

6MB OPTICAL INTERFACE UNIT (6M OPT INF:X0306)  
FUNCTIONAL DESCRIPTION

1. GENERAL

- 1.01 This section is a cover sheet for the NEC America, Inc., 6MB Optical Interface Unit (6M OPT INF:X0306) Functional Description. This section is reproduced with permission of NEC America, Inc., and is equivalent to NEC practice NECA 365-407-410, Issue 1.
- 1.02 Whenever this section is reissued the reason(s) for reissue will be listed in this paragraph.
- 1.03 This section provides a general description of the 6M Optical Interface Unit (6M OPT INF:X0306-).
- 1.04 If corrections are required in the attached document, use Form-3973 as described in Section 000-010-015.
- 1.05 If equipment design and/or manufacturing problems should occur, refer to Section SW 010-522-906 for procedures on filing an Engineering complaint.

2. ORDERING PROCEDURE

- 2.01 The 6M Optical Interface Unit (6M OPT INF:X0306) may be ordered via the Southwestern Inventory Management System (SWIMS).
- 2.02 To order additional copies of this practice, use NECA 365-407-821SW as the section number.

3. REPAIR/RETURN

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

Attachment: NEC America, Inc.  
6MB Optical Interface Unit (6M OPT INF:X0306)  
Functional Description

PROPRIETARY

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

**6MB OPTICAL INTERFACE UNIT (6M OPT INF : X0306)  
FUNCTIONAL DESCRIPTION**

---

**NEC America, Inc.**  
**Transmission Division**

14040 Park Center Road  
Herndon, Virginia 22071  
Phone No: (703) 834-4000  
Fax No: (703) 481-6904  
Telex No: 899498  
TWX No: 710-831-0639  
Easylink No: 62939917

◆6MB OPTICAL INTERFACE UNIT (6M OPT INF:X0306)◆  
 FUNCTIONAL DESCRIPTION

CONTENTS

Page

1. GENERAL .....	2
2. DESCRIPTION .....	2
3. FUNCTIONAL OPERATION .....	3
A. XMT Path .....	3
B. RCV Path .....	6
C. ALM Function .....	7
4. CONTROL AND INDICATORS .....	8
5. STRAPPING SELECTION .....	8

ILLUSTRATIONS

Figure	Title	Page
3-1	6M OPT INF Unit (X0306) Block Diagram .....	4
4-1	6M OPT INF Unit (X0306) Control and Indicators .....	9

TABLES

Table	Title	Page
2-1	6M OPT INF Unit Group .....	3
3-1	LED Optical Source Characteristics .....	5
3-2	PIN Optical Detector Characteristics.....	6
4-1	6M OPT INF Unit Control and Indicators .....	8

Copyright © 1986 by NEC America Inc. All rights reserved.

This document is not an offer to sell. The information contained in this document is subject to change without notice.

1. GENERAL

1.01 This practice provides a general description of the 6 M Optical Interface unit (6M OPT INF: X0306- ) and contains the following information.

- (1) Description
- (2) Functional operation
- (3) Controls and Indicators
- (4) Strapping selection

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

2. DESCRIPTION

2.01 This unit consists of one epoxy-glass printed wire board (PWB) and associated circuit components. Printed circuit wiring is etched on both sides of the PWB. On the left side surface (viewed from front) of the PWB, the components are mounted.

2.02 LEDs and switch for controlling and indicating the operational status and optical input/output connectors are located at the front of this unit.

2.03 This unit is mounted in the FD-2240A E8980A shelf with back board connectors J19 (Sys 1), J16 (Sys 2), J12 (Sys 3) and J9 (Sys 4) in case that high speed interface is optical fiber. The unit inputs and outputs of 6.312 Mb/s unipolar signal are terminated at a connector on the rear of the PWB. 6.312 Mb/s optical input and output connectors are located on the front of the PWB.

2.04 The unit designation, unit code, manufacturing date and serial No. are printed on the right side surface of the connector.

Table 2-1  
6M OPT INF Unit Group

No.	Unit Code and Group	Equipment Voltage	Remarks
1	X0306E	-48 Vdc	1300 nm, MM, LED-PIN
2	X0306F	-48 Vdc	1310 nm, SM, LED-PIN
3	X0306F1	-48 Vdc	1310 nm, SM, LED-PIN New version of Grp: 0F00

2.05 The lower front edge of the PBW is fitted with ejector to facilitate insertion and removal of the board from the shelf. A CLEI and bar code label is placed on the surface of the ejector. See Figure 4-1.

