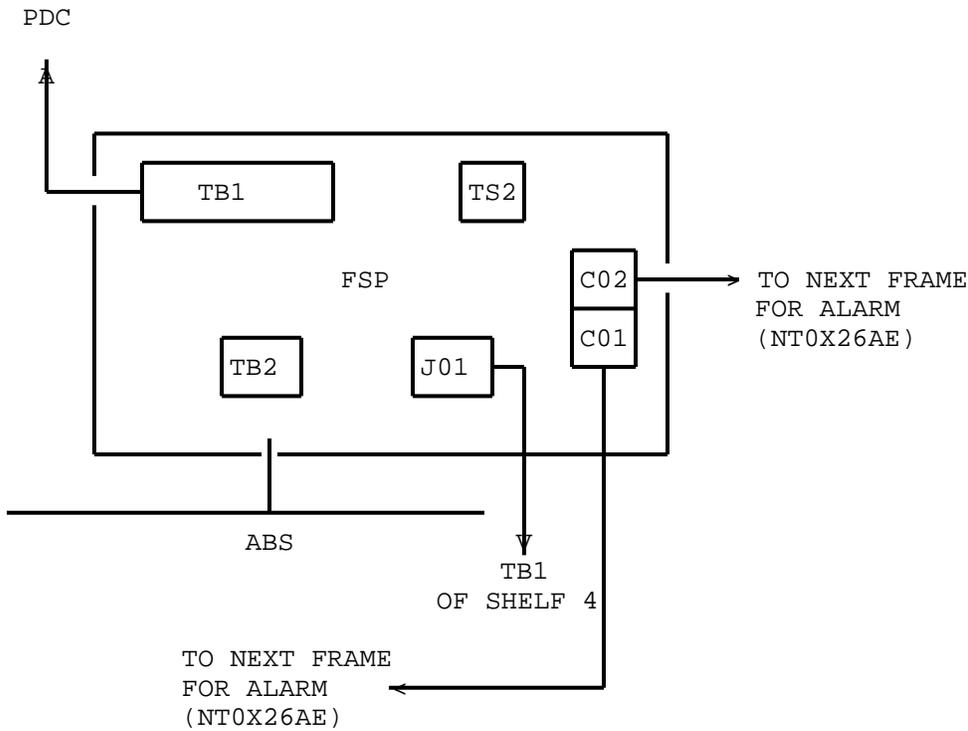
Fig. 10 - Connections to the FSP of the HLE

<u>To the SLCC</u>

4.03   The DS-30 control cables (NT0X26ZC) from each HLE shelf
        are connected to the SLCC by going down the left and right
sides (from the rear) and connecting at circuit card positions 04
and 24. Refer to Figure 11 on page 25.

	FROM				TO		
0X26		Frame	Shelf-Slot	Pins	Frame	Plane	Port
ZC	A B A(C) B(D)	HLE	X-04	10A/B-17A/B 18A/B-25A/B 56A/B-63A/B 64A/B-71A/B	SLC	0	0,1 2,3 0,1 2,3
ZC	A B A(C) B(D)	HLE	X-24	10A/B-17A/B 18A/B-25A/B 56A/B-63A/B 64A/B-71A/B	SLC	1	0,1 2,3 0,1 2,3

X can be one of 18, 32, or 51

Fig. 11 - Connections form the HLE to the SLCC

To the DSX

4.04   Refer to Figure 12.

	FROM				TO			
ZXAM	Frme	Shelf	Slot	Pins	Frame	Slot	Pins	Plane
Send/ Rcve	HLE	X	06/07 08/09 10/11 12/13	T/R00-T/R03 T/R04-T/R07 T/R08-T/R11 T/R12-T/R15	DSX/ Fiber	GR1 GR2 GR3 GR4	Ports 0-3 Ports 4-7 Ports 8-11 Ports 12-15	0 0 0 0
Send/ Rcve	HLE	X	06/07 08/09 10/11 12/13	T/R00-T/R03 T/R04-T/R07 T/R08-T/R11 T/R12-T/R15	DSX/ Fiber	GR1 GR2 GR3 GR4	Ports 0-3 Ports 4-7 Ports 8-11 Ports 12-15	1 1 1 1

X can be one of 18, 32, or 51

Fig. 12 - Connections from the HLE to the DSX

CONNECTIONS FOR THE RFLE

To the FSP

4.05   Connections to the FSP of the RFLE are similar to those of
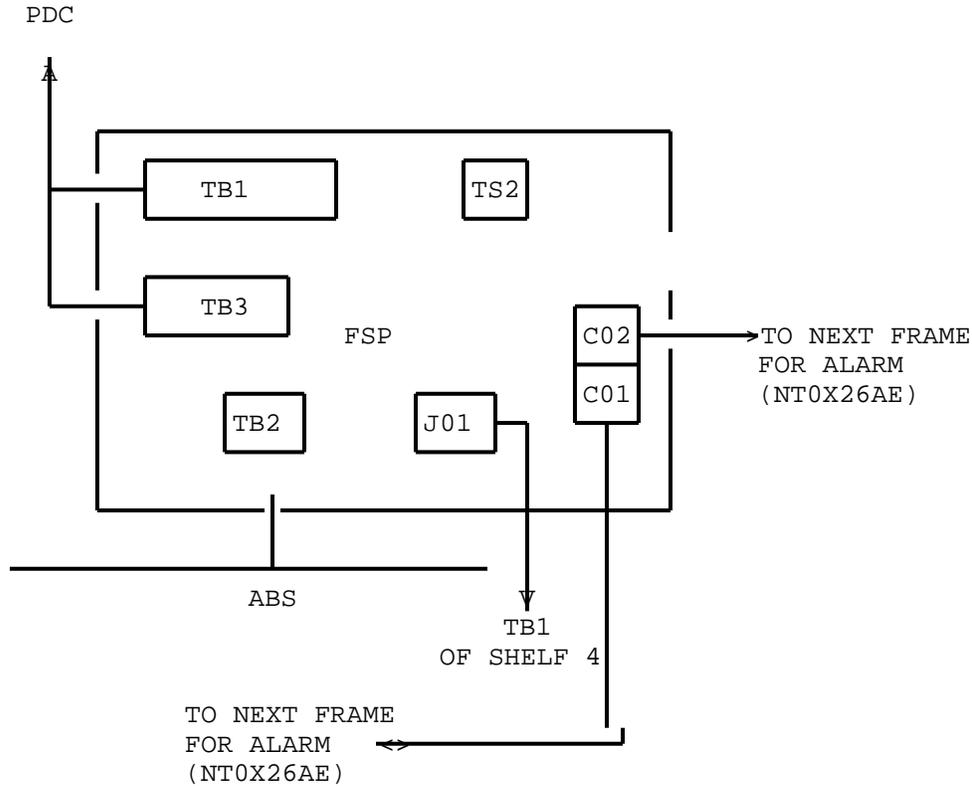   the HLE.   There are however, a few differences. Refer to
Figure 13.

PDC

Fig. 13 - Connections to the FSP of the RFLE

To the MTM

4.06   Cables are run from the DF to the MTM backplane.

To the LGEI

```
        FROM                            TO

┌───────┬─────┬───┬────┬──────────┬─────┬────┬────┬─────┬───────────────┐
│ 0X26  │Frme │Shf│Slot│   Pins   │Frme │Shf │Slot│Pins │   Network     │
│       │     │   │    │          │     │    │    │     │ Plane   Port  │
│       │     │   │    │          │     │    │    │     │               │
│ ZH(A) │RFLE │ 51│04/ │10A/B-17A/B│IAE/│X/  │ 22 │ S B │  0/1     1    │
│   (B) │     │   │ 24 │18A/B-25A/B│LGEI│X+14│    │ E E │         2-3   │
│   (C) │     │   │    │56A/B-59A/B│    │    │    │ E L │          4    │
│       │     │   │    │60A/B-63A/B│    │    │    │   O │          5    │
│       │     │   │    │64A/B-71A/B│    │    │    │   W │         6-7   │
├───────┴─────┴───┴────┴───────or─────────────┴────────┼───────────────┤
│                                                      │               │
│ ZH(A) │A    │   │    │10A/B-17A/B│SLC │ 1  │    │     │          1    │
│   (B) │B    │   │    │18A/B-25A/B│    │    │    │     │         2-3   │
│   (C) │A(C)─────────── DO NOT CONNECT────── ──────────────────────    │
│ ZK(C) │B(D) │   │    │56A/B-63A/B│    │    │    │     │         4-5   │
│   (D) │     │   │    │64A/B-71A/B│    │    │    │     │         6-7   │
├──────────────────────────────────────────────────┬──────────────────┤
│ X can be one 18 or 51                             │                   │
└──────────────────────────────────────────────────┴──────────────────┘


NOTE:  X can be 18 or 51

        Pins can be   10A/B-17A/B          Ports 0-1
                      18A/B-25A/B                2-3
                      56A/B-63A/B                4-5
                      64A/B-71A/B                6-7
```

Fig. 14 - Connections from the RFLE to the LGEI

To the DSX

4.08   Refer to Figure 15 on page 28.

ZXAM	Frame	Shlf	Slot	Pins	Frame	Slot	Pins	Plane
FROM					**TO**			
Send/ Rcve	RFLE	X	06/07	T/R00-T/R03	DSX/	GR1	Port 0-3	0
			08/09	T/R04-T/R07	Fiber	GR2	Port 4-7	0
			10/11	T/R08-T/R11		GR3	Port 8-11	0
			12/13	T/R12-T/R15		GR4	Port 12-15	0
Send/ Rcve	RFLE	X	06/07	T/R00-T/R03		GR1	Port 0-3	1
			08/09	T/R04-T/R07		GR2	Port 4-7	1
			10/11	T/R08-T/R11		GR3	Port 8-11	1
			12/13	T/R12-T/R15		GR4	Port 12-15	1

X can be one of 18, 32, or 51

Fig. 15 - Connections from the RFLE to the DSX

CONNECTIONS TO THE PACKET HANDLER

4.09   The packet handler, which is part of the host LGC-LCMI
        configuration, may be located at either the host or remote
site. Refer to the Provisioning part for example configurations.

Located at the Host

4.10   If located at the host site, a DS-1 link is provisioned
        from the DPN packet handler (the DIU) to the DS-1 Trans-
port system. The corresponding DS-1 link is provisioned from the
remote DS-1 Transport system to the LGCI.

Located at the Remote

4.11   If located at the remote site, the packet Handler DIU
        interfaces directly to the remote LGCI.

Note: Regardless of whether the packet handler is locally or
remotely located, the provisioning of network ports is not
affected, since the packet handler is provisioned by B8ZS DS-1
trunks from the LGCI and is then routed either directly to the
Packet Handler or routed through the DS-1 Transmission system and
then on to the Packet Handler.

5. OVERVIEW OF THE BASIC OAM INTERFACE

MAINTAINING THE DS-1 TRANSPORT SYSTEM

5.01   Monitoring the DS-1 Transport system is the responsibility
        of the Operating Company. If the Operating Company choos-
es to use the FMT150 product, manufactured by Northern, an inter-
face is provided that allows the user to run tests during both
initial installation and on a periodic basis.   Refer to the
appropriate documents that are listed in the Introduction.

MAINTAINING THE RFLE AND HLE.

Hex Display

5.02   This LED, located on the NTBX56AA card, displays a series
        of hex codes when the card is initialized. This LED also
displays certain codes when alarms have been detected. Refer to
Figure 16 on page 30 for a list of these codes and their mean-
ings.

5.03   Since these codes are in hex, ranges of numbers are based
        on 16. The value n can range from 0 to F, the equivalent
of 0 through 16.

Sources of Sync and the Hex Display

5.04   Note that since the HLE and RFLE establish and maintain
        sync with different sources, the hex displays for these
have different meanings. On the HLE, the BX56AA card syncs with
either the first DS-30 link or the other unit, resulting in a hex
display of A0 (the first DS-30 link) or AF (the other unit). On
the RFLE, the BX56AA can sync with any one of the other 15 DS-1
links or the other unit, resulting in a hex display of An (with
n the number of the DS-1 link) or AF (the other unit).

POWER UP/SELF TEST CODES

Code   Description
----
00   Reset has occurred

01   Processor Test (test processor memory)

02   EPROM Test (Checksum)

03   RAM Test

04   VCXO (VXCO frequency is checked against
                CPU frequency)

05   6X50 Detection Test (presence of one or
                more 6X50s is confirmed)

06   Local Link Test (Communication with 6X50s via
                mtce bits is tested)

07   Control Injection (Communication with 6X50s via
                control channel is tested)

08   Terminal Communication Test (Communication with
                6X50s via terminal bit is tested)

09   Initializing the BX56

_____
EVENT AND STATE CODES

Code   Description

 3n   Link n has been lost
 4n   Frame Slip on link n
 5n   Frame loss on link n
 6n   Yellow alarm on link n
 7n   Link n is down

 80   Activity gained from other unit

 An   In sync on link n (inactive unit, n=F)

 En   Link n has been established

       Fig. 16 - Codes for Power Up/Self Test and Event/State

TEST FAILURE CODES

Code	Description	Action
21	Processor Error	Processor Test failed - Replace BX56
22	EPROM Error	EPROM Checksum failed - Replace BX56
23	RAM Error	External RAM test failed - Replace BX56
24	VCXO Error	No local frame pulse - Replace BX56
25	VCXO Error	VXCO is running too fast or clock is too slow - Replace BX56
26	VCXO Error	VXCO is running too fast or clock is too slow - - Replace BX56
27	No 6X50s Detected	Replace BX56 if 6X50s are present - If not, install 6X50s
28	Local Link Failure	Unable too talk to any 6X50s on the maintenance bus. Replace the BX56, if the error continues, replace 6X50s
29	Control Failure	Unable to talk to any 6X50s on control channel - Replace BX56, if the error continues, replace the 6X50's
2A	Terminal Communi-cation Failure	Unable to talk to any 6X50s on terminal bit - Replace the BX56 if the error continues
2D	No Active Links	Not receiving maintenance code on any DS-1. Check fiber and far end BX56
2E	Giving Up Activity	Unable to sync on any source and forced to give up activity
2F	Looking for Sync	Trying to sync with line frame pulse If this lasts more than 20 seconds: At host site, check 6X40 and DS-30, then replace the BX56 At remote site, replace the BX56, check 6X50s and DS-1s.

Fig. 17 - Test Failure Codes

Setting up the switches at the NTBX5702

5.05   There are three switches on the NTBX7502 paddle board.
        These switches, which are locking toggle switches to pre-
vent accidental switching, control the following:

*   top switch - This switch is used for board testing.   Having
     the switch down causes the board to stop when a fault is
     encountered during a self test. Having the switch up makes
     the board continue the self tests even if a failure is found.
     Except when debugging, this switch should be left in the up
     position.

