

**City University of Hong Kong
Department of Electronic Engineering**

EE 3115 Lab3 Fiber Optic Link Experiment

Objectives

1. To study the basic principle of an optical fiber link.
2. To familiarize with the basic components in an optical link.
3. To demonstrate the fiber as an optical transmission medium between the transmitter module and the receiver modules by setting up a one-way signal transmission experiment.
4. To demonstrate team work as one student will be responsible for the transmitter module and the other for the receiver module, and to submit an individual report.

Equipment and Components Required

Refer to the Appendices.

Introduction

This optical link circuit kit allows you to send signal through 1mm diameter Plastic Optical Fiber (POF) cable. In general, the signal transmitted in the POF cable will not be affected by any electric or magnetic fields, and therefore the cable has the advantage of immunity from the ambient “noisy” environment. The kit is constructed on a single-sided printed circuit board (PCB) and consists of the transmitter module and the receiver module. This kit can be used to send the signal in well over 50 m of cable. Note that hair-thin glass fibers which have a much larger bandwidth-length product, are not normally employed for intra-office communication usage.

Backgrounds and Procedures

I. On the transmitter (Tx) circuit board.

There is a signal generator as an input source. This electrical signal is then amplified by the LM358 audio amplifier IC and is then converted to an optical signal by switching the voltage to the LED. The light emitted from the LED is therefore modulated by the input signal.

Question: Is the modulation scheme an amplitude or phase modulation? Compare this with the modulation scheme normally used inter-office optical communication links.

Note:

1. Make sure to get all the electrolytic capacitors inserted the correct way!

2. The emitter which goes on the Tx board has a ***pink dot marked on a blue case.***
3. The LED is contained in a plastic case which allows easy connection of the POF cable.

II. On the receiver (Rx) circuit board

The optical signal is directed at a photo-Darlington in the receiver which converts the optical wave into an electrical signal. The signal is then amplified and finally fed into CRO.

Note:

1. The detector which goes on the Rx board has a ***red dot marked on its black case.***
2. A 9V source is required for the Rx and Tx board.
3. A voltage regulator (LM78L05) is used in the circuit to overcome feedback in the circuit.

III. Connecting the Tx and Rx modules

A 30 cm of 1mm diameter POF cable is supplied to connect the transmitter and receiver modules.

Note:

1. After the modules are assembled and completed, adjust the power supply with 9V DC to the Tx and Rx modules. You must be able to see the red LED light inside the plastic case.
2. The POF cable must ***NOT*** be bent too much - a radius of curvature of over 2 cm should be maintained. Make sure that there are no loop-backs or kinks.
3. At the Rx end, check that the end of the POF cable shows red light coming from the transmitter.
4. If it does not work, check all solder joints carefully as poor soldering may be the most likely reason. Next check the ICs, electrolytic capacitors are in their correct positions with the correct polarity.

IV. Further Study

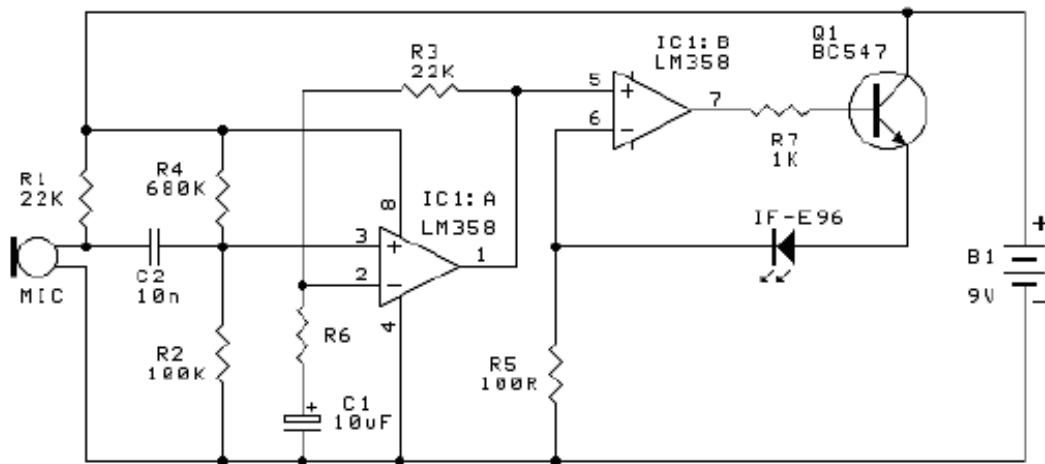
- 1) Connect two PCBs with unpolished fiber cable.
- 2) Import sine wave with frequency of 1 kHz. Try to adjust the amplitude of the signal in order to get an appropriate waveform. Observe the output waveform and explain what happened in the circuit.
- 3) Polish the fiber gradually itself until a smooth surface achieved. Compare with the previous waveform.
- 4) Cut the fiber in the middle and hold the two polished cut ends close to each other. Note what happened to output signal.
- 5) Increase the separation and try different alignment angles. Comment what you have discovered.
- 6) At the input source, the signal generator can be replaced by microphone which is provided in the kit. Repeat again and comment the sound quality.