2.06 There are three groups for this unit. Table 2-1 lists these groups.

### 3. FUNCTIONAL OPERATION

3.01 The 6M OPT INF unit is a combined type of transmission and receive and consists of transmission (XMT) section and receive (RCV) section. Optical source of this unit is light emitting diode (LED). See Figure 3-1 for block diagram of this unit.

#### A. XMT Path

3.02 The 6M OPT INF unit receives unipolar 6.312 Mb/s data from the MUX unit, converts it to a coded mark inversion (CMI) optical light pulse signal and sends the resulting optical pulse stream to the transmit optical line.

3.03 LED Type 6M OPT INF units utilize an LED to generate the transmit optical signal. Two LED types are available, one for single mode operation and one for multi mode operation. Table 3-1 lists LED optical source characteristics.

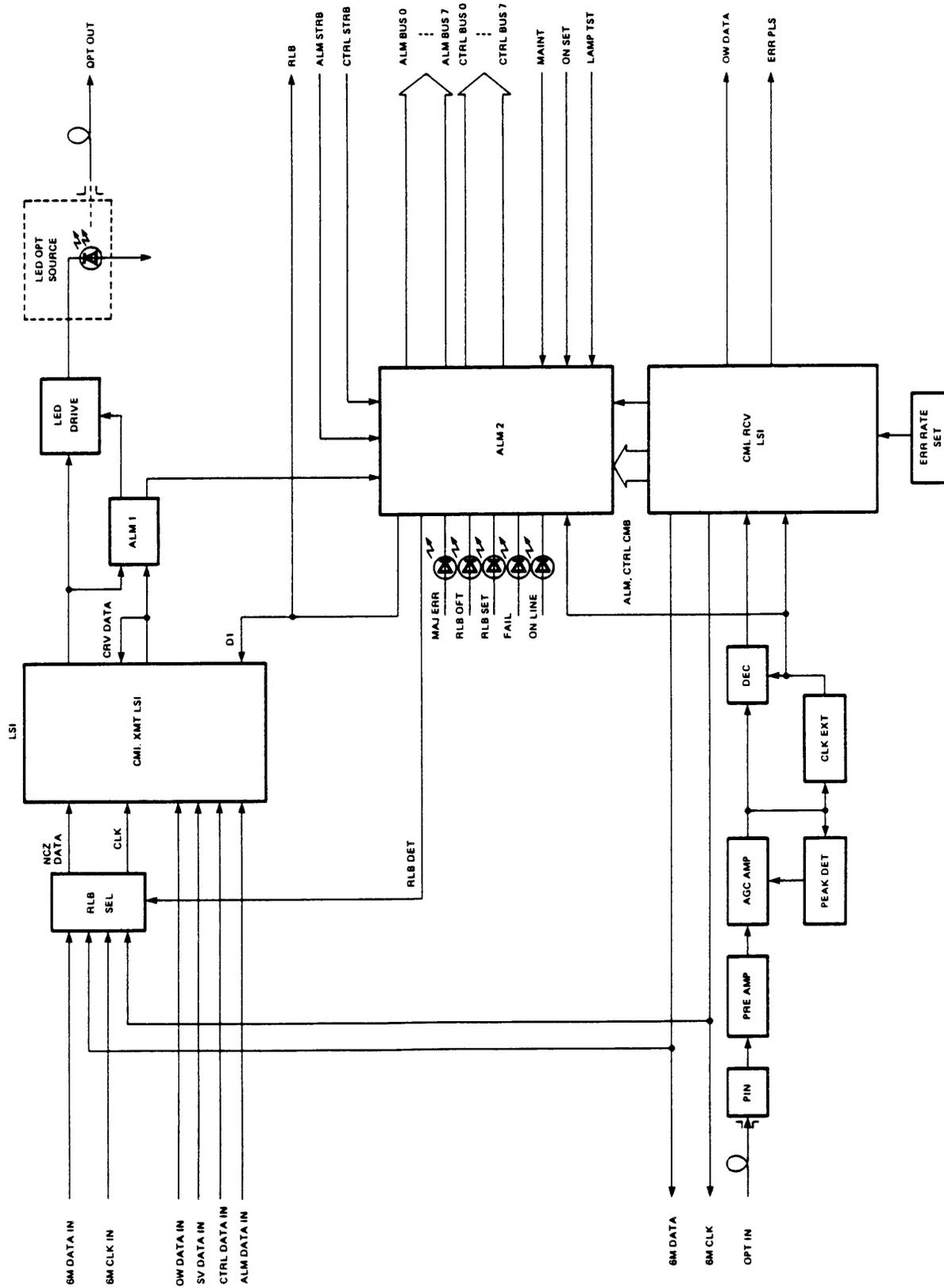


Figure 3-1 6M OPT INF Unit (X0306) Block Diagram

3.04 The input 6M XMT data and 6M XMT clock into the 6M OPT INF unit are sent to the RLB SEL. The RLB SEL normally sends 6M OPT XMT data and 6M OPT XMT clock to the CMI XMT LSI and if RLB CMD is detected at the RCV section, sends RLB data and RLB clock.

3.05 Unipolar data (NRZ) and clock signals enter the CMI XMT LSI and converts them into CMI data according to the following rules:

- (1) "1" is coded to [11] and [00] alternately.
- (2) "0" is coded to [01].

3.06 The CMI XMT LSI also inserts overhead bits in the CMI coded data for transmission to the distant end. Information carried in the overhead bit pattern includes orderwire data from the optional OW equipment and receive side on-line status data. Both types of data are transmitted by a CMI Code Rule Violation (CRV) technique in which the coding rules are intentionally violated for transmission of overhead data.

3.07 The coded data from the CMI XMT LSI go to an LED driver (LED DRIV) circuit which drives the LED optical source. An alarm circuit 1 (ALM 1) monitors the LED DRIVE input signal and the CRV signal. When signal loss occurs, the ALM 1 sends a failure indication signal to the alarm circuit 2 (ALM 2).

