Experiment No. 1

Aim: ToestablishanaloglinkusingOpticalFiber.

Objectives:i)TogetfamiliarwithOpticalfibertrainerkits.

ii)Toobservetransmission&receptionofanalogsignalsthroughOF.

iii) To measure analog bandwidth of OFC link.

Equipment/Components: Kit- 1andKit- 2,CRO,Functiongenerator,1Meterfibercable,etc.

Circuit/BlockDiagram:

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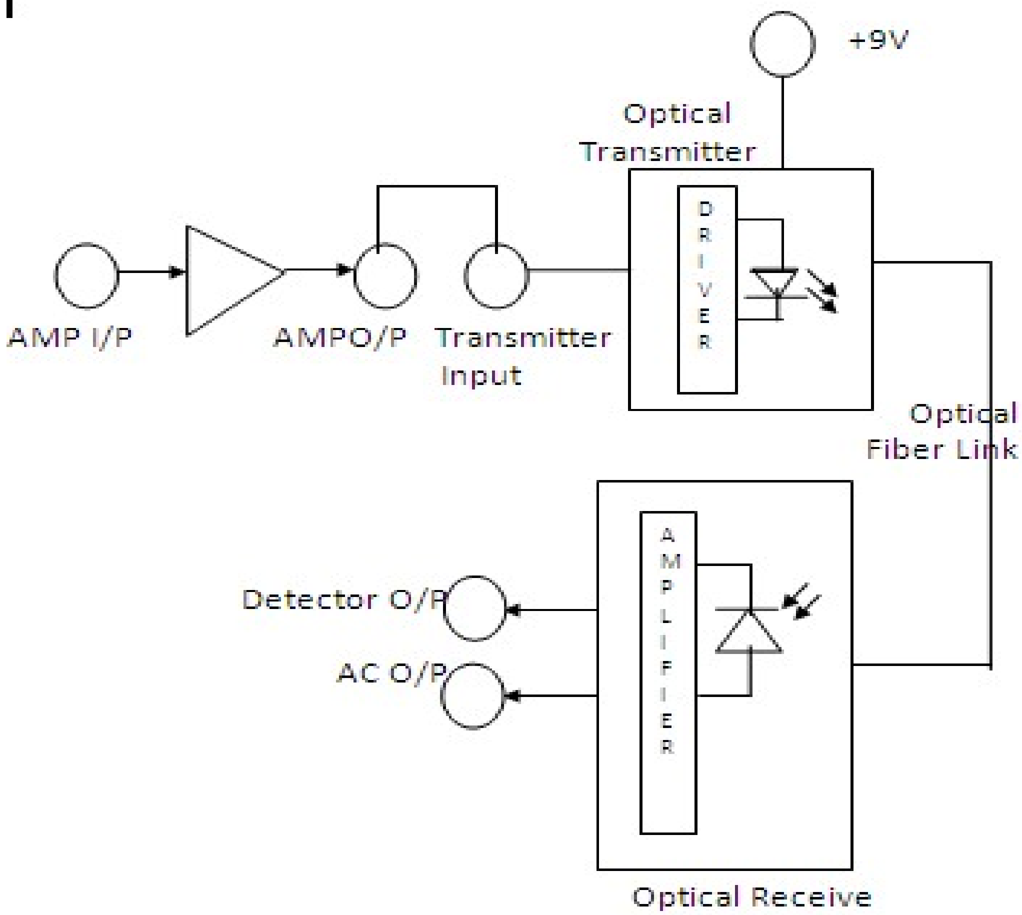


BLOCK DIAGRAM FOR SETTING UP AN ANALOG LINK

Theory: Fiber Optic Link can be used for transmission of analog as well as digitalsignals. Basically fiber optic link contains three main elements, a transmitter, anopticalfiberandareceiver.Thetransmittermoduletaketheinputsignalinelectricalformandthentransformitintooptical(light)energycontainingthe

same information. The optical fiber is a medium which carries this energy to thereceiver. At the receiver, light is converted back into electrical form with the samepatternas originally fedto the transmitter.

Transmitter: Fiber optic transmitters are typically composed of a buffer, driver &optical source. The buffer electronics provided both an electrical connection &isolation between the transmitter & the electrical system supplying the data. Thedriver electronics provides electrical power to the optical source in a fashion thatduplicates the pattern of data being fed to the transmitter. Finally to the opticalsource (LED) converts the electrical current to light energy with the same pattern.The LED SFH450V supplied with kit operates outside the visible light spectrum. Itsoptical output is centered at near infrared wavelength of 950nm. The emissionspectrum is broad, so a faint red glow can usually be seen when the LED is on in adark room. The LED SFH450V used in the kit 1 is coupled to the transistor driver ina common emitter mode. The driver is preceded by the amplifier buffer. Theamplifier in this case is a LM741 operational amplifier configured as a voltagefollower. Thus LED emits constant intensity of light. When the signal is applied totheamplifieritoverridestheDClevelatthebaseofthetransistorwhichcausethe Q point of the transistor to oscillate above the midpoint. So the intensity ofthe LED varies about its previous constant value. This variation in the intensity haslinear relation with the input electrical signal. Optical signal is then coupled toopticalfiberbymeans of connector.