*   middle - This switch controls the local/remote control for
     the NTBX56A. Having the switch up invokes local control; you
     control the card from the top connector. Having the switch
     down invokes remote control; the card is controlled from the
     bottom connector at the far end. Unless you are using a con-
     nector to control a card locally, you should keep this switch
     down.

*   bottom - This switch resets the NTBX56AA.   During normal
     operation, this switch is down. Toggling this switch up and
     then down resets the NTBX56AA.

Setting up a Terminal to Monitor the NTBX56AA

5.06   The primary user interface is through terminals connected
        to the NTBX5702.   Following are the ways to control the
local and remote NTBX56AA:

*   Local control of the NTBX5702

     —   The terminal is connected to the top D connector.

     —   The middle switch of the BX5702 is up.

     —   Either the middle switch of the far end BX5702 is down or
          there is no BX5702 at the far end.

*   Remote

     —   The terminal is connected to the bottom D connector.

     —   Either the middle switch of the far end is BX5702 is down
          or there is no BX5702 at the far end.

5.07   To select the correct DS-1 allowing use of the remote ter-
        minal, enter "F" at the local terminal. The terminal then
displays the message "looking for remote terminal communication"
and the @ sign. The process of looking for the proper link may
take up to 60 seconds. If a link is found the terminal displays
which link is being used for terminal communication with the mes-
sage "***communication confirmed on link N***" (N is the number

of the link.). If a link is not found, the terminal displays
"*** unable to communicate on any link ***."

5.08   Once communication has been established, the remote termi-
       nal is used the same way as a local terminal.

Terminal Commands

5.09   Following are the commands that are issued from the termi-
       nal.   Note that the <M>enu command gives a list of these
commands and that the first letter can be used to invoke the com-
mand.

*   Alarm link n

     Sends a yellow alarm on the n link. When the alarm is sent,
     scanning for errors on other links is stopped, so the alarm
     command should be issued again to clear the alarm.

*   Backspace Key

     Changes the being used for backspace.   (It cannot be a HEX
     digit, the current backspace, or Enter.)

*   Clear Hex Log

     Clears the log of the hex codes which have been displayed on
     the LED of the BX56AA. To complete the command, issue the
     password, which is "DEAD."

*   Dump Memory

     Views blocks of 8031 memory .   You are prompted for which
     type of memory and which address you wish to see. A firmware
     listing is required to make full use of this feature.

*   Escape Key

     Changes the being used for ESC. (It cannot be a HEX digit,
     the current backspace, or Enter.)

*   Find Remote Link

     Finds the link on which the remote terminal communication is
     to take place.

*   Hex Log Dump

     Dumps the contents of the hex log being kept by the BX56AA.
     The codes are displayed with the most recent first. An empty
     hex log is initialized to all zeros.

*   Loopback

     Controls the three types of loopbacks for the RLE shelf:

Page 33

1. All DS-1 loopback - loops all DS-1 channels back onto the
    RLE shelf

2. DS-30 loopback - allows all DS-30 links to be looped back
    onto the Ds-30.

3. Single DS-1 loopback - allows a single DS-1 to be looped
    back onto the RLE shelf.

*   Menu

    Displays a list of the commands

*   Note :

    Allows a single line note to be placed on the paper.   The
    line should be terminated with a closing square bracket.   The
    note could be used for a time stamp to indicate when the sys-
    tem was checked.

*   Power-up Results

    Displays the results of the self tests. If the command has
    not been used since the reset, the first line will indicate
    that a reset has occurred.

*   Query

    Displays various status information about the BX56AA. Any
    error conditions are flagged by "***" before and after the
    message.

*   Read Memory

    Performs a repeated read of the specified memory location.
    This command is not useful on a hard copy printer. On a CRT,
    this command allows changes to be viewed continuously.   Hit
    any key to abort the test (the display stops in a few sec-
    onds). Using this command requires a firmware listing.

*   Sync Link

    On a RFLE, specifies on which DS-1 link to sync.   Specifying
    "F" caused the unit to give up activity.

*   Terminal Link

    Manually sets the link on which the remote terminal communi-
    cation is to be run. This commend must be executed on both
    the host and remote ends from a local port.

*   <V> Firmware Version

    Displays the firmware version of the BX56AA.

*   Write to Memory

    Writes to the 8031 memory. This command should not be used
    without a knowledge of the firmware and a listing.

6.   MAINTENANCE PROCEDURES FOR THE BASIC OAM

TROUBLESHOOTING DURING POWER UP

6.01   When the HLE or RFLE is powered up, the following sequence
        should appear on the hex display:

1. 00
2. 01
3. 02
4. 03
5. 04
6. 05
7. 06
8. 07
9. 08
10. 09
11. 2F
12. (2E)
13. E0
14. E1
15. E2
16. E3
17. E4
18. E5
19. E6
20. E7
21. E8
22. E9
23. EA
24. EB
25. EC
26. EE
27. EF
28. A0 (or AF) for the HLE, A0 through AF for the RFLE

6.02   The sequence E0 to EF may be shorter if there are less
        than eight network links configured. Once both planes are
active (flashing A0 or AF), then there should be no alarms on the
frame (s).

6.03   Following are possible alarms that may occur when the sys-
        tem is being powered up.

<u>Usage Notes</u>

6.04   The steps are listed in the order of most to least likely
        cause of trouble. If a step has not solved a problem,
continue with the next step.

NTBX56AA Reset Freezes

*   Description

    The Hex display shows all radix LEDs on (FF) and the Hex out-
    put is not flashing (as if the display were in the reset
    state). This state can occur when the unit is initially pow-
    ered up or when the card is replaced on a shelf.

*   Action

    Ensure that the lower toggle switch on the NTBX5702 is in the
    down position. If the condition does not clear within 10-15
    seconds, reseat the BX56AA card. If the condition still
    exists, replace the BX56AA card.

NTBX56AA Fails Power Up Diagnostics

*   Description

    The Hex display shows a failure code from 20 to 2A. The cor-
    rect sequence would count from 01 to 09.

*   Action

    Reseat the NTBX56AA card. If the condition still exists,
    refer to Figure 17 on page 31. In most cases, the first step
    is to replace the NTBX56AA.

A DS-1 Link is not Established

*   Description

    One of the 'E' codes for establishing a provisioned DS-1 is
    missing.

*   Action

    1. Ensure that the NT6X50 cards are the AA or the AB (Rel
        60) version.

    2. Ensure inter-bay cabling is correct.

    3. Reset the NTBX56AA card (toggle the lower switch on the
        NTBX5702) to repeat the diagnostic result. Type "P" on
        the associated printer to verify that the suspect
        NT6X50AA card was found by checking the power-up results
        log

    4. Replace the suspect NT6X50AA card, using the following
        chart:

Missing E code   NT6X50AA card slot

	Plane 0	Plane 1
E0, E1	6	22
E2, E3	7	21
E4, E5	8	20
E6, E7	9	19
E8, E9	10	18
EA, EB	11	17
EC, ED	12	16
EE, EF	13	15

Note: The codes that can appear depend on the configura-
tion.   For example, if only four DS-30 links are provi-
sioned for the site, only codes E0 to E7 will appear,
since only eight DS-1 links are established.

5. Verify the connections from the DS-1 to the optical tran-
smission equipment.   Refer to the NTPs listed in the
introduction.

6. Remove the backplane cabling and physically loop the DS-1
back onto itself. Reset the NTBX56; if the link still
fails to establish, a backplane route has failed.

Hex Display Show "2D"

*   Description

The system at one end is fully functional, but it is not
receiving the maintenance code from the far-end DS-1 links.
Usually, this problem is with the DS-3 links; otherwise, all
DS-1 links would have to fail simultaneously. Another trouble
source is cabling problems.

*   Action

1. Ensure the far end is functioning (A0,AF on the far end
hex displays).

2. Verify the far-end transmit side and the local-end
receive section of the fiber transmission system.

3. Set a local loopback on the DS-1 links from the HLE/RFLE
shelf to verify that the problem originates at the far
end. Refer to the command list in Terminal Commands on
page 33.   When performing the loopback, the hex display
should read A0 and AF.

4. Check the cabling of the fiber transmission system.

Host NTBX56AA Unable to Obtain Sync

*   Description

    The hex display on the NTBX56AA at the HLE shows "2F" for
    more than 20 seconds.   This indicates that the unit cannot
    sync to the Network DS-30 links on both planes.

*   Action

    Check the cable connections to the HLE NT6X40AA cards at the
    backplane, paying particular attention to link 0. Check and
    replace the 6X40AA cards if required. If the problem contin-
    ues, replace the NTBX56AA card.

IN SERVICE MAINTENANCE

6.05   Once the system is in service, many of the standard DMS
       maintenance concepts apply, with the system automatically
recovering from external disruptions. For example, if one of the
optical cables were to be cut, the remote LGCI would continue to
function with the other network plane.

6.06   Since the HLE/RFLE are redundant configurations, a card
       failure would not interrupt service. Isolation of faults
can be done by using these three loopbacks:

1. loop all DS-1s back onto the shelf

2. loop one DS-1 back onto the shelf

3. DS-30 loopbacks - Loop all DS-30 links back onto the DS-30
    links

 These commands are described in Terminal Commands on page 33.

Guidelines for Replacing HLE/RFLE cards.

6.07   Whenever changing an HLE/RFLE card, follow this sequence:

1. Busy the associated network links.

2. Ensure the plane is the inactive side, with the NTBX56AA
    flashing "AF". If this needs to be done, input <S>ynch at the
    printer and select the option F on which to sync; this forces
    the unit to give up activity to the other plane.

Once you have changed the relevant card, return the network links
to service.

LGCI Fails to Receive WAI After Reset

*   Description

    The MAP indicates that there is no message link to the
    peripheral.

*   Action

    1. Verify there are no alarms on the fiber transmission
        equipment and no DS-1 loss indicated on the hex display.

    2. Verify the SLCC cross-connections and the cabling from
        the SLC to the HLE. Refer to Figure 11 on page 25.
        Remember that a DS-30 link to the HLE is dedicated for
        the remote MTM.

    3. Verify the cabling between he RFLE and the LGCI.

    4. Ensure that the message card for the LGCI is the correct
        version.

    5. Check the communication between the host and remote MTM.
        At this point, if all checks pass, the problem is likely
        to be external

    6. Reset all NTBX56AA cards by toggling the lower switch on
        the NTBX5702.

Cannot communicate with the Remote Terminal

*   Description

    A terminal that is attached remotely is not responding.

*   Action

    Ensure the middle toggle switch on the far-end NTBX5702 is in
    the down position. With the local terminal connected to the
    top RS232 socket, type "F" to establish communication with
    the far end.

Printer is Babbling

*   Description

    The printer is continuously printing a response such as
    'INVALID COMMAND'.

*   Action

    1. Reseat the NTBX5702, ensuring there are no bent pins on
        the backplane.

    2. Reseat the NTBX56AA.

   3. Reset the NTBX5702.

Network Links Fail from InSv

*   Description

    The DMS logs/alarms subsystem indicates there is a network
    link failure.   The following assumes all connections have
    been verified and there are no alarms on the fiber remote
    equipment.

*   Action

    1. Test the speech links (at the NET LINKS level of the MAP)
        to determine whether specific links or an entire plane
        has failed. If a plane has failed, the message links
        will immediately show an alarm.   Speech links, on the
        other hand, will not show an alarm unless the DMS has
        tried to use them.

        -   If all the links have failed, replace the 6X40AA card
            on the associated RFLE unit.
        -   If only one or two fail, check the hex display and
            print out the hex log to see if a DS-1 failure has
            occurred. If it has, replace the associated NT6X50AA
            card.   Retest the links, and if they still fail,
            replace the NTBX56AA.

Hex Display Shows 70-7F (DS-1 Link is Down)

*   Description

    The hex display and logs show the state of the DS-1 links.
    If a link fails, it will indicate a yellow alarm, frame
    slips, and frame loss before going down. The following
    assumes there are no alarms at the fiber transmission equip-
    ment.

*   Action

    Determine whether the failure is at the local or far end by
    running a local DS-1 loopback at both the HLE and RFLE. If
    the loopback fails, replace the local NT6X50AA card.

Hex Code is 2D

*   Description

    The far end system is not sending the required maintenance
    codes.

*   Action

    Replace the far end NTBX56AA.

Routine Testing of the BX56AA

*   Description.

    The following procedure checks the power up/self tests for
    the NTBX56AA while the FRSC is in service. Note that if done
    properly, call processing will not be affected.

*   Action

    1. Post the LGCI that is located off the RFLE.

        −   If the LGCI in INSV and has no problems, continue

        −   If the LGCI has any alarms, STOP.   Perform mainte-
            nance on the LGCI

    2. At the HLE remove the BX56AA card for plane 0 (slot 05).
        Note that LED on the card goes blank, with the far end
        LEDs going 7n (n hex)

    3. Ensure the LGCi goes ISTb.

        −   If the LGCI goes SYSB, STOP.   Perform maintenance on
            the LGCI.

    4. Reinsert the BX56AA card so that power up/self tests are
        initiated.

    5. Wait for LEDs to settle.

        −   If LEDs settle at An (n = hex, 0 to F), continue.

        −   If LEDs settle at another value, translate trouble
            code.

    6. Repeat steps 2 through 5 for Plane 1 (slot 23)

    7. Repeat steps 2 through 6 for the RFLE (at the remote
        site).

7. OVERVIEW OF THE ENHANCED OAM INTERFACE

7.01   To better enable maintenance personnel to integrate the
        OAM of the FRSC into the overall operation of an office,
an enhanced OAM interface is available. This interface is pro-
vided through an IBM-compatible Personal Computer (PC) that has
been loaded with the Enhanced OAM software program.

HOW OAM CAPABILITIES ARE ENHANCED

Monitoring Capabilities

7.02   The FRSC OAM program monitors all of the NTBX56AA cards at
        the host and remote sites. As well as monitoring and
reacting upon messages received from the BX56 cards, the program
also polls each NTBX56 card to ensure that the communication link
to each card is functioning correctly.

7.03   The program also saves all messages that come from each
        NTBX56 card to a unique file. These files can be used to
trace the history of commands and events that happened to one
particular NTBX56 card during trouble-shooting.

7.04   All BX56 cards are monitored at the host end. Each NTBX56
        card at the host end monitors the associated card at the
remote end using a dedicated DS-1 communication link.

Using a Personal Computer Interface

7.05   Unlike the Basic OAM Interface, the Enhanced Interface is
        menu-driven and has on-line help available. Moreover, you
can use the program even if you are not familiar with PC opera-
tion or the Disk Operating System (Microsoft DOS).

SYSTEM CONFIGURATION

7.06   Hardware is installed at what are called the Maintenance
        Center and Host site. These concepts are explained below.