Appendices:

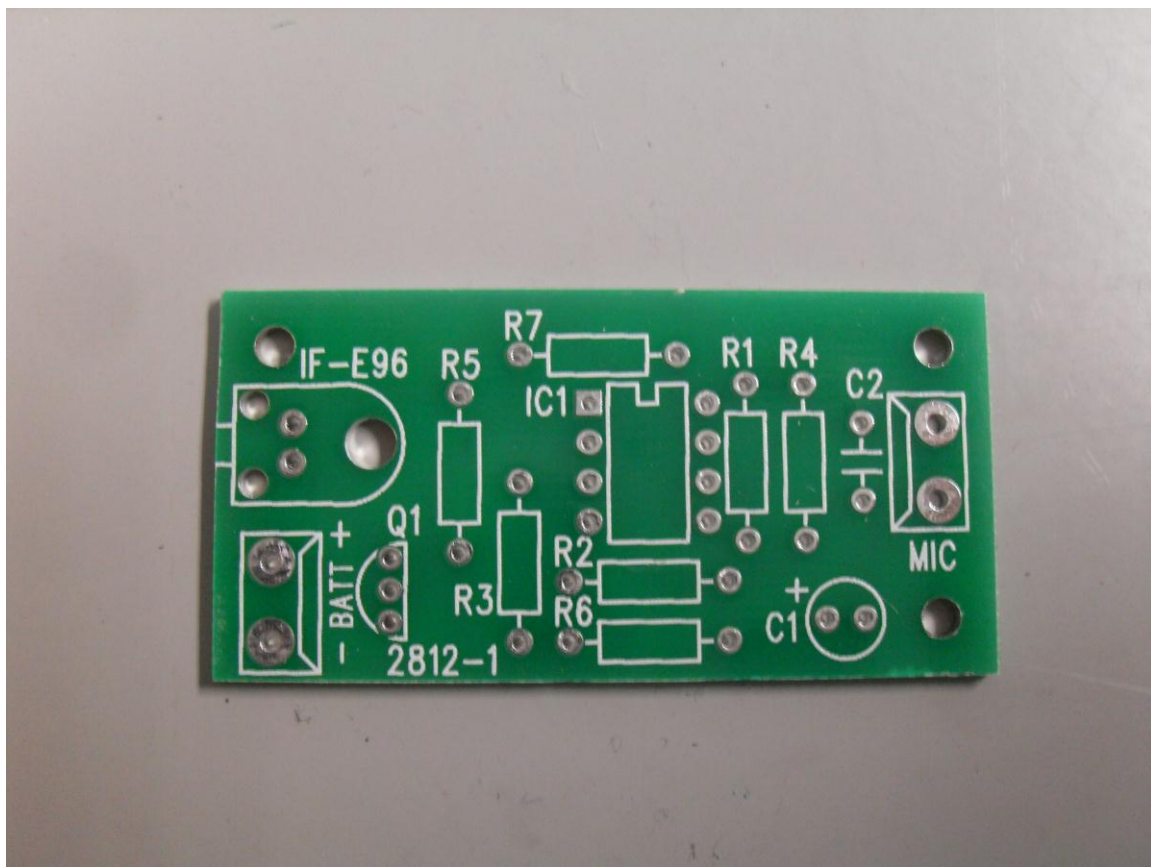
A. Component Listing

Resistors 1/4W, 5%:		
10R (brown, black, black)	1	
100R (brown, black, brown)	2	
1K (brown, black, red)	1	
10K (brown, black, orange)	1	
22K (red, red, orange)	2	
100K (brown, black, yellow)	4	
220K (red, red, yellow)	1	
680K (blue, grey, yellow)	1	
1M (brown, black, green)	1	
100K Koa trimpot (104)	1	
68K (blue, grey, orange)	1	
Capacitors:		
100 uF electrolytic	1	
10 uF electrolytic	3	
100 nF monoblock (104)	4	
10 nF mylar (103)	2	
47nF box poly	1	
Misc.		
Kit 26R, Receiver PCB	1	
Kit 26T, Transmitter PCB	1	
LM 358 IC	2	
LM 386 IC	1	
78L05 regulator	1	
BC547 transistor	1	
IF-D93 detector (red dot on black case)	1	
IF-E96 emitter (pink dot on blue case)	1	
Electret Microphone	1	
Speaker 8 ohm, 1W	1	
8 pin DIL IC socket	3	
2 pole terminal block	3	
9V battery snap	2	
3mm nut & bolt set	1	
1mm Fibre Optic Cable (~14ft)	4M	

B. Transmitter Circuit Module:



FIBRE OPTIC TRANSMITTER



C. Receiver Circuit Module:

