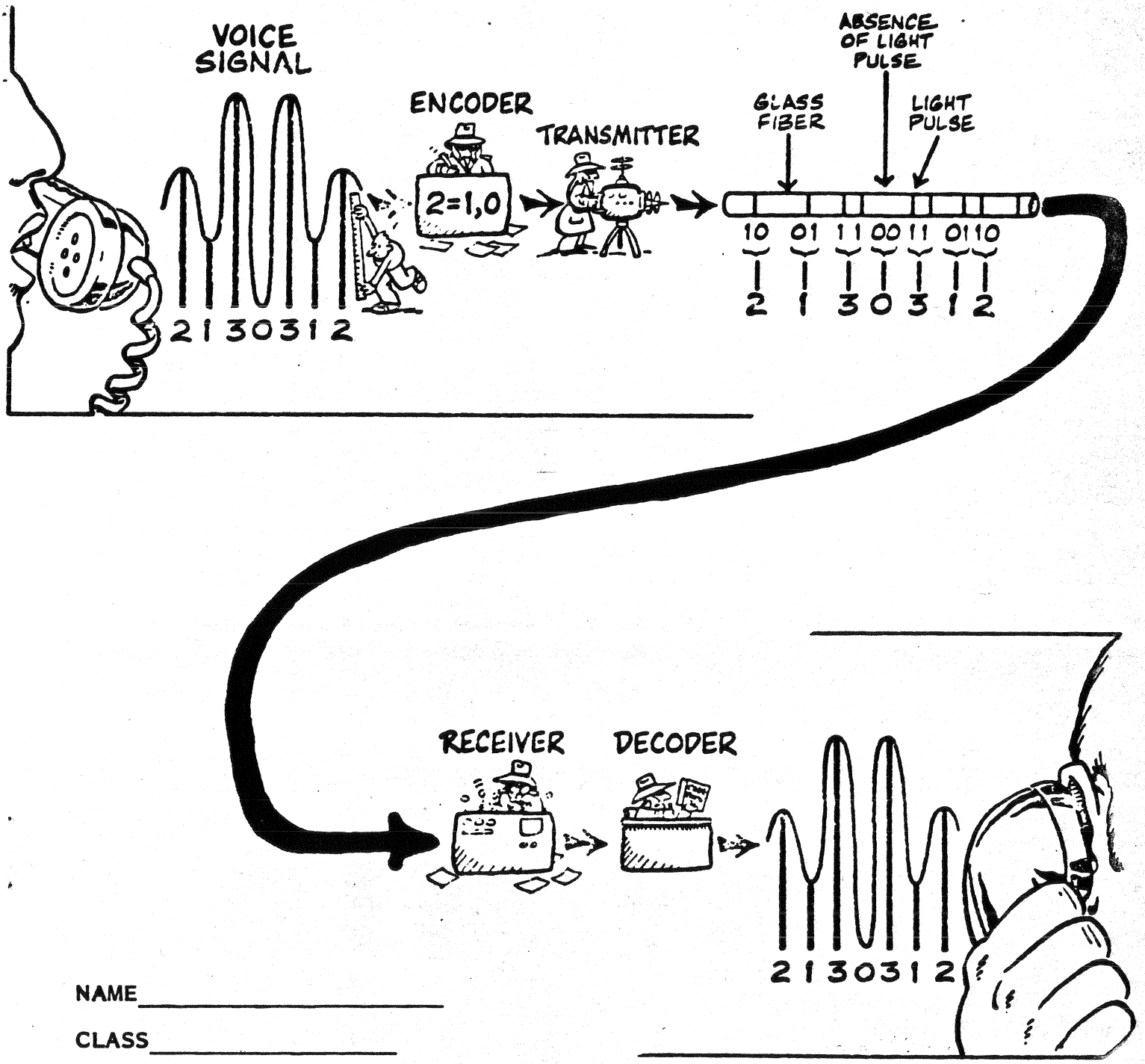
FIBER OPTICS



NAME_____

CLASS_____

HOUR_____

INTRODUCTION TO FIBRE-OPTICS COMMUNICATION

An optical fibre is a strand of glass or plastic with special optical properties which enable light to travel a large distance down its length. By converting electrical signals to light at a transmitter, sending this down a length of optical fibre, and converting it back to electrical signals at the receiver, a communications link is formed.

The idea of using glass instead of wire as the transmission link was developed in the early 1960's. The first problem was to produce glass clean enough to let the light pass down it without a large reduction in intensity. In the mid-1970's a major breakthrough allowed this to come about. A glass fibre was created that was clear enough to allow light to travel 1 kilometer (approx. .6 of a mile) before the intensity was reduced by 1/2. Normal window glass allows light to travel about 1/2 of an inch before the light intensity drops by 1/2.

Optical fibre communications has many advantages over electrical communications, the main advantage being greater transmission distance, this means that an electrical cable carrying 2,000 telephone conversations must have a signal boost approximately every 1 1/4 miles, but a fibre optic cable will carry it about 5 miles before it needs a boost.

Other advantages include high information carrying capability, which is good for computer communications. No electromagnetic interference-good for places like factories, railways or places with a lot of electrical machines. No energy leakage-good for military communication. Light weight intra-aircraft communications. No possibility of sparks-good for oil and gas installations and mines.

Optical fibre systems are playing an important role in telecommunication and information technology. By the end of the decade fibre-optics will become the most popular way to transmit information where we use a cable to carry information.

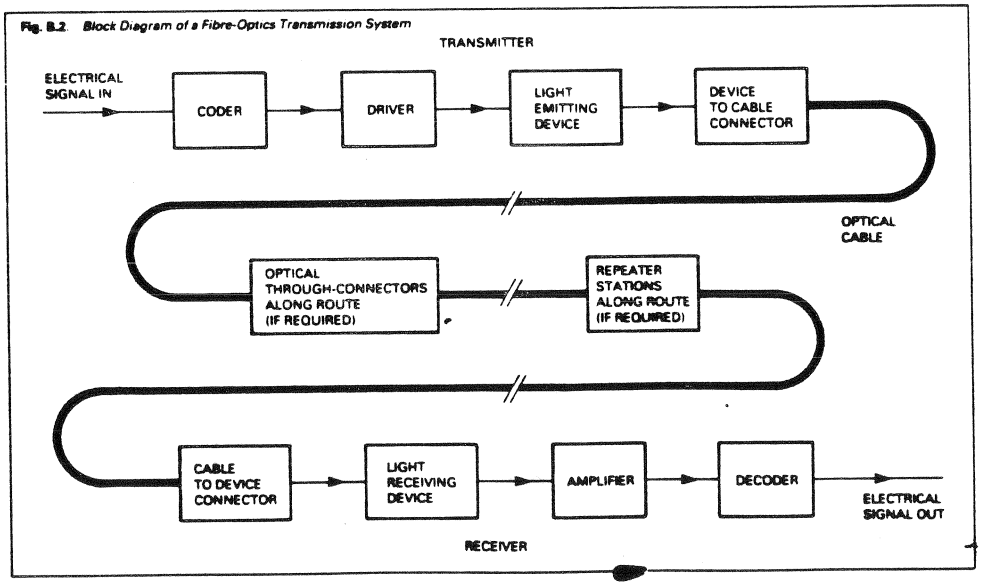


Fig. 8.2. *Block Diagram of a Fibre-Optics Transmission System*

The main parts of a fibre-optics transmission system are shown below. (Diagram) The coder converts the electrical signal into a form ready for transmission. The driver feeds this information to the light emitting device either a L.E.D. (light emitting diode) or a laser. The light is sent into a fibre contained in a cable. Along the way there may be come through-connectors, which allow separate cable lengths to be connected, and repeater stations, which boost the optical signal so it does not drop too low. The signal is then detected by a receiving diode, amplified and decoded back to the original signal.

Now lets see some action!

The fibre optics educator is an expensive piece of equipment so please handle it properly.

Get the fibre optics educator from the lab supervisor and take an inventory of all the parts below.

You should have:

A) Transmitter
B) Receiver
C) Radio
D) Light (torch)
E) Microphone
F) Long Cable
G) Short Cable
H) Mirror
I) Ear phone with earpiece
J) Ear phone without earpiece
K) Optical through connector (black plastic)
I) Audio Cable (gray)
J) Fibre optic educator manual

If you are missing any parts, or have any questions, see the lab supervisor NOW or you will be held responsible for all of the equipment later.

Now go on to objective one - good luck!

OBJECTIVE ONE-OPTICAL CABLE

OBJECTIVE 1: After reading the directions and performing the experiment the student will be able to answer several questions on optical cables.

REFERENCE: Directions provided on the next page and equipment provided in the fibre optics educator.

ASSIGNMENT: Follow the directions and answer the questions on that page.

OBJECTIVE ONE-REFERENCE/QUESTIONS

1) Point one end of the shorter fibre-optic cable to a light source such as a room light. Now look at the other end.

   What do you see? _____.

2) Turn on the light(torch) provided and place the bulb close to one end of the longer length of cable, look at the other end.

   What color is the light coming out? _____.

   This is because the fibre absorbed some colors of light and this color is absorbed the least out of all the colors present in the white torch light.

3) Use the black through connector provided and join the two lengths of optical fibre together as shown. Again shine the torch light into one fibre end, does the light pass through both fibres? _____.

OBJECTIVE TWO-ANALOGUE TRANSMISSION

OBJECTIVE: After reading the reference below and following the directions the student will be able to send analogue signals, radio, or voice signals from one location to a receiver via free space and/or optical fibre and answer questions on analogue transmission correctly.

REFERENCE: Flip chart and directions, located next to the fibre optics educator.

ASSIGNMENT: Follow the directions on the flip chart and answer the questions on the next page.

OBJECTIVE TWO - QUESTIONS

1) What happens when you face the diodes at each other?

_____.

2) What happens to the signal when you separate them by about 3 feet?

_____.

3) What happens when you place a finger over the high radiane red diode?

_____.

4) What happens when you reflect the signal by the mirror?

_____.

5) What is the result of facing the cable ends at each other?

_____.

6) What does this tell you about the fibre optic cable?

_____.

7) What is the result of using the metal diaphram to reflect the signal?

_____.

8) What do you think is happening that causes this?

_____.

OBJECTIVE THREE - DIGITAL TRANSMISSION

OBJECTIVE: After following the directions on the reference sheet, the student will be able to send a digital signal through the fibre optic cable and successfully answer questions on the results of doing this.

REFERENCE: The direction sheet, found on the next page.

ASSIGNMENT: Follow the directions on digital transmission and answer the questions on page 9

OBJECTIVE THREE - REFERENCE SHEET

NOTE: It is presumed you have made yourself familiar with the fibre optic educator in Objective Two and know how to set it up and move the controls. If you are not sure, please refer to the flip chart for the set up.

1) Set the transmitter to digital operation.

2) Turn the rotary switch to TTL/CONTACT/MORSE position and out put power at maximum.

3) Set the receiver analogue/digital switch to digital and set digital threshold sensitivity control midway.

4) Connect the optical cable from the receiver to the transmitter (question 1) (question 2).

5) Remove the optical cable from the transmitter and receiver and point the transmitter diode and receiver diode at each other.

6) Push the morse key (question 3).

7) Turn the transmitter rotary switch into Pseudo-random signal.

8) Turn down the signal generator frequency control to a minimum (question 4).

9) Turn the signal generator frequency control clockwise. (question 5).

OBJECTIVE THREE - QUESTIONS

1) What happens when the morse key is pushed down?

_____.

2) What happens to the digital indicator?

_____.

3) What happens when you push the morse key down?

_____.

4) What do you hear?

_____.

5) What is the result?

_____.

FIBRE OPTICS-SELF TEST

1) Optical fibre is a _____ of _____.

2) Optical fibre must be perfectly _____.

3) True or false Optical fibre can transmit telephone conversations a greater distance than wire cable.

4) The light emating device could be an LED (light emitting diode) or a _____.

5) An example of analogue signal might be _____.

6) True or False The signal coming over the optical fibre may be reflected over free space to another optical fibre.

7) Digital signals are either _____ or _____.

8) True or False The quality of the signal over free space is as clear as over optical fibre.

9) Optical cable cannot be bent because the light signal will be distorted. True or False.

10) At the receiver the optical signal is _____ back to the original signal.

SELF-TEST ANSWERS

1) strand, glass

2) clear

3) T

4) laser

5) voice or radio

6) T

7) on, off

8) F

9) F

10) decoded