Table 3-1  
LED Optical Source Characteristics

Characteristic	LED Type	
	Long Wavelength (Single Mode)	Long Wavelength (Multi Mode)
Wavelength	Approx. 1.31 $\mu\text{m}$	Approx. 1.30 $\mu\text{m}$
Spectrum width	140 nm maximum	140 nm maximum
Peak output power into fiber	-30 dBm	-14 dBm

## B. RCV Path

3.08 The 6M OPT INF unit receives a coded mark inversion (CMI) optical signal from optical line and converts it to electrical form. It decodes the data and sends the decoded data to the DMUX unit. The 6M OPT INF unit also detects and extracts overhead data from the receive signal.

3.09 Table 3-2 lists the PIN characteristics.

Table 3-2  
PIN Optical Detector Characteristics

Characteristics	Optical Detector
	Long Wavelength (PIN)
Optimized wavelength	1.3 $\mu\text{m}$
Quantum efficiency	Approx. 0.6
Excess noise factor (X)	Less than 0.9
Coupling loss (with fiber)	Approx. 0.2 dB
Application	Long span (greater than 10 km)

3.10 The receive optical signal enters the unit and goes to a pin photodiode (PIN) circuit. The PIN circuit converts the optical pulse stream to an electrical signal. A PRE AMP circuit amplifies the electrical signal and sends it to an AGC amplifier (AGC AMP).

3.11 The AGC functions performed by the AGC AMP compensate for input level variations. The PEAK DET circuit monitors AGC AMP output.

3.12 The AGC AMP output goes to a timing extraction (CLK EXT) circuit which develops the 6.312 Mb/s receive clock (6M RCV CLK) signal. The 6M RCV CLK signal clocks the data through a decision (DEC) circuit to the CMI RCV LSI.

3.13 The CMI RCV LSI consists of CMI decoder, CRV DMUX and ERR counter.

- (1) CMI decoder : Divides 6M CMI data into NRZ data and CRV data.
- (2) CRV DMUX : Separates CRV data into each overhead bit.
- (3) ERR counter : Monitors violation of CMI code and sends out ERR pulse when exceeds the error rate which is predetermined by strapping selection.

3.14 6M data and 6M clock which are sent out from the CMI RCV LSI are output to the DMUX unit and orderwire data, clock and SYNC are output to the terminal. And other overhead bit, each ALM and CTRL signals are output to the alarm detection circuit 2 (ALM 2).

#### C. ALM Function

3.15 Alarm detection circuits (ALM 1, ALM 2) monitor unit operation. If unit failure or optical loss occurs, the ALM 2 circuit lights the FAIL indicator and sends a failure indication signal to the ALM unit and CTRL unit. If the bit error rate exceeds the strap selected threshold level, the ALM 2 circuit lights the MAJ ERR indicator and sends an alarm indication signal to the ALM unit and CTRL unit.

4. CONTROL AND INDICATORS

4.01 Table 4-1 and Figure 4-1 show control and LED indicators on the 6M OPT INF unit (X0306). Physical location of them is shown in Figure 4-1.

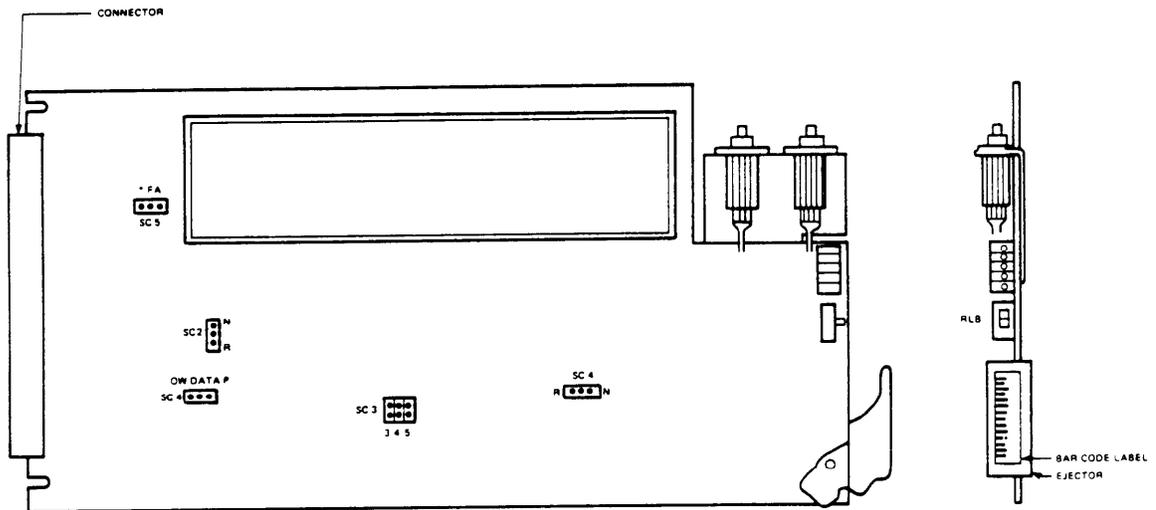
Table 4-1  
6M OPT INF Unit Control and Indicators

Feature	Type	Control/Indicator	Function
Status	Green LED	ON LINE	Lights when this unit is used at on-line side.
Alarm	Red LED	FAIL	Lights when a failure occurs in this unit.
		MAJ ERR	Lights when bit error rate exceeding predetermined threshold is detected in receive side signal.
		RLB DET	Lights when remote loopback signal from remote station is detected.
		RLB SET	Lights when RLB switch on this unit is turned to ON.
Operation	Two Position DIP switch	RLB	To execute 6M OPT level remote loopback, this switch is turned to ON.

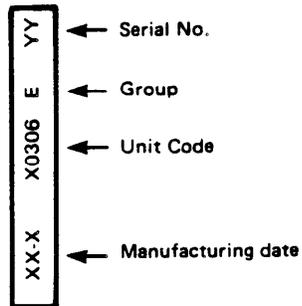
NOTE: Remote loopback switch should be operated after MAINT switch is turned to ON.

5. STRAPPING SELECTION

5.01 As shown in Figure 4-1, there are five strapping locations on this unit. NEC practice NECA 365-407-203 describes detailed strapping selections of the unit.



• Factory adjustment



NOTE: Printed on the right side surface of the main board connector.

Figure 4-1 6M OPT INF (X0306) Control and Indicators