6MB OPTICAL INTERFACE UNIT (6M OPT INF:X0307)
FUNCTIONAL DESCRIPTION

1. GENERAL

1.01 This section is a cover sheet for the NEC America, Inc., 6MB Optical Interface Unit (6M OPT INF:X0307) Functional Description. This section is reproduced with permission of NEC America, Inc., and is equivalent to NEC practice NECA 365-407-411, 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:X0307-).

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:X0307) may be ordered via the Southwestern Inventory Management System (SWIMS).

2.02 To order additional copies of this practice, use NECA 365-407-822SW 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:X0307)
Functional Description

NEC PRACTICE

NEC

NECA 365-407-411
Issue 1, December 1986

6MB OPTICAL INTERFACE UNIT (6M OPT INF : X0307)

FUNCTIONAL DESCRIPTION

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♦6MB OPTICAL INTERFACE UNIT (6M OPT INF:X0307)♦
FUNCTIONAL DESCRIPTION

CONTENTS

ILLUSTRATIONS

TABLES

1. GENERAL

1.01 This practice provides a general description of the 6M Optical Interface unit (6M OPT INF: X0307-) 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, components are mounted.

2.02 LEDs and switch for controlling and indicating the operational status and optical input/output connectors are located on 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 this PWB. 6.312 Mb/s optical input and output connectors are located on fron 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.

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 the 6M OPT INF (X0307) 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 laser diode (LD). 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. An LD is utilized to generate the optical signal.

Table 2-1
6M OPT INF Unit Group

No.	Unit Code and Group	Equipment Voltage	Remarks
1	X0307B	-48 Vdc	1300 nm, MM, LD-APD
2	X0307C	-48 Vdc	1310 nm, SM, LD-APD
3	X0307C1	-48 Vdc	1310 nm, SM, LD-APD New version of Grp:0C00