Maintenance Center

7.07   A Maintenance center is a location that will monitor the
        FRSC system on a either a permanent basis or a temporary
(trouble shooting) basis. This Center contains the (up to four)
PCs that are used.

Host Site

7.08   An FRSC Host site will usually be in a Central Office
        environment.   The equipment required at the host site
depends on the number of NTBX56AA cards being monitored in the
complete system (host and remote). This PC program can monitor
up to 12 BX56 cards. The number of HLE/RFLE shelf combinations

(either 1, 2 or 3) determines the number of NTBX56 cards in the system.

7.09   Figure 18 on page 46 shows how the maintenance Center and
       the Host office can be configured. The Maintenance Center
can access the Host Equipment in the following ways:

*   Co-located

    In this configuration, the PCs are co-located with the host
    office equipment. No dial-up is required.

*   Remotely Located

    In this configuration, the PC dials up the host equipment
    though modems. This can be a single- or multiple dial up.

GENERAL HARDWARE REQUIREMENTS

Maintenance Center

7.10   Every Maintenance Center, whether locally or remotely
       located, requires an 'IBM Compatible' PC, running Micro-
soft DOS, with the following:

*   At least 128 kB of memory

*   10 MB hard disk drive (formatted) to store the program and
    log data

*   A floppy disk drive to install system software.

7.11   The configuration of the serial port depends on where the
       PC is located.

*   Remote

    A serial port hooked to a 1200 baud Hayes compatible external
    modem or an internal modem (1200 baud, Hayes compatible).
    Either the serial port or the internal modem (whichever is
    used) should be configured as COM1.

*   Local

    If the maintenance center is co-located at the FRSC host
    site, the modem will not be necessary, just a serial port
    configured as COM1.

7.12   Follow instructions that come with the serial port card or
       the internal Hayes compatible modem to install them. Make
sure whichever one that is used is configured as COM1. If you
use an external modem, you must connect the serial port to the
Hayes compatible external modem with an RS-232 cable.

7.13   The hard disk drive on the PC should already be formatted,
        but if it is not, you will have to format it using the
directions found in the DOS manual.

<u>Host Site</u>

7.14   At the host site, the type of configuration determines the
        equipment used.   Refer to Figure 18 on page 46.   In a
local configuration, the PC is connected directly to the Program-
mable Sharing Device (PSD). In a remote configuration, the PC is
either connected to the PSD (for multi dial-up) or the Terminal
Eliminator (for single dial-up).

HOST OFFICE   REMOTE SITE

```
        PSD      M
                 O
 PSD  ┌──────┐   D────┌───┐          ┌──────────────────┐
      │      │   E    │\ /│          │  Remotely Located│
      └──────┘   M    │ S │          │  (Multi dial-up) │
                 S    │ W │          │                  │
                      │ I │    M     │                  │
 TE   ┌──────┐        │ T │    O     │┌──┐              │
      │      │        │ C │────D─────││PC│              │
      └──────┘        │ H │    E     │└──┘              │
                      │ I │    M     │                  │
                      │ N │          └──────────────────┘
 HLE  ┌──────┐        │ G │
      │      │        │/ \│
      └──────┘        └───┘
```

```
                      ┌───┐
                      │\ /│
                      │ S │
                      │ W │          ┌──────────────────┐
                 M    │ I │    M     │  Remotely Located│
                 O    │ T │    O     │  (Single dial-up)│
 TE   ┌──────┐   D    │ C │    D ┌──┐│                  │
      │      │───E────│ H │────E─│PC││                  │
      └──────┘   M    │ I │    M └──┘│                  │
                      │ N │          │                  │
 HLE  ┌──────┐        │ G │          └──────────────────┘
      │      │        │/ \│
      └──────┘        └───┘
```

```
        PSD
 PSD  ┌──────┐
      │      │──────┐
      └──────┘      │
                    │
 TE   ┌──────┐    ┌──┐
      │      │    │PC│
      └──────┘    └──┘
 HLE  ┌──────┐  Co-located
      │      │  No-dial-up
      └──────┘
```

PC = Personal Computer

PSD = Programmable Sharing Device

TE = Terminal Eliminator

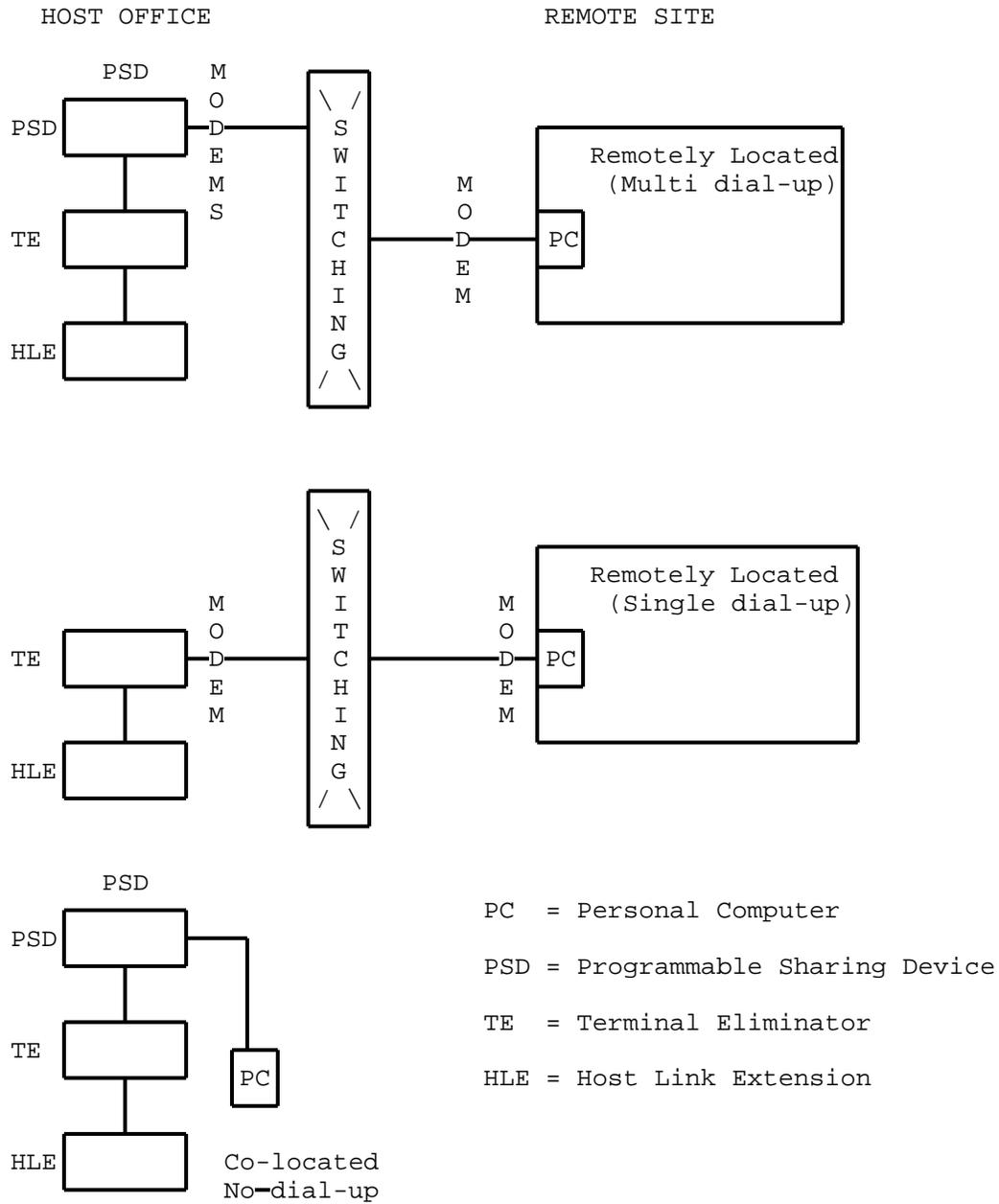HLE = Host Link Extension

Fig. 18 - How the Enhanced OAM Can Be Configured

8.   SETTING UP THE ENHANCED OAM INTERFACE

INSTALLING THE PROGRAM - MAINTENANCE CENTER

8.01   Necessary software will automatically be copied to the
        hard drive of the PC, drive 'C:', using an installation
'batch' program. A floppy disk containing the installation pro-
gram and the application software is provided by NTI (Product
Engineering Code (P0707196).

8.02   The installation of the FRSC OAM program requires minimal
        knowledge of PC operation. For a listing of the installa-
tion program and a more detailed description of what it does,
refer to Appendix A. The following steps show how to install the
program on the formatted hard drive of the PC.

1.   If not already done, power up the PC and wait for the sys-
     tem-ready prompt (usually 'C>'. Place the installation disk
     into the floppy drive (drive A)

2.   Type

          >A:INSTALL

     MOST of the following messages should appear on the screen.

        In order to install the FRSC OAM program, the files
        "Autoexec.bat" and "Config.sys" should be in the root
        directory of the C:\ drive. If these files do not
        presently exist, they will be created for you.
        These files should not be marked as "Hidden" files and
        there should be no batch files executed within
        "Autoexec.bat"
        This install batch file creates a new directory on the
        C: drive called "C:\OAM", and one subdirectory within OAM
        called "C:\OAM\HELP". The program also appends some
        commands to the "Autoexec.bat" and "Config.sys" files.
        Strike a key when ready . . .

     Note: This is just a general warning and a short description
     of what the installation program actually does. Batch files
     can be identified by the fact that there their filename is
     always followed by ".BAT".

3.   Hit any key to continue, and note the following messages that
     appear on the screen:

```
              1 Files(s) copied
        A:COMMAND.MNU
        A:HELP.MNU
                2 Files(s) copied
        A:MAINT.HLP
        A:STATUS.HLP
        A:SCAN.HLP
        A:UPDATE.HLP
        A:CLRALM.HLP
        A:QSYNC.HLP
        A:QPORT.HLP
        A:TRAN.HLP
        A:FIND.HLP
        A:CLRCOMM.HLP
        A:PURGE.HLP
        A:FIRMW.HLP
        A:PASSTHRU.HLP
        A:DOSCOM.HLP
        A:QUIT.HLP
        A:LOOP.HLP
               16 Files(s) copied
        C:\CONFIG.SYS
        A:CONFIG.DAT
               1 Files(s) copied
        C:\AUTOEXEC.BAT
        A:EXEC.DAT
               1 Files(s) copied
```

        (The screen clears)

        Installation of the FRSC OAM system is now complete.
        Please remove installation disk from drive A: and
        re-boot the computer (ctrl-alt-del) to start the FRSC OAM.

4. Follow the instructions and re-boot the PC by simultaneously
    pressing the control (Crtl) key, the alternate (Alt) key and
    the delete (Del) key. When the computer finishes rebooting,
    the FRSC OAM program should begin automatic execution. Refer
    to Part 9 on page 61for further instructions on using the
    FRSC OAM program.

EXAMPLE CONFIGURATIONS

8.03   As mentioned in Host Site on page 43, up to 12 BX56 cards
       can be monitored by one Enhanced OAM Interface program.
This means that up to six fully configured HLE shelves (three at
the host and three at the remote) can be monitored. In the fol-
lowing sections, instructions are given for setting up a one,
two, or three HLE/RFLE-shelf combination.

Monitoring One HLE/RFLE Shelf Combination

8.04   Figure 19 shows how the system could be configured with
        one HLE shelf at the host office and one RFLE shelf at the
remote office.   The system has four NTBX56AA cards, two in the
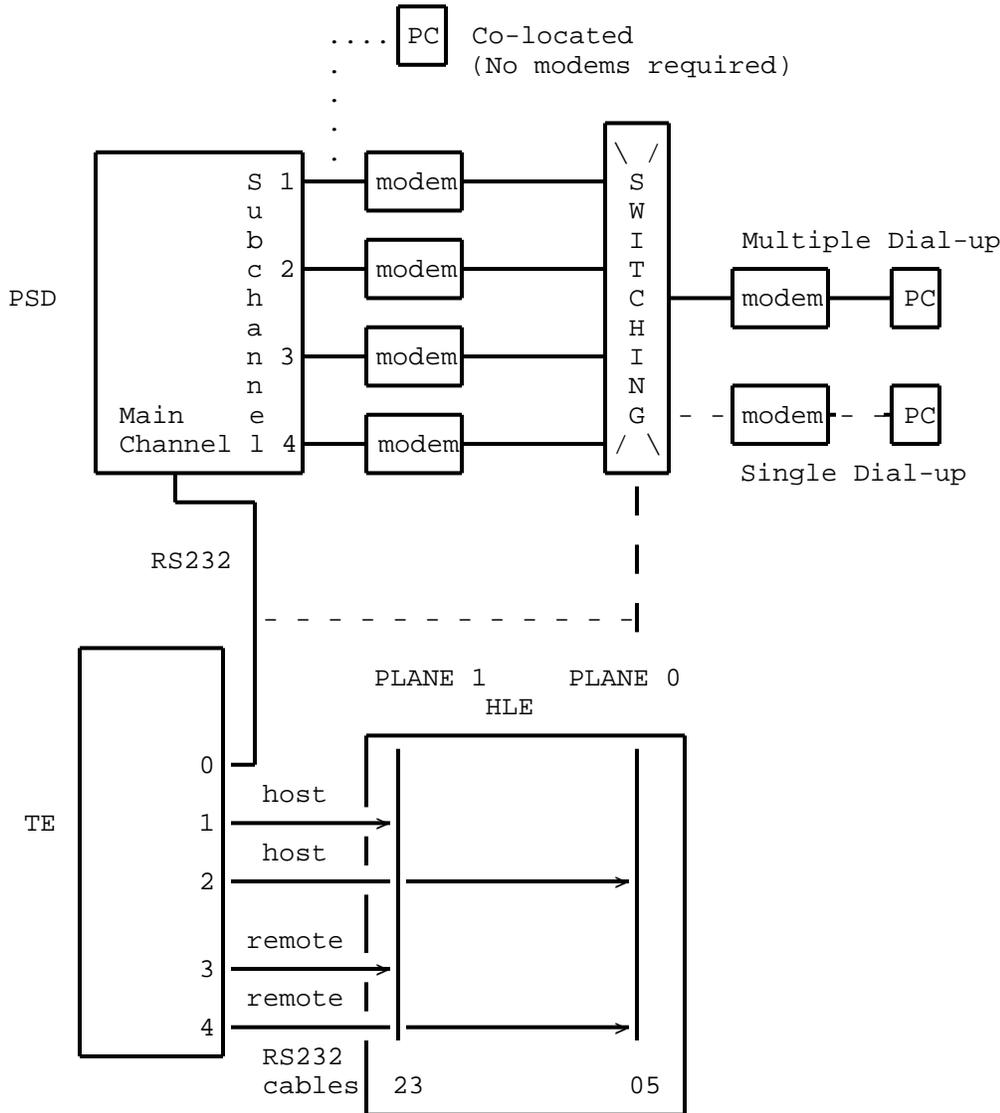HLE shelf and two in the RFLE shelf.

Fig. 19 - Example Configuration for Monitoring One HLE/RFLE Shelf

---

8.05   The following steps describe the required equipment and
        installation:

1. Ensure that you have the following equipment:

    Quantity   Equipment
    --------   -----------
    (1 to 4)   Auto-Answer 1200 baud modem (one per dial in).

      (1)   Black Box Terminal Eliminator (Catalog
                   # GL-TL482B) and
                   SPECIAL FIRMWARE TE033189.3E02

      (1)   Black Box Programmable Sharing Device (PSD-4,
                   Catalog # GL-TL304B).

    (5 + 1 for Male to male, straight RS-232 cables (NT0X26BK
    each modem) or equivalent).

2. Locate a table, desk or counter where you can place the Ter-
    minal Eliminator, PSD-4 and modem(s). Make sure that there
    is an AC outlet for the Terminal Eliminator, the PSD-4 and
    the modem(s).

3. Configure the DIP switches inside the Terminal Eliminator as
    shown below:

                                      Settings
    Switch
    Designation   1   2   3   4   5   6   7   8
    -----------   ------------------------------
    SWA - SWE   off off on on on on off off

    SWF   on on off off off off on off

    SWG   off off on on off off off off

    Also, ports 1 - 4 should be configured as DTEs and port 0
    should be configured as a DCE using the shunt jumpers for
    each port.

4. Configure the jumpers and dial setting inside the PSD-4 as
    shown below:

```
     Switch                              Settings
     Designation
     -----------              ------------------------------


     S1S2 (MAIN)              DTE position

     S3S4, S5S6, S7S8 and      In DTE position if hooking to a
     S9S10 (SUBCHANNEL)       modem and in DCE position if hook-
                             ing straight to a PC serial port

     SW5 (BAUD RATE DIAL)      Position 6 for 1200 baud

     J1 (CHASSIS GROUND)      DISCONNECT position

     J2 (TIME OUT)            DISABLE position

     J3 (FORMAT)              ASYNC position

     J4 (CONTENTION)          DATA position
```

5.   Label each RS-232 cable on both ends (for identification).

6.   Using 4 of the labeled RS-232 cables, connect ports 1 - 4 of
     the Black Box Terminal Eliminator to the 4 female RS-232 con-
     nectors on the 2 NTBX5702 paddle cards on the backplane of
     the HLE shelf. Make a note of which RS-232 cable is hooked
     the local and remote port of plane 0 (right side of the HLE
     shelf, looking from behind the frame) and the local and
     remote port of plane 1 (the left side of the HLE shelf). Use
     the form in Appendix B to record the information.   This
     information will be used later to datafill the PC OAM pro-
     gram.

7.   Use 1 of the labeled RS-232 cables to connect port 0 of the
     Terminal Eliminator to the main channel of the PSD-4 unit.

8.   Use the remaining RS-232 cables to connect each auto-answer
     modem to sub-channels 1 to 4 of the PSD-4 unit. Ensure that
     the auto-answer modem does not echo characters (echo off) and
     that the modem only responds to incoming calls (ie. does not
     recognize commands coming in on the RS-232 port). Most mod-
     ems have dip switches to control character echo and command
     recognition.

     Note: If a PC is to be located at the host location instead
     of at a dial-up location, simply connect the serial port of
     the PC to one of the PSD-4 subchannels, as shown by the dot-
     ted line. Also, make sure that the subchannel is configured
     as a DCE by using the sliding switch inside the PSD-4 unit.)

     Note: If you only desire one dial up to the host system, you
     can delete the Black Box Port Sharing Device and all but one
     Auto-Answer modem.   Simply hook the Auto answer modem

straight to port 0 of the Black Box Terminal Eliminator, as
shown by the dashed line.

9. Plug phone lines into each of the auto-answer modems.

8.06   This completes the hardware installation for monitoring
       one HLE shelf and one corresponding RFLE shelf. Please
note that if additional HLE/RFLE shelf pairs are added, the num-
ber of ports on the Terminal Eliminator can be increased by add-
ing the 4 port expansion board described in the section that
follows.   If more than 8 NTBX56's are to be monitored, a second
Terminal Eliminator can be added. Use the directions in the fol-
lowing sections (Monitoring two HLE/RFLE shelf combinations,
Monitoring three HLE/RFLE shelf combinations) when expanding
your FRSC OAM system.

Monitoring Two HLE/RFLE Shelf Combinations

8.07   Refer to Figure 20 on page 53, which shows two HLE shelves
       at the host site and two corresponding RFLE shelves at the
remote site. The system has 8 NTBX56AA cards, four in the HLE
shelves and four in the RFLE shelves.

```
                              ....┌──┐  Co-located
                              .   │PC│  (No modems required)
                              .   └──┘
                              .        ┌───┐
         ┌──────────┐    .    ┌──────┐ │\ /│
         │       S1 ├─────────┤modem ├─┤ S │
         │       u  │         └──────┘ │ W │     Multiple Dial-up
         │       b  │                  │ I │
         │       c2 ├─────────┬──────┐ │ T │  ┌──────┐   ┌──┐
         │       h  │         │modem ├─┤ C ├──┤modem ├───│PC│
   PSD   │       a  │         └──────┘ │ H │  └──────┘   └──┘
         │       n3 ├─────────┬──────┐ │ I │
         │       n  │         │modem ├─┤ N │
         │  Main e  │         └──────┘ │ G │  ┌──────┐   ┌──┐
         │ Channel l4├────────┬──────┐ │/ \│- ┤modem ├- ┤PC│
         └────────┬─┘         │modem ├─┤   │  └──────┘   └──┘
                  │           └──────┘ └─┬─┘  Single Dial-up
             RS232│                      │
                  └ - - - - - - - - - - -┘
      ┌──────┐
      │    0 │─┐
      │      │ │    host    ┌───────────────────────┐
  TE  │    1 │ └─────────►  │                       │
      │      │    host      │  │                    │
      │    2 │───────────   │  │───────────────►    │
      │      │    remote    │  │                    │   HLE
      │    3 │───────────►  │  │                    │
      │      │    remote    │  │                    │
      │    4 │───────────   │  │───────────────►    │
      └──────┘  RS232       │ 05                  23│
                cables      └───────────────────────┘

      ┌──────┐
      │    5 │───────────►  ┌───────────────────────┐
      │    6 │───────────►  │  │───────────────►    │
      │      │              │  │                    │
      │    7 │───────────►  │  │                    │   HLE
      │    8 │───────────   │  │───────────────►    │
      └──────┘  RS232       │ 05                  23│
                cables      └───────────────────────┘
  Expansion
  Board
```
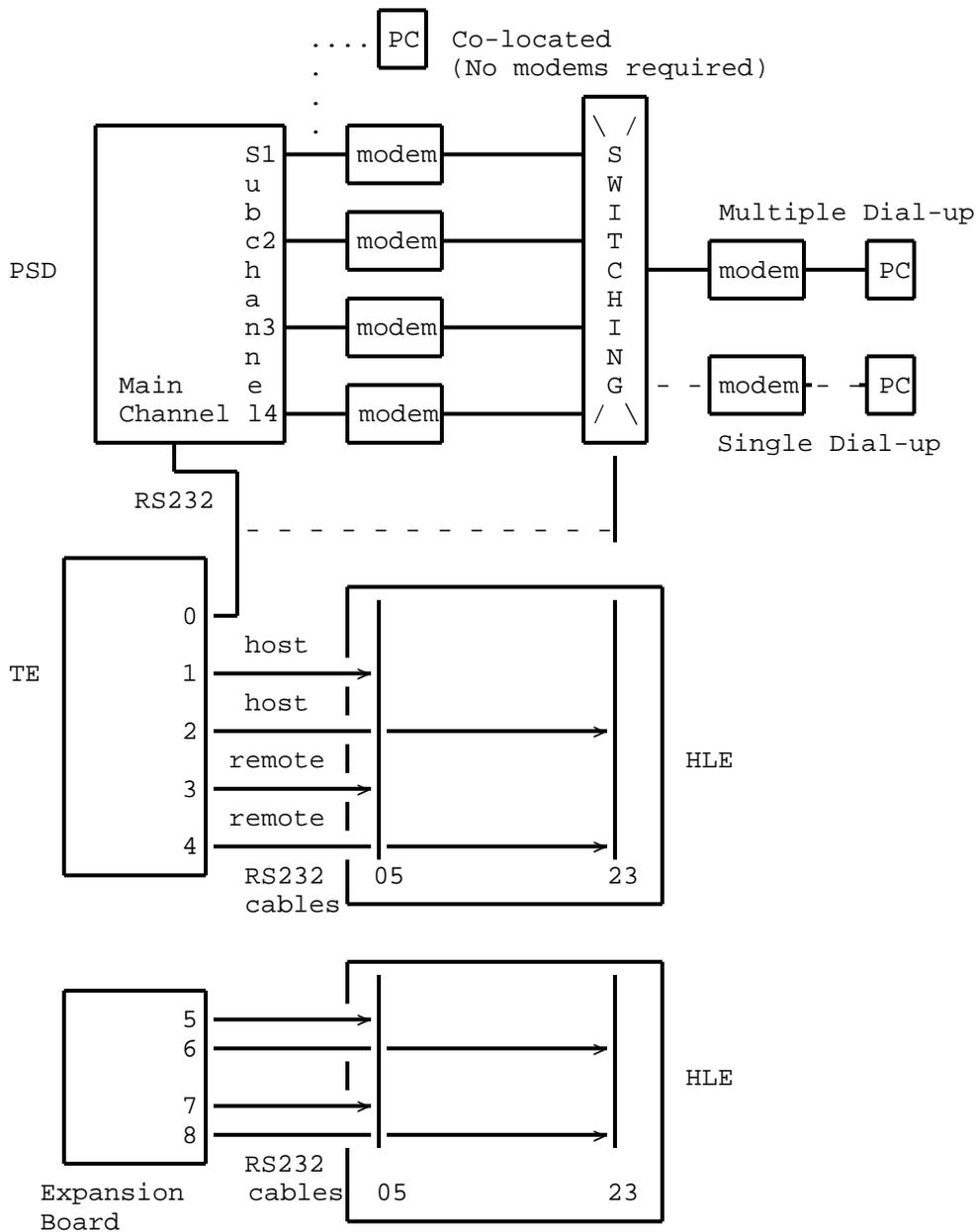
Fig. 20 - Example Configuration for Two HLE/RFLE Shelves

8.08   The   following   steps   describe the required equipment and
       installation:

1. The required equipment is as follows:

     Quantity Description
     -------- -----------
     (1 to 4) Auto-Answer 1200 baud modem (one per dial in).

        (1)   Black Box Terminal Eliminator (Catalog
                # GL-TL482B) with 4 port expansion board
                (Catalog # GL-TL483-C) and
                SPECIAL FIRMWARE TE033189.3E02

        (1)   Black Box Programmable Sharing Device (PSD-4,
                Catalog # GL-TL304B).

     (8 + 1   Male to male, straight RS-232 cables (NT0X26BK or
     for each equivalent).
     modem)

2.   Locate a table, desk or counter where you can place the Ter-
     minal Eliminator and modem(s). Make sure that there is an AC
     outlet for the Terminal Eliminator, the PSD-4 and the
     modem(s).

3.   Configure the DIP switches inside the Terminal Eliminator as
     shown below:

                                       Settings
      Switch
      Designation   1   2   3   4   5   6   7   8
      -------------------   ------------------------------
      SWA - SWE, SWH - SWK   off off on on on on off off

      SWF   on on off off off off on off

      SWG   off off on on off off off off

     Also, ports 1 - 8 should be configured as DTEs and port 0
     should be configured as a DCE using the shunt jumpers for
     each port.

4.   Configure the jumpers and dial setting inside the PSD-4 as
     shown below:

Switch Designation	Settings
S1S2 (MAIN)	DTE position
S3S4, S5S6, S7S8 and S9S10 (SUBCHANNEL)	In DTE position if hooking to a modem and in DCE position if hooking straight to a PC serial port
SW5 (BAUD RATE DIAL)	Position 6 for 1200 baud
J1 (CHASSIS GROUND)	DISCONNECT position
J2 (TIME OUT)	DISABLE position
J3 (FORMAT)	ASYNC position
J4 (CONTENTION)	DATA position

5. Label each RS-232 cable on both ends (for identification).

6. Using 8 of the labeled RS-232 cables, connect ports 1 - 8 of the Black Box Terminal Eliminator (with 4 port expansion board) to the 8 female RS-232 connectors on the 4 NTBX5702 paddle cards on the backplane of the HLE shelves. Make a note of which RS-232 cable is hooked the local and remote port of plane 0 (right side of the HLE shelf, looking from behind the frame) and the local and remote port of plane 1 (the left side of the HLE shelf) on both HLE shelves. Use the form in Appendix B to record the information.   This information will be used later to datafill the PC OAM program.

7. Use 1 of the labeled RS-232 cables to connect port 0 of the Terminal Eliminator to the main channel of the PSD-4 unit.

8. Use the remaining RS-232 cables to connect each auto-answer modem to sub-channels 1 to 4 of the PSD-4 unit. Ensure that the auto-answer modem does not echo characters (echo off) and that the modem only responds to incoming calls (ie. does not recognize commands coming in on the RS-232 port). Most modems have dip switches to control character echo and command recognition.

    Note: If a PC is to be located at the host location instead of at a dial-up location, simply connect the serial port of the PC to one of the PSD-4 subchannels, as shown by the dotted line. Also, make sure that the subchannel is configured as a DCE by using the sliding switch inside the PSD-4 unit.)

    Note: If you only desire one dial up to the host system, you can delete the Black Box Port Sharing Device and all but one Auto-Answer modem.   Simply hook the Auto answer modem

straight to port 0 of the Black Box Terminal Eliminator, as shown by the dashed line.

9. Plug phone lines into each of the auto-answer modems.

8.09   This completes the hardware installation for monitoring two HLE shelves and two corresponding RFLE shelves. Please note that if an additional HLE/RFLE shelf pair is added, a second Terminal Eliminator should be added to the monitoring system. Use the directions in the following sections when expanding your FRSC OAM system.

Monitoring Three HLE/RFLE Shelf Combinations

8.10   Figure 21 on page 57 shows a system that consists of three HLE shelves at the host site (a fully provisioned HLE frame) and three corresponding RFLE shelves at the remote site (along with the MTM shelf, a fully provisioned RFLE frame). The system has 12 NTBX56AA cards, 6 in the HLE shelves and 6 in the RFLE shelves.
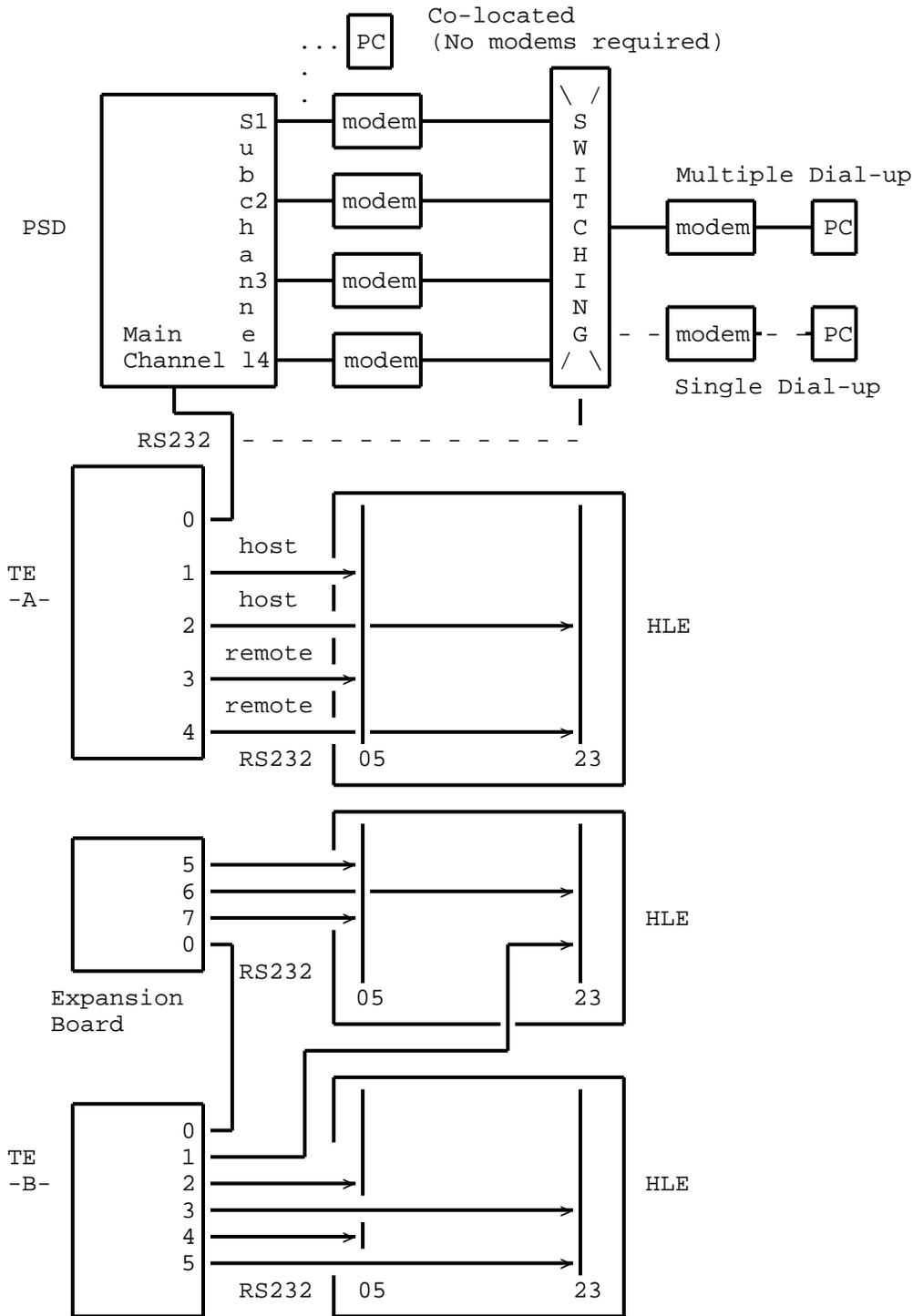
Fig. 21 - Example Configuration for Three HLE/RFLE Shelves

8.11   The   following   steps   describe the required equipment and
installation:

1. Ensure that you have the following equipment:

    Quantity   Description
    --------   -----------
    (1 to 4)   Auto-Answer 1200 baud modem (one per dial in).

       (1)   Black Box Terminal Eliminator (Catalog
                  # GL-TL482B) with 4 port expansion board
                  (Catalog # GL-TL483-C) and
                  SPECIAL FIRMWARE TE033189.3E02

       (1)   Black Box Terminal Eliminator (Catalog
                  # GL-TL482B) with 4 port expansion board
                  (Catalog # GL-TL483-C) and
                  NORMAL PRODUCTION FIRMWARE (ie. no special
                  firmware order).

       (1)   Black Box Programmable Sharing Device (PSD-4,
                  Catalog # GL-TL304B).

    (14 + 1 for Male to male, straight RS-232 cables (NT0X26BK
    each modem) or equivalent).

2. Locate a table, desk or counter where you can place the Ter-
    minal Eliminator(s) and modem(s). Make sure that there is a
    115 ACV outlet for each Terminal Eliminator, the PSD-4 and
    the modem(s).

3. Configure the DIP switches inside the Terminal Eliminators as
    shown below:

                                         Settings
     Switch
     Designation   1   2   3   4   5   6   7   8
     -------------------   -------------------------------
     SWA - SWE, SWH - SWK   off off on on on on off off

     SWF   on on off off off off on off

     SWG   off off on on off off off off

    Also, all ports on both Terminal Eliminators should be con-
    figured as DTEs except for port 0. Port 0 on both Terminal
    Eliminators should be configured as a DCE. Configure the
    ports using the shunt jumpers.

4. Configure the jumpers and dial setting inside the PSD-4 as
    shown below:

```
   Switch                              Settings
   Designation
   -----------                  ------------------------------

   S1S2 (MAIN)                  DTE position

   S3S4, S5S6, S7S8 and          In DTE position if hooking to a
   S9S10 (SUBCHANNEL)           modem and in DCE position if hook-
                                ing straight to a PC serial port

   SW5 (BAUD RATE DIAL)          Position 6 for 1200 baud

   J1 (CHASSIS GROUND)          DISCONNECT position

   J2 (TIME OUT)                DISABLE position

   J3 (FORMAT)                  ASYNC position

   J4 (CONTENTION)              DATA position
```

5. Label each RS-232 cable on both ends (for identification).

Note: For this discussion, the Terminal Eliminator with special
firmware (TE033189.3E02) shall be known as "A" and the Terminal
Eliminator without special firmware shall be known as "B".)

6. Using 7 of the labeled RS-232 cables, connect ports 1 - 7 of
    Terminal Eliminator "A" to 7 of the female RS-232 connectors
    on the 8 NTBX5702 paddle cards on the backplane of the HLE
    shelves. Use 1 RS-232 cable to connect port 8 of Terminal
    Eliminator "A" to port 0 of Terminal Eliminator "B".

    Using 5 of the remaining RS-232 cables, connect ports 1 - 5
    of Terminal Eliminator "B" to the remaining female RS-232
    connectors on the 8 NTBX5702 paddle cards on the backplane of
    the HLE shelves.   Make a note of where each RS-232 cable is
    hooked, to which local and remote port of plane 0 (right side
    of the HLE shelf, looking from behind the frame) and which
    local and remote port of plane 1 (the left side of the HLE
    shelf) on all three HLE shelves. Use the form in Appendix B
    to record the information.   This information will be used
    later to datafill the PC OAM program.

7. Use 1 of the labeled RS-232 cables to connect port 0 of the
    Terminal Eliminator to the main channel of the PSD-4 unit.

8. Use the remaining RS-232 cables to connect each auto-answer
    modem to sub-channels 1 to 4 of the PSD-4 unit. Ensure that
    the auto-answer modem does not echo characters (echo off) and
    that the modem only responds to incoming calls (ie. does not
    recognize commands coming in on the RS-232 port). Most mod-
    ems have dip switches to control character echo and command
    recognition.

Note: If a PC is to be located at the host location instead
of at a dial-up location, simply connect the serial port of
the PC to one of the PSD-4 subchannels, as shown by the dot-
ted line. Also, make sure that the subchannel is configured
as a DCE by using the sliding switch inside the PSD-4 unit.)

Note: If you only desire one dial up to the host system, you
can delete the Black Box Port Sharing Device and all but one
Auto-Answer modem.   Simply hook the Auto answer modem
straight to port 0 of the Black Box Terminal Eliminator, as
shown by the dashed line.

9. Plug phone lines into each of the auto-answer modems.

8.12   This completes the hardware installation for monitoring
       three HLE shelves and three corresponding RFLE shelves.
Please note that if additional HLE/RFLE frames are added, they
should be set up as a separate system, using the above
directions.   The FRSC OAM program can be used to call each HLE
frame (one at a time) or another PC for each additional HLE frame
can be installed at the maintenance center for continuous moni-
toring of all HLE frames.

9.   OPERATING THE ENHANCED OAM INTERFACE

DATAFILLING THE SPECIFIC CONFIGURATION

9.01   Upon   startup,   the   program   looks for a data file (named
        PORT.DAT) containing specific information about the host
site being monitored. Upon initial installation, this file will
not exist and the user will be asked first for the number of
NTBX56 cards in the system (1 to 12) and then for information
about each of these BX56 cards. This information relates a port
on the Black Box Terminal Eliminator to a particular BX56 card.

9.02   The NTBX56 card connected to port 1 of the Black Box Ter-
        minal Eliminator is card 1, the NTBX56 card connected to
Terminal Eliminator port 2 is card 2 and so on, up to card 8. If
there are only 8 BX56 cards, then the system requires only one
Terminal Eliminator to monitor all 8 cards and NTBX56 card 8 is
connected to port 8.   However, if more than 8 BX56 cards are
being monitored, card 8 is connected to port 1 of the second Ter-
minal Eliminator. This is due to the fact that port 8 of the
first Terminal Eliminator is connected to port 0 of the second
Terminal Eliminator (See section of installing hardware for moni-
toring 3 HLE/RFLE shelf combinations for more detail).   The
NTBX56 card 9 would then connect to port 2 of the second Terminal
Eliminator and so on.

9.03   The information necessary to answer the FRSC OAM datafill
        questions will need to be obtained during hardware instal-
lation.   Use the form in Appendix B to record the necessary
information.   The following is a list of the information
requested about each NTBX56 card being monitored by the program.

1.   Number of NTBX56AA cards

     Total number of NTBX56AA cards being monitored at both the
     host and the remote site.   This is equal to the number of
     Terminal Eliminator ports hooked directly to BX56 cards.

2.   Site Name

     A unique name for the host or remote site that can be up to 8
     characters long. The name should not contain blank spaces.

3.   Site Location

     Where the card is located, at the Host end (along with the
     DMS Network) or at the Remote end with the peripheral equip-
     ment.

4.   Associated Far End Port

     If datafilling for a remote card, the port monitoring the
     host card of this remote card.   If datafilling for a host

card, the port monitoring the remote card with which this host card is associated.

5. Network Plane

The DMS Network Plane Number (0 or 1).

6. Network Links Supported

The number of DMS DS-30 links being supported by this BX56 card. The answer will be a number from 1 to 8.

7. Specific DMS DS-30 Link Numbers

The corresponding DS30 link number (from the DMS datafill) of each of the links that are supported by each NTBX56AA card. You may change this data after all links are entered by answering 'N' to the question "Is the data correct (Y/N)?

8. Frame Number

The number identifier of the DMS frame that this card resides in.

9. Shelf Position

The DMS frame shelf position. Must be 18 (the bottom RLE shelf), 32 (the middle RLE shelf) or 51 (the top RLE shelf).

10. Port LOG file

The name of the file that you want messages from this NTBX56 card to be captured in. Must be 8 characters or less and must not contain any blank spaces.

11. MASTER/MONITOR Mode

The program will now ask the user if they want to log on as a 'MONITOR' or as a 'MASTER.' In the MONITOR mode, a PC can monitor the status of the host site, but can not send commands to the BX56 cards. Also, the communication links are not supervised in the MONITOR mode. In the MASTER mode, the PC has full access to the system and can issue any available BX56 command. Also, a PC in the MASTER mode will supervise the communication link with each NTBX56 card and flag any cards that are not responding.

As many as four PCs can be monitoring one host site at the same time but only one of the four PCs can be in MASTER mode. If more than one PC is dialed into the host site, users should coordinate who is to be MASTER and who is to be MONITOR. Hitting carriage return or answering 'N' to this question ('Do you want to log on as MASTER?'), will put the PC in MONITOR mode. Answering 'Y' to this question will put the PC in MASTER mode.

Once the program is started, the Change PC Mode command can be used to query which mode the PC is in, and also to change mode from MASTER to MONITOR or from MONITOR to MASTER.

```
CAUTION
```

If more than one PC is monitoring a host site, only one of those PCs should be in MASTER mode.   The ability to be the MASTER PC can be passed from one PC to another by first putting the MASTER PC into MONITOR mode (using the Change PC Mode command), and then changing the desired MONITOR PC to MASTER mode.   Having two MASTER PCs talking to the same host site can lock-up the PCs and the host mainte-nance communications equipment (specifically, the Terminal Eliminator).

12. Dial-up vs. Host Access

The program will ask you if you want to dial up a host site. If the PC is located at the host site, and hooks straight to the PSD-4 unit, then the question should be answered 'N' for no.   If the PC is using a modem to dial up the host site, then the question should be answered 'Y' for yes. If 'Y' is typed in, the user is prompted for the telephone number of the host site. All Hayes modem dialing conventions can be used; refer to the modem instruction manual for the use of the 'pause' character and such.

USING THE PROGRAM STATUS SCREEN

9.04   After the modem call is made, or 'N' is answered to the telecom module prompt, the normal program status screen will appear, as shown in Figure 22 on page 64.

Port 01	Port 02	Port 03	Port 04
....	....	....	....

   H.18.1.MATE   H.18.0.CO   R.18.1.MATE   R.18.0.CO

```
P3 <link establish test passed>
P3 <control test passed>
P3 <terminal communication test passed>
P3 <Q
P3 <REMOTE unit INACTIVE PLANE 1>
P3 <terminal communication through DS1>
P3 <continue on error>
P3 <in sync on the other unit>
P3 <no tests active>
P3 <6X50 boards loopbacks inactive>
P3 <terminal communication on link 0A>
P3 <activity on link(s) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C
P3                                                  0D 0E 0F of
P3 <index  plus minus  center  sample   delta  integrate dac  p

P3 <0000FF 000001 000004 000002 000002 0 0000 00EF21 000779 000
```

```
 ISDN  HLE/RLE    Press any key for MENU              REV1.5
```

Fig. 22 – Program Status Screen

9.05   The Program Status Screen is made up of three areas:

1. a status window (for each NTBX56AA card)

2. a message window (for logs and commands)

3. a status line at the bottom of the screen.