Receiver: Thefunctionofthereceiveristoconverttheopticalenergyintoelectrical form which is then conditioned to reproduce the transmitted electricalsignal in its original form. The detector SFH250V used in the kit 2 has a diode typeoutput.Theparametersusuallyconsideredinthecaseofdetectorareitsresponsively at peak wavelength & response time. SFH250V has responsively ofabout 4μA per 10 μW of incident optical energy at 950nm and it has rise & falltime of 0.01μSec.PIN photodiode is normally reverse biased. When optical signalsfalls on the diode, reverse current start flow, thus diode acts as closed switch andin the absence of light intensity, it act as an open switch. Since PIN diode usuallyhas low responsively, a trans impedance amplifier is used to convert this reversecurrentintovoltage.Thisvoltageisthenamplifiedwiththehelpofanotheramplifiercircuit.Thisv oltageistheduplicationofthetransmittedelectricalsignal.

Procedure:

1. Slightly unscrews the cap of IR LED SFH 450v from kit 1. Do not remove the capfrom the connector. Once the cap is loosened, insert the fiber into the cap andassurethatthefiberisproperlyfixed.Nowtightenthecapbyscrewingitback.
2. Connect the power supply cables with proper polarity to kit 1 and kit 2 whileconnectingthis, ensurethatthepowersupplyis off.
3. Connect the signal generator between the AMP input and GND posts in kit 1 tofeedtheanalogsignalto thepreamplifier.
4. Keep the signal generator in sign wave mode and the select the frequency of1KHzwithamplitude of 2VP-P (Max inputlevelis 4VP-P).

5. Switchonthepowersupplyandsignalgenerator.

6. Check the output signal of the pre-amplifier at the post AMP output in kit 1. Itshouldbesameas thatof theappliedinputsignal.

7. Now rotate the OpticalPowerControlpotP1located belowpower supplyconnector in kit 1 in anticlockwise direction. This ensures minimum current flowthroughLED.

8. Short the following posts in kit 1 with links provided.

a)-9Vand-9V.Thisensuressupplytothetransmitter.

b)AMPOutputandTransmitterInput.

9. Connect the other end of the fiber to detectorSFH250V in kit 2 very carefully aspertheinstructionin step1.

10. Ensure that the jumper located just above IC U1 in kit 2 is shorted to pin 2 andpin3.Shortingofthejumperallowstheconnectionofthe PINdiodetotrans-impedanceamplifierstage.

11. Observe the output signal from the detector at the DETECTOR output post on CRObyadjustingopticalpowercontrolpotP1inkit1andyoushouldgetthereproductionoftheoriginaltransmittedsignal.Note:sameoutputsignalisavailableatpostACoutputinkit2 withoutanyDCcomponent.

12. To measure the analog bandwidth of the link, keep the same connection andvarythefrequencyoftheoutputsignalfrom100Hzonwards.Measuretheamplitudeof thereceivedsignalfor eachfrequencyreading.

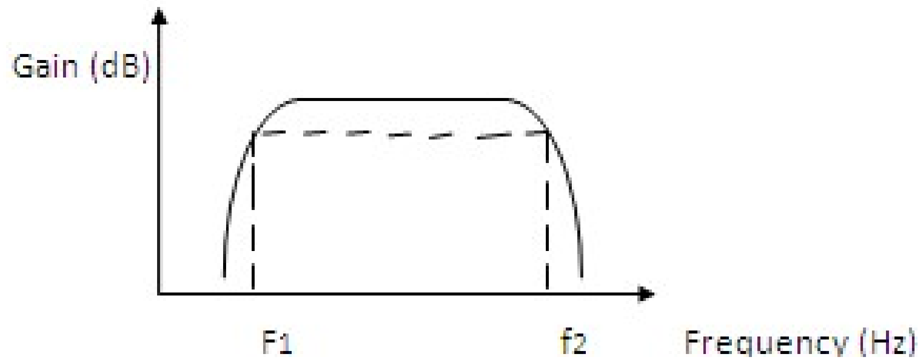
13. Plot a graph of gain v/s frequency .Measure the frequency range for which theresponseis flat.

Observation Table:

Input Voltage (V1) = Volts

Sr. No.	Input Frequency (V1)	Output Frequency (V2)	Gain = [10 log ((V2 /(V1)
1			
2			
3			

Nature of graph:



Calculations: Bandwidth = f2 – f1 Hz

Result:

Conclusion: