Name: ____________________________ Roll No: _____________ Date: ___________

SETTING UP A FIBRE OPTIC ANALOG LINK

PERFORMANCE OBJECTIVES

The objective of this experiment:

1. Is to set u p an 850nm fiber optic analog link.
2. The linear relationship between the input signal and the received signal is to observe.
3. The effect of gain control on the received signal is also to observe.
4. Bandwidth of the link is to measure.

HARDWARE REQUIREMENTS

- Module Kit: OFT Trainer
- Fiber cables: 1m and 3m
- Power Supply module, Input: 220-240 V AC, 50Hz. Output: +5V DC.
- Power interface cable with DIN jacks at both ends.
- Two channel, 20MHz Oscilloscope.
- Function generator, 1Hz-10 MHz
- BNC-BNC cables.
- Regular patch cord.
- 3-plug patch cord.

DISCUSSION

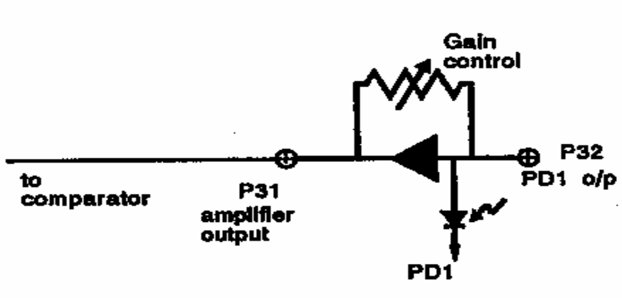
Optical fiber (or "fiber optic") refers to the medium and the technology associated with the transmission of information as light pulses along a glass or plastic wire or fiber.
Optical fibers are widely used in fiber-optic communication, which permits transmission over longer distances and at higher data rates than other forms of communications. Fibers are used instead of metal wires because signals travel along them with less loss, and they are immune to electromagnetic interference.

This experiment is designed to familiarize the user with OFT (Optical Fiber Trainer). An analog fiber link is to be set up in this experiment. The preparation of the optical fiber for coupling light into it and the coupling of the fiber to the LED and the detector are described in Appendix. The LED used is an 850nm LED. The fiber is a multimode fiber with a core diameter of 1000µm. The detector is a simple PIN detector.
The LED optical power output is directly proportional to the current driving the LED. Similarly, for the PIN diode, the current is proportional to the amount of light falling on the detector. Thus, even though the LED and the PIN diode are non-linear devices, the current in the PIN diode is directly

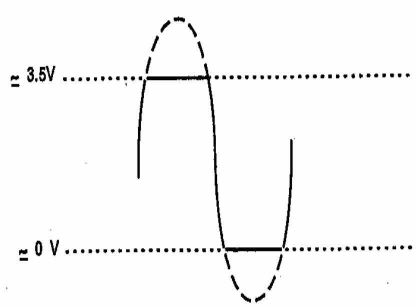
proportional to the driving current of LED. This makes the optical communication system a linear system.

PROCEDURE

1. The OFT Trainer comes with a power supply module, operating at 220-240AC, 50Hz. The output of the power supply module is +5V DC (regulated) and is available through a DIN socket. A power-interface cable with DIN jacks at both ends is provided for connecting the power supply module to the OFT.
2. Connect one end of the power-interface cable to the power supply module, and the other end to the OFT.
3. Set the switch SW8 to the ANALOG position. Switch the power on.
4. Feed a 1 Vp-p (peak to peak) sinusoidal signal at 1KHz[with zero d.c.], from a function generator, to the ANALOG IN post P11; and observe a fed in signal in oscilloscope, using the following procedure:
   i. Connect a BNC-BNC cable from the function generator to the BNC socket I/O3.
   ii. Connect the signal post I/O3 to the ANALOG IN post P11 using a 3-plug patch cord. Use a long half of the patch cord for this and plug the centre plug into the I/O3.
   iii. Connect a BNC-BNC cable between the BNC sockets I/O2 and the oscilloscope.
5. Connect one end of the 1m fiber to the LED source LED1 in the optical Tx1 block.
6. Connect the other end of the fiber to the detector PD1 in the optical Rx1 block.
7. The PIN detector output signal is available at P32 in the optical Rx1 block. Vary the input signal level driving the LED and observe the received signal at the PIN detector. Plot the received signal peak-to-peak amplitude with respect to the input signal peak-to-peak amplitude. What is the relationship?
8. The PIN detector signal at P32 is amplified, with amplifier gain controlled by the GAIN potentiometer as shown in figure. With a 3V p-p input signal at P11, observe P31 as the gain potentiometer is varied. (Note that the signal at P31 gets clipped below 0V and above 3.5 V).



Gain Control



Signal at P31

9. Measure the bandwidth of link as follows:
   Apply a 2V p-p sinusoidal signal [with zero d.c.] at P11 and observe the output at P31. Adjust GAIN such that no clipping takes place. Vary the frequency of the input signal from 100 Hz to 5MHz and measure the amplitude of the received signal. Plot the received signal

as a function of frequency [using a logarithmic scale for frequency]. Note the frequency range for which the response is flat.

10. Apply a Square wave or a Triangular wave with 1V p-p and zero d.c. at the input of the Transmitter [at P11]. Vary the frequency and observe the output at P31. Note the frequency at the received signal starts getting distorted. Explain this using the Bandwidth obtained in the previous step.
11. Repeat step 7 to step 10 using the 3m fiber instead of the 1 m fiber. Plot the received signal amplitude at the PIN detector as a function of input signal amplitude.

The LED output optical power is directly proportional to the current driving it. The PIN diode current driving it. The PIN diode current is also directly proportional to the optical power incident on it. Therefore, the relationship between the input electrical signal and the output electrical signal is linear. Thus, the optical fiber link is a linear element.

<u>REVIEW QUESTIONS</u>

1. Define Optical fiber.

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2. What are the advantages of using Fiber Optics as a medium?

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3. What is the distinguishing feature of light emitting diode in comparison of common diode?

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4. What is the working principal of PIN diode?

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5. Define Bandwidth?

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