9.06   In addition, there is a command menu accessed by hitting
       any key on the PC keyboard, and a help menu which is
accessed through the command menu.   Each of these screen areas
will be covered in detail.

Status Window (Alarms) for Each NTBX56AA

9.07   A   Link   Status   display board appears for each port data-
        filled in the system. All alarms and link information   is
displayed   here.   The   display   is   updated   every   time a LOG is
received with link status information.

9.08   Condition of the System:

9.09   Following are the types of indicators that can appear   and
        their meaning.

*   No alarms

     A   port with no alarms, supporting 5 DS-30 Network links with
     all DS1 links established will look like this:

```
┌─────────────────────┐
│      Port 1         │        .  means DS1 link established
│..........------      │        -  means not datafilled
└─────────────────────┘
```

     If an alarm is received, then the number of the link is dis-
     played   and   the alarm type is displayed beneath it, as shown
     in the next items.

*   DS-1 Alarm

```
                  ┌─────────────────────┐
                  │      Port 1         │
Link Number->     │..3.......------      │
                  │           ALARM │ <-- reverse video
                  └─────────────────────┘
```

              link # and 'ALARM' -- reverse video

*   Frame Loss

```
                  ┌─────────────────────┐
                  │      Port 1         │
Link Number->     │..3.......------      │
                  │           Frame │ <-- highlighted normal video
                  └─────────────────────┘
```

*   Frame Slip

```
                   ┌─────────────────────┐
                   │      Port 1         │
Link Number->      │ ..3.......──────     │
                   │             Slip│<── normal video
                   └─────────────────────┘
```

        The above alarms remain on the status board until they are
        cleared by selecting the 'Clear Alm Flags' option from the
        COMMAND menu.

*   A DS-1 has been lost

        If a link is lost, the link number is indicated flashing with
        a DS-1(s) LOST message. Other alarms associated with this
        link only are cleared.   The following example shows a port
        which has lost DS-1 link number 3.

```
                   ┌─────────────────────┐
                   │      Port 1         │
                   │ ..3.......──────     │
                   │                     │
                   │ DS-1(s) L O S T     │
                   └─────────────────────┘
```

        If a link fails, it will indicate a yellow alarm, frame
        slips, and frame loss before going down. The following
        assumes there are no alarms at the fiber transmission equip-
        ment.

        Determine whether the failure is at the local or far end by
        running a local DS-1 loopback at both the HLE and RFLE.   If
        the loopback fails, replace the local NT6X50AA card.

*   Port does not have sync

        If a port does not have sync, then a 'No sync' message is
        displayed. If sync was lost during normal operation, the mes-
        sage is in reverse video. If sync is lost as a result of a
        reset occurring, the message is written in normal video.

*   Communication Link is down

        Whenever there are no user commands being executed, the com-
        munication link to each port is monitored by the PC. When a
        NTBX56AA card fails to answer 3 polls, the link is marked as
        down, and the message "COMM LINK DOWN" is displayed in flash-
        ing letters for that port window, as in the following:

```
┌─────────────────────────┐
│       Port 1            │
│  ................       │
│                         │
│   COMM LINK DOWN        │
└─────────────────────────┘
```

When the communication link is down, the information in the port status window is not accurate. Steps must then be taken to re-establish the communication link, which usually means replacing the far end NTBX56.

9.10   Additional Alarm Information:

9.11   Underneath each port window, there is a line containing the following information:

*   NTBX56AA card site location (Host or Remote)

*   shelf position (18, 32 or 51)

*   network plane supported (0 or 1), and

*   source of sync, either the Mate card (MATE) or the Central Office (CO).

9.12   The following example shows this information line:

```
┌─────────────────────────┐
│       Port 1            │
│  ..23...........        │
│                         │
│  DS-1(s) L O S T        │
│  H,18,1,MATE            │
└─────────────────────────┘
```

9.13   In this example, the NTBX56AA monitored by port 1 is at the Host site (H), on shelf 18, supporting network plane 1 and synced to its mate card (ie. flashing AF on the NTBX56AA hex display).

Message Window (for Logs and Commands)

9.14   All incoming logs from the NTBX56AA cards being monitored are displayed in the message window. This window's size is made proportionate to the number of status windows needed on the screen. The more status windows, the smaller the message window and vice versa. Also, when commands are executed, the outgoing commands and the responses from the NTBX56AA cards are shown in the message window. When you execute a command, you

should watch the message window to be sure the command executed
as expected.

Status Line (for Available Commands)

9.15   At the bottom of the screen is a status line. During nor-
        mal monitoring, the line tells the FRSC OAM software
revision number and the available options (ie. Hit Any Key for
Command Menu). During command execution, the status line will
contain appropriate information to the command being executed.

THE COMMAND MENU

9.16   The command menu is used to query or troubleshoot the FRSC
        system and to update the information on the PC screen.
The menu is pulled up to the left part of the screen by hitting
any key on the PC keyboard. Notice that when the command menu is
on the screen, there are directions for its use on the Status
Line at the bottom of the screen. A command is executed by using
the arrow keys on the PC keyboard to selecting a command, and
then pressing Enter.

Note: Only the MASTER PC can execute BX56 commands. If a BX56
command is executed by a PC in the MONITOR mode, an error message
is displayed and the command is aborted.

9.17   Figure 23 on page 69 shows the Command Menu.

```
 *COMMAND MENU*     ┌──────────────┬──────────────┬─────────────┐
                    │   Port  02   │   Port  03   │   Port  04  │
Abort Menu          │..............│..............│............ │
HELP                │              │              │             │
Scan Recent Alm     ├──────────────┴──────────────┴─────────────┤
Update Port         │   H.18.0.CO      R.18.1.MATE     R.18.0.CO │
Clear Alm Flags     │                                           │
                    ├───────────────────────────────────────────┤
Query Sync Link     │ h test passed>                            │
Query Port Data     │ passed>                                   │
Translate Links     │ unication test passed>                    │
                    │                                           │
Find Mtc Link       │ NACTIVE PLANE 1>                          │
Clear Comm          │ unication through DS1>                    │
Polling OFF/ON      │ rror>                                     │
LinkAudit OFF/ON    │ e other unit>                            │
                    │ ve>                                       │
Purge LOG files     │ oopbacks inactive>                        │
                    │ unication on link 0A>                     │
BX56 F/W Version    │ ink(s) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C│
Set/Rem Loopback    │                               0D 0E 0F of 1 │
Passthru            │ inus  center  sample   delta  integrate dac  p│
                    │                                           │
DOS Command         │  000004 000002 000002 0 0000  00EF21 000779 0000│
QUIT to DOS         └───────────────────────────────────────────┘
```

┌───┐
│ Select COMMAND MENU item using arrow keys and press <ENTER> │
└───┘

Fig. 23 - The Command Menu

9.18   These commands are divided into 6 distinct groups (sepa-
       rated by a blank line):

1.   Normal Operation

2.   Querying system information

3.   Troubleshooting

4.   Managing files

5.   Troubleshooting in depth

6.   Using DOS commands

9.19   The commands used to support these functions are explained
       in the following sections.

Note: BX56 commands are marked as "MASTER Mode Only."

<u>For Normal Operation</u>

*   Abort Menu Command

     This command exits the command menu, and returns the PC to
     its normal monitoring mode.   The command menu can also be
     exited by placing the cursor on a space with no command and
     hitting enter.

*   HELP command

     This command pulls up the Help menu on the right side of the
     PC screen. Once this screen is up, you can get help for com-
     mands by using the arrow keys to choose the command in the
     help menu and hitting enter.   This bring up a window with
     information text on your choice. You can scroll through the
     text using the PC keyboard arrow keys.

     Exit the Help screen by hitting the escape key (ESC).   In
     addition to help on each command available from the command
     menu, there is also help available on reading port status
     information (Status Display) and executing maintenance proce-
     dures (Mtc Procedures). Figure 24 on page 71 shows the help
     screen.

```
                                      ** HELP MENU **
 ┌─────────────────┬─────────────────┬──┤ Abort Menu
 │                 │                 │  │  Mtc Procedures
 │    Port  01     │    Port  02     │Po│ Status Display
 │.................│.................│..│ Scan Recent Alm
 │                 │                 │  │ Update Port
 │                 │                 │  │ Clear Alm Flags
   H.18.1.MATE        H.18.0.CO      R.18│
                                      │  Query Sync Link
 ┌─────────────────────────────────────┤  Query Port Data
 │P1 V                                  │ Translate Links
 │P1 < BX56AA firmware issue 2 version 1.0 Find Mtc Link
 │P1 <                                  │ Clear Comm
 │P1 V                                  │ Polling OFF/ON
 │P2 V                                  │ LinkAudit OFF/ON
 │P3 V                                  │
 │P4 V                                  │ Purge LOG files
 │                                      │
 │                                      │ BX56 F/W Version
 │                                      │ Set/Rem Loopback
 │                                      │ Passthru
 │                                      │
 │                                      │ DOS Command
 │                                      │ QUIT to DOS
 └─────────────────────────────────────┴──────────────────┘


 ┌──────────────────────────────────────────────────────┐
 │ Select HELP MENU item using arrow keys and press <ENTER>│
 └──────────────────────────────────────────────────────┘
```

Fig. 24 - The Help Menu Screen

*   Scan Recent Alm Command

    Selecting this item from the command menu allows the user to
    examine the last 40 most recent LOGS received by the system
    from all ports.

    The LOGS are arranged in order of reception, with the more
    recent logs occurring towards the bottom of the file. (i.e.
    oldest LOG at the top of the file, most recent log at the
    bottom)

    The user can scroll through these LOGs using the cursor arrow
    keys, and the paging keys (PageUp, PageDown, Home, End).

    Pressing the <ESC> key quits this option and resumes OAM nor-
    mal operation.

*   Update Port Command (MASTER Mode Only)

Selecting this item from the command menu allows the user to
update the status and state information maintained by the
system for the specified port. This is done by sending the
'P' command and the 'Q' command to the NTBX56. The 'P' com-
mand queries power-up results and the 'Q' command queries
current card status.

At Selection of this option the user is prompted for a port
number.

This option is used to inform the system of the state of the
HLE/RLE links during startup, or following an interruption in
the OAM cable connections.

This command is executed automatically upon FRSC OAM program
startup and upon re-establishment of a lost communication
link.

Note: If a link has not been established, then its number
will be left on the status board. Since the system has no way
of knowing if this link was lost or never established, the
LOST alarm is not raised.

*   Clear Alm Flags Command

The system will not clear DS1 link ALARMs, Frame Loss and
Frame Slip alarms automatically. Selecting this option will
only clear these three 'soft' alarms. It will not clear LOST
link indications from the board.

Querying the System

*   Query Sync Link Command

This option is used to find out the sync source for a speci-
fied port. At Selection of this option the user is prompted
for a port number.

The HOST units derive their sync source from the DS-30 Net-
work Links. The remote units derive sync off one of the DS1
links. The remote side unit will seek a sync source from one
of the DS1 links 0 to E.

The 'active' unit means the unit which is generating the sync
from a DS1 link (BX56 HEX display An where n is one of HEX 0
to HEX E).

The 'inactive' unit (the other plane) gains its sync signal
from the 'active' unit (BX56 HEX display AF).

Note: The 'active' and 'inactive' designations are NOT
related to which DMS Network plane is considered active.

Both planes of the HLE/RLE Remote equipment are to be consid-
ered active because they are carrying the exact same traffic.
The DMS active side depends on the DMS XPM and the DMS NM.

* Query Port Data

The 'Query Port Data' option displays the datafill informa-
tion for a specified port. The data includes:

— Site Name
— Location (Host site or Remote site)
— Associated Far End Port
— Network Plane supported
— Number of Network Links supported
— DMS Frame number
— DMS shelf position
— Port Prefix designation
— LOG file name for this port

Following is an example output.

```
        Query BX56 Port Datafill Information

PORT:  1
Associated Far End Port : 3
Site Name : isdn  HOST
Frame Number 1  /  Shelf Position 18
Network plane 1 ---  8 DS30 links
Port Prefix : P1  Log filename : p1.log
```

* Translate Links

The DS-30 Network links are transported to the remote site
using DS1 trunks. One DS30 is supported by 2 DS1 trunks. The
maintenance links are also supported by the same DS1s.

This option permits the user to query which DS1 links support
which DS-30, and which DS-30 is supported by a specific DS-1.
At Selection of this option, the user is prompted for a port
number, the direction (DS-1 to DS-30 or DS-30 to DS-1), and
then either the DS-1 or the DS-30 link number and network
module

The DS-30 links designations are in terms of the HLE DS-30
ports and not the DMS Network Link numbers.

Troubleshooting

*   Find Mtc Link Command (MASTER Mode Only)

    Communication with the far-end site HLE/RLE equipment is accomplished by establishing a maintenance link.

    On selection of this option, the user is prompted to enter a Port number. This command takes several seconds to complete (about 45 seconds). On successful completion, the following message will appear on the main window:

            P# COMMUNICATION ESTABLISHED ON LINK ##

    If the command is unsuccessful then the message will read:

            P# UNABLE TO ESTABLISH COMMUNICATION ON ANY LINK

    If this occurs, re-execute the command.

    If a maintenance command is issued to a far-end port and no response is received then execute this option on the related near-end port to establish communication. In order to find out which far end port is associated with the port you are trying to communicate with, use the Query Port Data command (Associated Far End Port). For example:

    Near-end port   Plane 0   connected to Port 1
    Far-end port   Plane 0   connected to Port 2

    Execute the 'Find Mtc Link' on Port 1 to establish
    the Port 2 maintenance link.

*   Clear Comm Command (MASTER Mode Only)

    This option clears a corrupted communication link to a BX56 port. The user is queried for the port number. If this command is not successful in re-establishing normal operation, check port cabling and for far-end ports, execute the 'Find Mtc Link' option.

*   Change PC Mode

    As many as four PCs can be monitoring one host site. Each PC can be in one of two modes, the MONITOR mode or the MASTER mode.

    In the MONITOR mode, a PC can monitor the status of the host site, but can not send commands to the BX56 cards. Also, the communication links are not supervised in the MONITOR mode.

    In the MASTER mode, the PC has full access to the system and can issue any available BX56 command. Also, a PC in the MASTER mode will supervise the communication link with each NTBX56 card and flag any cards that are not responding.

The Change PC Mode command can be used to query which mode the PC is in, and also to change mode from MASTER to MONITOR or from MONITOR to MASTER.

```
┌─────────────┐
│   CAUTION   │
└─────────────┘
```

If more than one PC is monitoring a host site, only one of those PCs should be in MASTER mode. The ability to be the MASTER PC can be passed from one PC to another by first putting the MASTER PC into MONITOR mode (using the Change PC Mode command), and then changing the desired MONITOR PC to MASTER mode. Having two MASTER PCs talking to the same host site can lock-up the PCs and the host maintenance communications equipment.

Managing Files

*   Purge LOG files Command

    This option allows the user to erase the contents of the LOG files and start clean. All the Port log files are re-initialized to an empty state.

    In addition, this option will recover LOG file operation if the existing LOG files are inadvertently erased from the DOS command level. All previous data will be lost.

    This system also automatically monitors the disk space availability on the system. If the disk becomes full to a specified capacity, the LOG files are automatically re-initialized, preventing the OAM LOGS from completely overrunning the disk capacity. Some reserve disk capacity is always maintained on the PC system.

Troubleshooting (in Depth)

*   BX56 F/W Version Command (MASTER Mode Only)

    This option queries the BX56 firmware version installed on system for a specified port.

    This is used to enable the user to verify the system is running the correct firmware version.

*   Set/Rem Loopback Command (MASTER Mode Only)

    This option permits the user to set DS1 loopbacks on the system for a specified port. DS1 loopbacks can be used to trouble shoot remote link problems. (Note: The DMS-100

speechloop test should pass with the appropriate DS1s in loopback, but the message test will not pass.)

The loopback types available are

   All DS1 links
   Individual links

The system keeps track of what loopbacks are set. If a link is looped for a particular loop type, then selecting 'Set/Rem Loopback' will remove the loopback.

DS1 loopbacks loop the NT6X50AA pack onto itself. Setting these loopbacks will raise alarms on the related far-end port of the system.

Loopbacks are only allowed on the near-end DS1s because far-end DS1 loopbacks will cause a loss of communication with the host-end processor (NTBX56AA).

*   Passthru Command (MASTER Mode Only)

This is a diagnostic option not required for general opera-tion of the system. It permits direct communication with the specified port.

This option is passworded and should be used with caution since inadvertent system disruption is possible.

For this mode only, prefix all numbers entered including HEX link numbers with an '#'.

```
┌─────────────┐
│   CAUTION   │
└─────────────┘
```

   Always exit this mode when finished by pressing
   <ESC>.   Remaining in this mode for an extended
   period of time may result in loss of data on the
   other ports in the system. If this mode has been
   active for an extended period of time and loss of
   data is suspected, then execute the 'Update Port'
   command to recover.

Using DOS Commands

*   DOS Command

     Selecting this item from the command menu allows the user to
     execute any command on the PC without terminating the current
     OAM session.

     The user is prompted for the DOS command to be executed. The
     command is executed, showing the results on the screen.
     Pressing any key following execution of the DOS command
     resumes OAM operation.

     LOGs received from the remotes (HLE/RLE) will buffered during
     this time and processed once the OAM process is resumed. Loss
     of data could occur if the system is left in the suspended
     state (waiting for a key to be pressed) for an extended peri-
     od of time. The system is in its normal processing state when
     the status line at the bottom of the screen reads:

          "Press any key for Menu"

     This function can be used to scan specific port LOG files
     using the DOS 'type' or 'more' function, print all or a por-
     tion of the files and any other related activities. This
     function can also be used to save datafill specific to one
     site (for future use) and allow new datafill for a new site.
     Also, previous datafill files that were saved can be brought
     back up as the current datafill file. (See Additional Com-
     mands section for more detail).

┌──────────────┐
│   CAUTION   │
└──────────────┘

          Do not delete the LOG files using the DOS delete
          command or subsequent LOG data will be lost. To
          delete LOG files and start new log files use the
          'Purge LOG files' option on the COMMAND menu. If
          the LOG files are accidentally deleted under DOS,
          then immediately execute the 'Purge LOG files'
          option to restore normal operation.

     For more information on DOS command, consult a DOS Reference
     Manual.

*   QUIT to DOS Command

     This option executes a complete shutdown of the OAM system
     and then exits to the DOS environment.

     The user is queried to confirm this request.

Additional Commands

9.20   Even though knowledge of DOS commands is not essential to
        the OAM program operation, there are a few DOS commands
that can be very useful. These commands are listed below.   For
more detailed information on DOS commands, consult a DOS refer-
ence manual. All of the DOS commands described below can be exe-
cuted from within the FRSC OAM program, using the 'DOS Command'
option from the command menu.

*   Type DOS command

     The type command allows a user to view an ascii text file on
     the computer screen. The format is 'Type (FN.FT)' where
     FN.FT is the filename and filetype of the file to be typed.
     This command is useful to examine log files. If a ¦ more' is
     appended to the type command, the computer will pause after
     each screen full of text until told to continue by the user
     by hitting any key.

*   Print DOS command

     If the PC in use has access to a printer, files can be print-
     ed out using this command.   The format is 'Print (FN.FT)'
     where FN.FT is the filename and filetype of the file to
     print. This command is useful in printing out log files and
     datafill files without leaving the FRSC OAM program.

*   DIR DOS command

     This is the DIRectory command. The format of this command is
     'DIR'.   This command displays the files that are on the hard
     disk. This command is useful for keeping track of datafill
     files and port log files. The '¦ more' option, described in
     the 'TYPE' command, can also be used with the 'DIR' command.

*   Rename DOS command

     This command is used to rename files on the PC disk; use this
     command with extreme care. The format is 'Rename (FN1.FT1)
     (FN2.FT2)' where FN1.FT1 is the filename and filetype of the
     file to be renamed, and FN2.FT2 is the new filename and file-
     type.

     This command can be used to change the datafill used by the
     OAM program.   First the current datafill file, PORT.DAT, is
     renamed to some filename easily remembered, for instance the
     host sitename of the site that this data file describes. At
     this point, you can either recall a previous datafill file by
     renaming it to PORT.DAT (use the DIR and Type commands to
     find out what files are available) , or start a new datafill
     file by rebooting the PC (control-alternate-delete).   When
     the FRSC OAM program restarts, you will be queried for new
     datafill information because the program could not find the
     file PORT.DAT.

*   Exit DOS

    Use this command to return to the OAM program.

10. PROVISIONING

PROVISIONING GUIDELINES

<u>HLE</u>

10.01 Figure 25 on page 81 shows the basic provisioning rules
       for the HLE frame.

```
Equipment                  PEC        Position   Rule
_____                 ___        _____   ____


Common framework           NT0X25AA              1
Earthquake framework        NT0X25AH              1
Frame Supervisory Panel    NTNX26BH    45         7
RLE Shelf                  NTBX5501    18         AP
RLE Shelf                  NTBX5501    32,51      2
RLE Paddle Board           NTBX5702              6
Fan Unit                                          3
Cage Filler Panel Asbly    NT0X84AA    65         AP
Cage Filler Panel Asbly    NT0X84AA              2
Circuit cards                                     4
Cables                                            5
```

Provisioning Rules

AP = Always Provided
1 = Provide either common or earthquake framework
2 = Determine how many RLE shelves are required
     based on each RLE shelf supporting 8 DS-30
     links per plane.
3 = Provide one per frame
4 = Refer to the System Component part for a layout
     of the RLE shelf. Provide enough DS-1 cards
     to support the DS-30 network ports for the
     LGCIs and MTMs. Each DS-30 port requires two
     DS-1 links. Work each shelf group from the
     outside in. Provide NT0X50 for unused slots.
5 = Following are the cables required:

        NT0X26ZC - DS-30 between the HLE and SLCC
        (One cable per group of four DS-30 links)

        NE-ABAM 18 pair - DS-1 between HLE and DSX-1
        (Four pairs per DS-30 per plane, so 32 pairs
         per plane per shelf). Separate cables should
         be used per plane.

6 = Two NTBX5702s per NTBX5501 RLE shelf

7 = Contains two NT0X91AEs and two NT0X91AAs

            Fig. 25 - HLE Frame Provisioning Rules

10.02 In addition, the following rules are to be followed to
       determine HLE requirements:

*   After determining the total number of DS-1 links that are to
    be connected from remote sites, subtract the DS-1 links car-
    rying Packet Handler traffic since these will be routed to
    the DIU.

*   Divide the number of DS-1 links by two to obtain the shelf
    requirements for both planes.

*   The minimum configuration is one RLE shelf. With all three
    shelves fully configured, the HLE supports 48 DS-1 links per
    plane over 24 NT6X50AA cards or 24 DS-30 ports per plane.

*   Provision the DIU at the Packet Handler to support additional
    DS-1 links.   One DS-1 link is used for packet handling per
    LGCI.

*   The DS-1 links are provisioned to account for supporting two
    planes, except for the DS-1 to the packet handler.

<u>RFLE</u>

10.03 Figure 26 on page 83 shows the basic provisioning rules
       for the RFLE frame.

```
Equipment                      PEC          Position    Rule
_____                     ___          _____    ____

Common framework           NT0X25AA                     1
Earthquake framework        NT0X25AH                     1
Frame Supervisory Panel     NTNX26BH       45            7
RLE Shelf                   NTBX5501       18            AP
RLE Shelf                   NTBX5501       32,51          2
RLE Paddle Board            NTBX5702                     6
Fan Unit                    NT3X90AC                     3
Maintenance Trunk Module   NT2X58CA       65            4
MTM Circuit cards           NT2X58AW       65            4
Cage Filler Panel Asbly    NT0X84AA                     2
RLE Circuit cards                                        5
Cables                                                  6
```

Provisioning Rules

AP = Always Provided
1 = Provide either common or earthquake framework.
2 = Determine how many RLE shelves are required
     based on each RLE shelf supporting 8 DS-30
     links per plane.
3 = Provide one per frame
4 = Determine requirements for line testing and frame
     alarm scanning for remote frames.
5 = Refer to the System Component part for a layout
     of the RLE shelf. Provide enough DS-1 cards
     to support the DS-30 network ports for the
     LGCIs and MTMs. Each DS-30 port requires two
     DS-1 links. Work each shelf group from the
     outside in. Provide NT0X50AAs for unused slots.

6 = Following are the cables required:

     NT0X26ZC - DS-30 between the RFLE and SLCC
     (One cable per group of four DS-30 links)

     NTNX36CK - With the RFLE, the DS-30 of the
     MTM is hard-wired to the FSP of the RFLE.
     Use this cable to connect the FSP (C03/CO4)
     to the RLE shelf. When the DS-30 ports of
     MTM are not hard-wired, a kit (NTBX66WB) is
     provided so that the NTNX36CK can be used.

     Use the NTNX36CL cable to connect the RLE
     shelf directly to the LGCI.

7 = Two NTBX5702s per NTBX5501 RLE shelf
8 = Contains two NT0X91AEs and two NT0X91AAs

Fig. 26 - RFLE Frame Provisioning Rules

10.04 In addition, the following rules are to be followed to
       determine RFLE requirements:

*   For each remote site calculate the number of ISDN lines using
     the same rules as for a host site, with 20 lines per drawer
     and limiting each LGCI to support 420 lines.

*   Determine the number of DS-30 ports required by multiplying
     the number of ISDN line cards by two B channels; D-channel
     traffic is routed to the Packet Handler from the Ds-1s of the
     LGCI.

*   Multiply the number of DS-30 ports by two to determine the
     number of DS-1 links required per network plane.

<u>Printer and Personal Computer Interface</u>s

10.05 If the printer interface is to be used, two printers are
       required per RLE shelf. These printers can be at the host
or remote site.

10.06 If the personal computer interface is used, one to four
       PCs can be used. Refer to Part 7 on page 43.

10.07 To comply with Isolated System Ground (ISG), use current
       loop converters on the cable from the Paddle Board
(NTBX5702) to the printer. Figure 27 shows the configuration and
order codes.   Note that this equipment is duplicated for each
NTBX57AA if the system is to be ISG-compliant.

Passive Current   Active Current
Loop Converter   Loop Converter

NTBX5702 A0354167 ———— A0354166 —< Printer
                  4-wire
                  cable

                  Power Supply   A03541268
                  (for active unit)
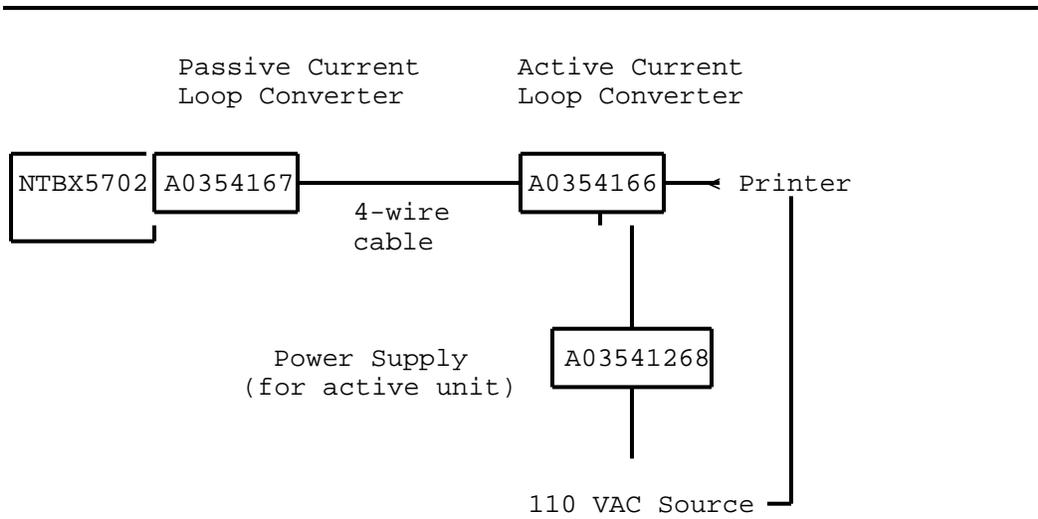
                  110 VAC Source —

Fig. 27 - Connecting the NTBX5702 (ISG Compliant)

EXAMPLE CONFIGURATIONS

10.08 Remember that because of the RLE configuration, the LGCI
       is limited to a maximum of eight C-side links per plane.
Figure 28 on page 86 shows the overall configuration in terms of
the number of links.

320 ISDN

LCMI-1

LCMI-1

LCMI-0

LCMI-0

2-18
DS-30

LCEI

LGCI-1

LGCI-0

LGEI

MTM

FSP

RLE RLE

RFLE

D F
S A
1 C
   I
T L
R I
A T
N I
S E
M S
I
S
S
I
O
N

16 DS-1

16 DS-1

DS-1

(B8ZS)

Packet Handler Link
DS-1 (B8ZS)

Plane1

Plane0

Network

FSP

8 DS-30

RLE RLE

8 DS-30

HLE

DIU

AM

RM

DPN -
Host
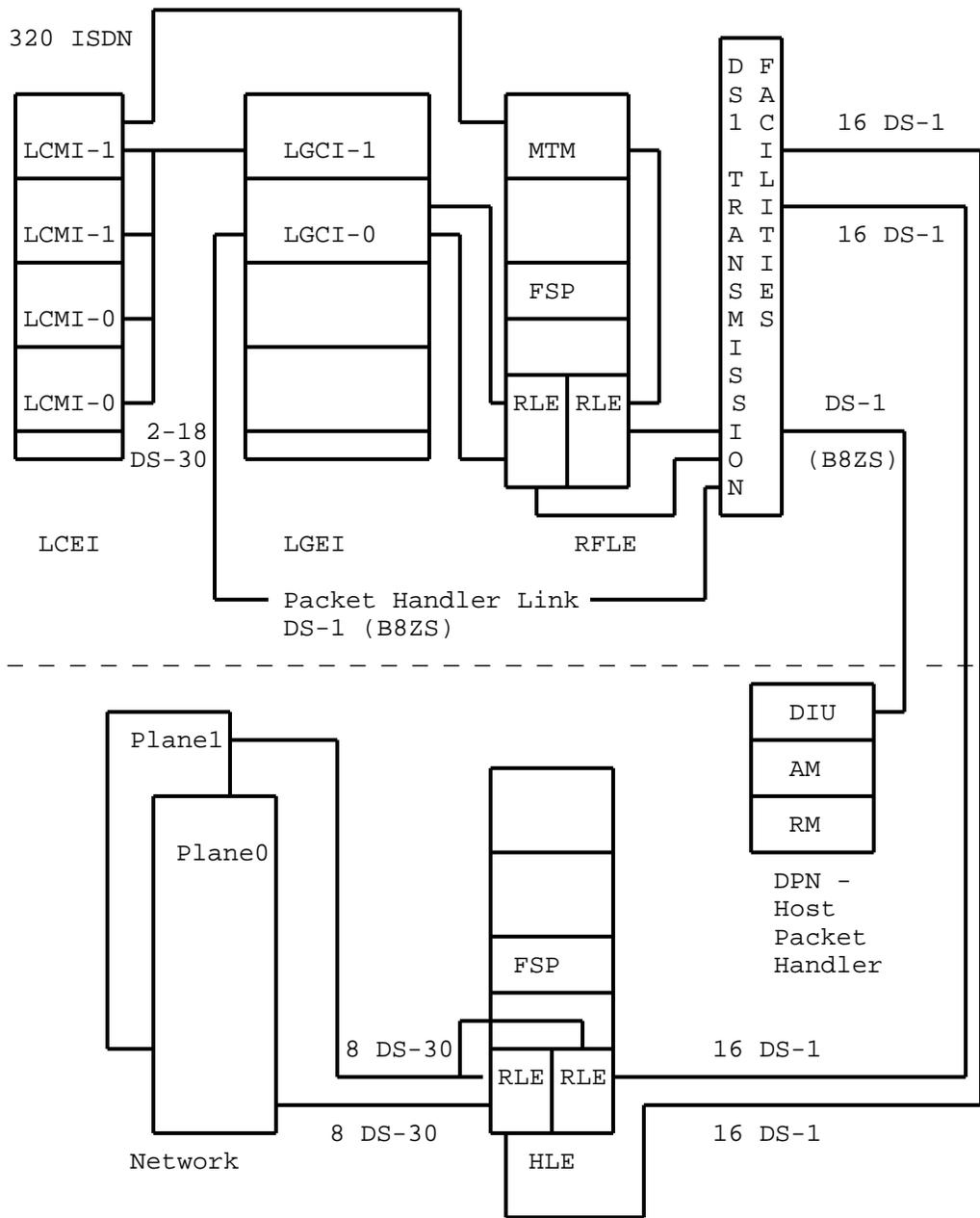Packet
Handler

16 DS-1

16 DS-1

Fig. 28 - FRSC Link Configuration

Example 1

10.09 The following example shows how the FRSC could be provi-
       sioned. This is a non-blocking configuration, in order to
highlight the capacity of the FRSC. The example assumes the fol-
lowing:

*   One RLE shelf of the HLE is fully configured.

*   One LGCI at one site is used

*   Eight duplicated DS-30 ports extended to the remote site

*   One DS-30 is dedicated to the MTM.

10.10 With this configuration, there are seven DS-30 links (32
       channels each) available for call processing. Two of these
seven links have seven messaging channels each, so,

(32 x 7)- (7 x 2) = 224 - 14 = 210 channels
210 channels are available for voice or
circuit switched data

10.11 This means that this configuration can support 105 ISDN
       lines with no concentration.

Example 2

10.12 This example assumes the following:

*   Two RLE shelves of the HLE are fully configured.

*   One LGCI at one remote site is used

*   16 duplicated DS-30 ports extended to the remote site

*   One DS-30 is dedicated to the MTM.

10.13 With this configuration, there are 15 DS-30 links (32
       channels each) available for call processing. Two of these
links have seven messaging channels each, so,

(32 x 15)- (7 x 2) = 480 - 14 = 466 channels
466 channels are available for voice or
circuit switched data

10.14 This means that this configuration can support 233 ISDN
       lines with no concentration.

11.   RESTRICTIONS/LIMITATIONS

ESA CAPABILITIES

11.01 Although the LGCI-LCMI configuration is located at a
       remote site, this configuration is not the same as the
Remote Switching Center, which contains the Remote Cluster Con-
troller (RCC).   The RCC, which is not presently an ISDN-based
peripheral, has the ability to process local calls should commu-
nication with the Host switch be cut off. The Fiber RSC does not
have this capability.

SPECIFICATIONS OF THE FIBER TRANSPORT SYSTEM

11.02 The customer-provided DS-1 transport system must meet the
       following requirements:

*   A DS-1 interface that is compatible with:

     —   Technical Advisory no. 34, "Interconnection Specification
          for Digital Cross Connects," October 1970, AT&T

     —   Technical Advisory no. 42, "Digroup Terminal and Digital
          Interface Frame Technical Reference and Compatibility
          Specification," August 1981, AT&T

     —   Figure 2-2, "Mask of Tolerable Sinusoidal Jitter and Wan-
          der," CCITT Recommendation, Q.503

*   A delay of no greater than 220 microseconds measured from the
     host DS-1 interface of the RLE shelf of the HLE to the remote
     DS-1 interface at the RLE shelf of the RFLE

*   A Bit Error Rate (BER) performance better than 1×10^{-9}.
     bits.

11.03 Note that a system that meets these requirements is the
       FMT150, manufactured by Northern Telecom.

12.   APPENDIX A - LISTING OF THE INSTALL.BAT BATCH FILE

12.01   Figure 29 shows the listing of the batch file
        "INSTALL.BAT". This batch file installs the FRSC OAM
software onto the hard drive (C:) of a PC. The line numbers are
just for reference and are not part of the batch file.

```
1  echo off
2  echo In order to install the FRSC OAM program, the files
3  echo "Autoexec.bat" and "Config.sys" should be in the root
4  echo directory of the C:\ drive.  If these files do not
5  echo presently exist, they will be created for you.
6  echo These files should not be marked as "Hidden" files and
7  echo there should be no batch files executed within
8  echo "Autoexec.bat"
9  echo This install batch file creates a new directory on the
10 echo C: drive called "C:\OAM", and one subdirectory
11 echo within OAM called "C:\OAM\HELP". The program also
12 echo appends some commands to the "Autoexec.bat"
13 echo and "Config.sys" files.
14 pause
15 c:
16 cd c:
17 md oam
18 cd oam
19 copy a:main.exe
20 copy a:*.mnu
21 md help
22 cd help
23 copy a:*.hlp
24 cd c:\
25 copy c:\config.sys+a:config.dat c:\config.sys
26 copy c:\autoexec.bat+a: exec.dat c:\autoexec.bat
27 cls
28 echo Installation of the FRSC OAM system is now complete.
29 echo Please remove installation disk from drive A: and
30 echo re-boot the computer (ctrl-alt-del) to start the FRSC OAM
31 echo on
```

Fig. 29 - Listing of the Batch File

12.02   Figure 30 on page 90 shows the functions performed by
        these commands.

Line Description
---- -----------
1   Turns echo off to keep commands from going to the screen
2-13 Displays a brief message on the screen. This message warns
     that if the files AUTOEXEC.BAT and CONFIG.SYS already exist
     on the PC hard drive (C:), they should be in the root dir
     (C:\). If they do not exist, they will be automatically
     created.
14   This puts the message "Strike any key when ready . " on the
     display and waits for a keyhit before continuing.
15   Changes the current drive to the hard disk (C:).
16   Changes the current directory to the root directory (C:\).
17   Creates the OAM subdirectory on the C: drive
18   Goes to the new OAM subdirectory.
19   Copies the OAM program (MAIN.EXE) to the OAM subdirectory.
20   Copies the pop-up menu files (COMMAND.MNU, HELP.MNU) to the
     OAM subdirectory.
21   Creates another subdirectory, HELP, underneath the
     subdirectory OAM.
22   Goes to the new HELP subdirectory.
23   Copies all of the text files used for on-line help system.
24   Changes the directory back to the root (C:\).
25   Appends the line "Files = 20" to the file "CONFIG.SYS". If
     CONFIG.SYS did not exist, it is created, containing only
     this one line. This command in CONFIG.SYS tells the system
     how many files can be opened simultaneously. The FRSC OAM
     program opens a log file for every port (up to 12) and also
     opens 3 files for program operation.
26   Appends the lines "cd c:\oam" and "main.exe" to the file
     "AUTOEXEC.BAT". If AUTOEXEC.BAT did not exist, it is created
     containing only these two lines. When the PC starts up,
     this file is always executed first. By changing directories
     to OAM and executing MAIN.EXE, this makes the FRSC OAM
     program start automatically whenever the PC starts.
27   Clears the screen.
28- Tells the user that in order to start the FRSC OAM program,
30   you must reboot the system.
31   Turns echo back on.

            Fig. 30 - Command Functions of the Batch File

12.03 In summary, the INSTALL.BAT program creates two new subdi-
       rectories   (OAM   and   HELP),   copies   the OAM   program
(MAIN.EXE) into the OAM subdirectory and the help files into the
HELP subdirectory, updates CONFIG.SYS to allow for 20 simultane-
ously open files, and changes AUTOEXEC.BAT to make the OAM pro-
gram execute automatically upon system start-up.

13. APPENDIX B - CONFIGURATION FORMS

13.01 The following is a list of information that should be cap-
        tured during hardware installation of the FRSC OAM system.
This information will be used to datafill the FRSC OAM program
for a specific site.

---

1. Number of NTBX56AA cards at the   _____
   Host and Remote sites (1 - 12)

   (One HLE/RFLE shelf Combination: 4 cards)
   (Two HLE/RFLE shelf Combination: 8 cards)
   (Three HLE/RFLE shelf Combination: 12 cards)

2. Name for the Host site :
   (Must be a unique and contain up to 8 characters) _____

3. Name for the Remote site :
   (Must be a unique and contain up to 8 characters) _____

4. For each card: (1 - 12)
   (Only fill out the same number of cards as answered in
    question 1)

                Fig. 31 - Overall Configuration Form

NTBX56AA Card 1:

    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____

    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

NTBX56AA Card 2:
                        -
    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

            Fig. 32 - NTBX56AA Cards One and Two

NTBX56AA Card 3:
                    -
   A. Location (Host/Remote) :   _____
   B. Far End Port (1 - 12) :   _____
   C. DMS Network Plane (0/1) :   _____
   D. Number of Network Links Supported (1 - 8) :   _____
   E. Specific Network Link Numbers (From DMS Datafill) :

      Link 0:   _____   Link 4:   _____
      Link 1:   _____   Link 5:   _____
      Link 2:   _____   Link 6:   _____
      Link 3:   _____   Link 7:   _____

   F. DMS Frame Number (1 - 99) :   _____

   G. DMS Shelf Position   _____
      (18: Bottom, 32: Middle, 51: Top shelf

   H. Port Log Filename   _____
      (Can contain up to 8 characters, such as P1.log)

NTBX56AA Card 4:
                    -
   A. Location (Host/Remote) :   _____
   B. Far End Port (1 - 12) :   _____
   C. DMS Network Plane (0/1) :   _____
   D. Number of Network Links Supported (1 - 8) :   _____
   E. Specific Network Link Numbers (From DMS Datafill) :

      Link 0:   _____   Link 4:   _____
      Link 1:   _____   Link 5:   _____
      Link 2:   _____   Link 6:   _____
      Link 3:   _____   Link 7:   _____

   F. DMS Frame Number (1 - 99) :   _____

   G. DMS Shelf Position   _____
      (18: Bottom shelf, 32: Middle shelf,
       51: Top shelf) :

   H. Port Log Filename   _____
      (Can contain up to 8 characters, such as P1.log)

             Fig. 33 - NTBX56AA Cards Three and Four

NTBX56AA Card 5:
                    -
   A. Location (Host/Remote) :   _____
   B. Far End Port (1 - 12) :   _____
   C. DMS Network Plane (0/1) :   _____
   D. Number of Network Links Supported (1 - 8) :   _____
   E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

   F. DMS Frame Number (1 - 99) :   _____

   G. DMS Shelf Position   _____
      (18: Bottom shelf, 32: Middle shelf,
       51: Top shelf) :

   H. Port Log Filename   _____
      (Can contain up to 8 characters, such as P1.log)

NTBX56AA Card 6:
                    -
   A. Location (Host/Remote) :   _____
   B. Far End Port (1 - 12) :   _____
   C. DMS Network Plane (0/1) :   _____
   D. Number of Network Links Supported (1 - 8) :   _____
   E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

   F. DMS Frame Number (1 - 99) :   _____

   G. DMS Shelf Position   _____
      (18: Bottom shelf, 32: Middle shelf,
       51: Top shelf) :

   H. Port Log Filename   _____
      (Can contain up to 8 characters, such as P1.log)

            Fig. 34 - NTBX56AA Cards Five and Six

NTBX56AA Card 7:
                    -

    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

NTBX56AA Card 8:
                    -

    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

                Fig. 35 - NTBX56AA Cards Seven and Eight

NTBX56AA Card 9:
              -

    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

NTBX56AA Card 10:
              --

    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

                    Fig. 36 - NTBX56AA Cards Nine and Ten

NTBX56AA Card 11:
                 --
    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

NTBX56AA Card 12:
                 --
    A. Location (Host/Remote) :   _____
    B. Far End Port (1 - 12) :   _____
    C. DMS Network Plane (0/1) :   _____
    D. Number of Network Links Supported (1 - 8) :   _____
    E. Specific Network Link Numbers (From DMS Datafill) :

        Link 0:   _____   Link 4:   _____
        Link 1:   _____   Link 5:   _____
        Link 2:   _____   Link 6:   _____
        Link 3:   _____   Link 7:   _____

    F. DMS Frame Number (1 - 99) :   _____

    G. DMS Shelf Position   _____
       (18: Bottom shelf, 32: Middle shelf,
        51: Top shelf) :

    H. Port Log Filename   _____
       (Can contain up to 8 characters, such as P1.log)

                Fig. 37 - NTBX56AA Cards 11 and 12