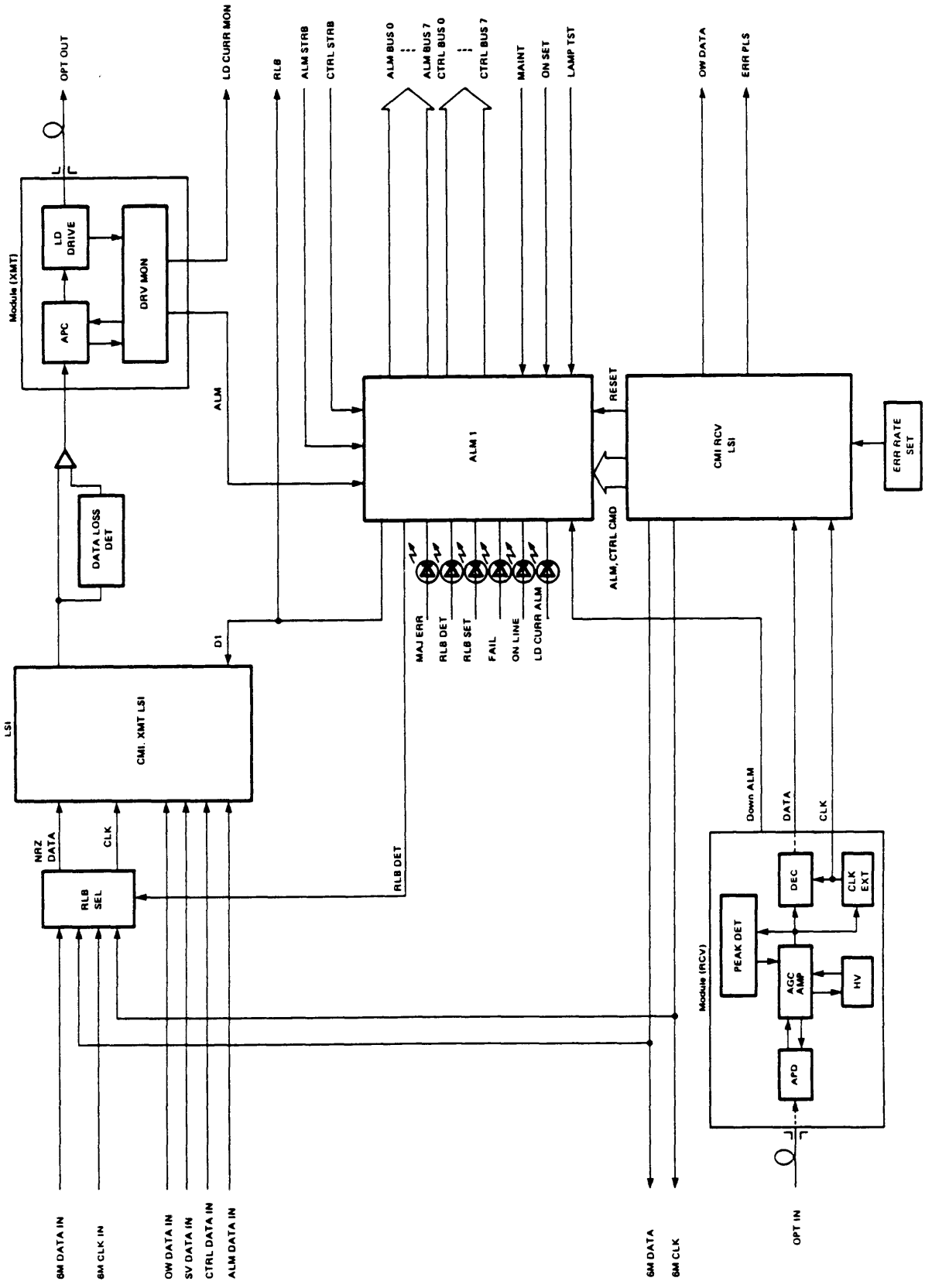


Figure 3-1 6M OPT INF Unit (X0307) Block Diagram

3.03 Laser diode (LD) type 6M OPT INF units utilize semiconductor laser diodes to generate the transmit optical signal. Two LD types are available, one for single mode operation and another is for multi mode operation. Table 3-1 lists LD optical source characteristics.

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 LSI and if RLB CMD is detected at the RCV section, sends RLB data and RLB clock.

Table 3-1
LD Optical Source Characteristics

Characteristics	LD Optical Source (InGaAsP)	
	Long Wavelength (Single Mode)	Long Wavelength (Multi Mode)
Wavelength	Approx. 1.31 μm	Approx. 1.30 μm
Spectrum width	Approx. 5 nm	Approx. 5 nm
Peak output power into fiber	+3 dBm ±0.5 dB	+5 dBm ±0.5 dB
Coupling loss (with fiber)	Approx. 5 dB	Approx. 5 dB
Application	Long span (greater than 10 km)	

3.05 The CMI XMT LSI consists of CMI coder and CRV MUX. 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 is sent to the module (XMT) via data loss detection circuit (DATA LOSS DET). At this module, the electrical signal is converted into optical signal. The LD light pulse output goes, via the unit's optical output connector, to the optical transmission line.

3.08 Average LD output power varies with both the operating temperature and age of the device. A photodiode (PD) measures the backward light beam from the LD and, together with an automatic power control (APC) circuit, stabilizes LD output power. When a rise in ambient temperature causes LD output power to decrease, the PD detects the decrease and the PC circuit increases LD bias current.

3.09 A driver monitor circuit (DRV MON) monitors PD and LD CURR MON operation. When the PD output indicates unit failure (no optical output), sends a failure indication signal to the alarm circuit 1 (ALM 1) and FAIL LED lights. When LD CURR MON voltage for LD bias current output is more than 1.2 Vdc, sends an alarm indication signal to the ALM 1 and LD CURR ALM LED lights. LD CURR alarms generally occur only when degradation due to age causes the LD to require excess bias current.

B. RCV Path

3.10 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.
Optical-to-electrical conversion part in the RCV section of this unit is assembled in one module.

3.11 Table 3-2 lists the APD characteristics.

3.12 The receive optical signal enters the unit and goes to an avalanche photodiode (APD) circuit. The APD circuit converts the optical pulse stream to an electrical signal.

Table 3-2
APD Optical Detector Characteristics

Characteristic	Optical Detector
	Long Wavelength (Ge-APD)
Optimized wavelength	1.3 μm
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)

3.13 The full-AGC and conventional AGC functions performed by the AGC compensate for the temperature characteristics of the APD as well as for input level variations. Peak detector (PEAK DET) circuits perform the full-AGC function. The PEAK DET circuit monitors AGC output.

3.14 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.

3.15 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.

3.16 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 (ALM 1).

C. ALM Function

3.17 Alarm detection circuit (ALM 1) monitor unit operation. If unit failure or optical loss occurs, the ALM 1 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 1 circuit lights the MAJ ERR indicator and sends an alarm indication signal to the ALM unit and CTRL unit.

And if a failure is detected in the LD bias, the ALM 1 circuit lights LD CURR ALM indicator and sends a LD CURR ALM 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 (X0307). Physical location of them is shown in Figure 4-1.

Table 4-1

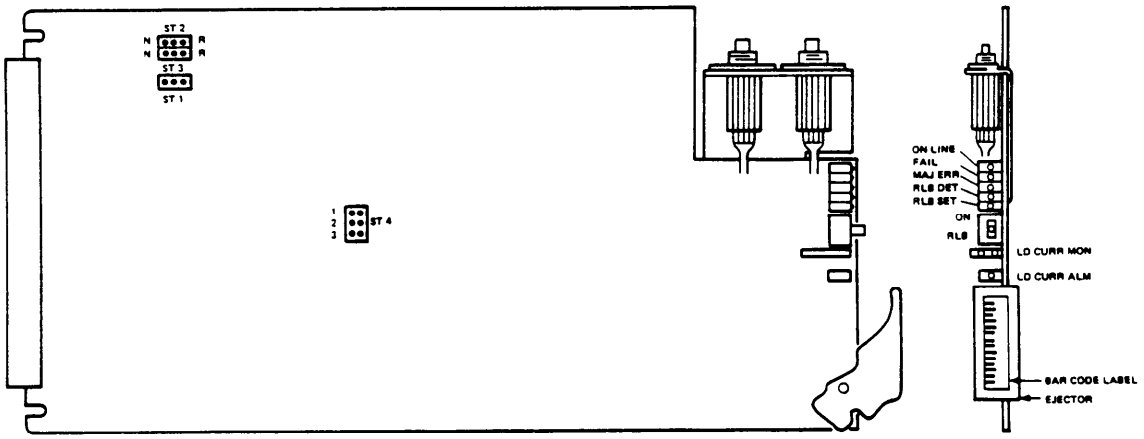
6M OPT INF Unit Control and Indicators

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.
		LD CURR ALM	Lights when over 120mA LD current flow.
Operation	Two position DIP switch	RLB	To execute DS2 level remote loopback, this switch is turned to ON.
	Monitor jack	LD CURR MON	Voltage check point for LD current.

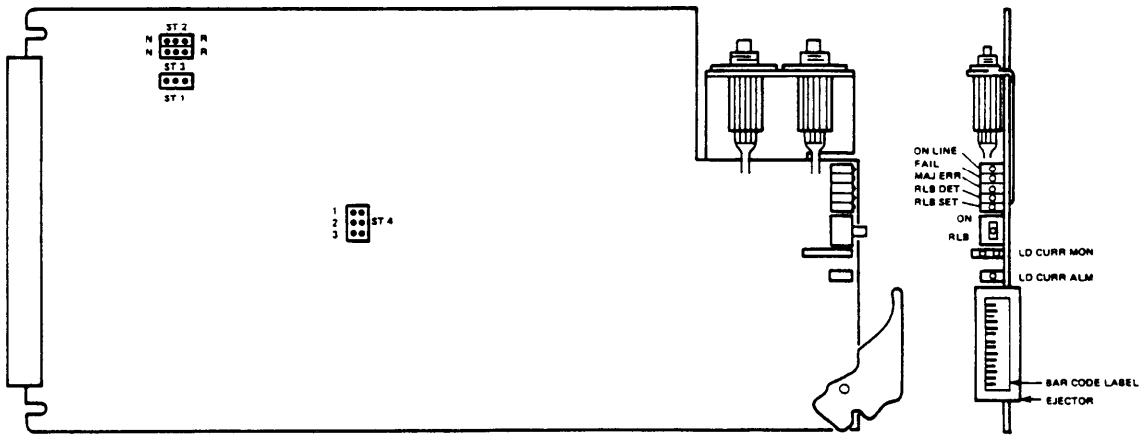
NOTE: Remote loopback switch should be operated after MAINT switch is turned to ON.

5. STRAPPING SLECTION

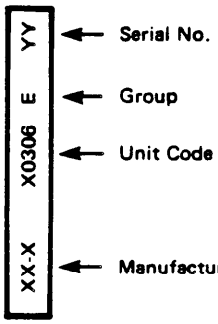
5.01 As shown in Figure 4-1, there are three strapping locations on the 6M OPT INF (X0307) unit. NEC practice NECA 365-407-203 describes detailed strapping selections of this unit.



(A) 6M OPT INF (Grp: 0B00/0C01) Unit



(B) 6M OPT INF (Grp: 0C00) Unit



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

Figure 4-1 6M OPT INF Unit (X0307) Control and Indicators