FIBER OPTICS

FCL ADVANCE FIBER OPTIC COMMUNICATION LAB

Advanced fiber optics communication lab is the most advanced & complete laboratory covering all the aspects of fiber optic study using plastic fiber. Ample number of experiments can be performed with this lab by referring to the exhaustive manual provided with the kit. This manual contains documentation on each and every experiment, data sheets of optical components used and circuit diagram of the complete kit. An interactive, multimedia E-Manual is also provided with the system.

The lab consists of four separate kits. Two of these kits are used to perform analog communication experiments and other two kits are used to perform digital communication experiments using optical fiber. Separate power supplies are provided so that simultaneously three batches of students can perform experiments on different sets. Function generator kits having necessary signals generated on them are also supplied along with this lab to reduce the cost of using external signal generators.

FCL-01 FIBER OPTIC ANALOG TRANSMITTER KIT & FCL-02 FIBER OPTIC ANALOG RECEIVER KIT

FCL-01 is an analog transmitter kit, which contains 660nm & 950nm fiber optic LED's and modulation circuits. FCL-02 is an analog receiver kit, which contains pin photo diode with trans-impedance amplifier & photo transistor with analog output; fiber optic detectors and demodulation circuits.
FCL-01 and FCL-02 are used to perform analog experiments.

FCL-03 FIBER OPTIC ANALOG AND DIGITAL MODULATION & DEMODULATION KIT

FCL-03 is analog & digital modulation / demodulation kit which contains 660nm fiber optic transmitter, pin photo diode with trans-impedance amplifier & photo transistor with TTL logic output photo detectors as receiver, modulation and demodulation circuits and PC-to-PC communication interface.

FCL-04 FIBER OPTIC ADVANCE DIGITAL COMMUNICATION KIT

FCL-04 is an advanced digital communication kit designed to perform digital communication experiments using optical fiber as transmission medium for data. It uses 660 nm red visible LED and TTL logic type output photo transistor as optical sensor. Optical link is designed to handle data rate of 512 Kbits/Sec.

FG-01 FUNCTION GENERATOR

FG-01 Function Generator is provided with Fiber Optic Communication Lab for supplying necessary signals to various driver stages, modulators and multiplexers used in the Trainers. Most commonly used signals like Sine wave, Triangular wave & Square waves are provided with variable and fixed frequency ranges.

FG-01 is compatible with FCL-01 & FCL-02 trainer kits.

FG-02 FUNCTION GENERATOR

FG-02 Function Generator is provided with Fiber Optic Communication Lab for suppling necessary signals to various driver stages, modulators and multiplexers used in the Trainers. Most commonly used signals like Sine wave, Triangular wave & Square waves are provided with variable and fixed frequency ranges.

FG-02 is compatible with FCL-03 & FCL-04 trainer kits.

FEATURES:

- Fiber Optic Transmitter : 2 wavelengths (660nm & 950nm)
- Fiber Optic Receiver : 3 types (Photo Diode, Photo Transistor with analog output & Photo Transistor with TTL logic output)
- Fiber Optic transmission sensor
- Fiber optic connector losses, bending and Propagation losses
- Lateral, Longitudinal and Angular displacement effect
- NA measurement
- EMI comparison
- Signal Strength Meter

- Eye Pattern.
- Length measurement of Fiber Optic cable.
- Voice Communication.
- PC-to-PC communication Technique using RS-232 Interface.
- PRBS Generator.
- Bit Error Rate Mesurement.
- Channel & Bit Indication.
- Envelope Detector
- Noise Source.
- Modulation / Demodulation Techniques:
  1. Pulse Amplitude Modulation (PAM).
  2. Amplitude Modulation.
  3. Intensity Modulation.
  4. Pulse Width Modulation (PWM).
  5. Pulse Position Modulation (PPM).
  6. Pulse Code Modulation using CODEC Chip.
- Multiplexing & Coding Techniques:
  1. Analog TDM
  2. Digital TDM
  3. FDM
  4. Manchester Coding / Decoding
- Switch Faults.

TECHNICAL SPECIFICATIONS:

Trainer Kits : 4 Nos.
- FCL-01 Fiber Optic Analog Transmitter Kit
- FCL-02 Fiber Optic Analog Receiver Kit
- FCL-03 Fiber Optic Analog And
- Digital Modulation/Demodulation Kit
- FCL-04 Fiber Optic Advance Digital Communication Kit

Function Generator : 2 Nos. FG-01 & FG-02.

Transmitter : 4 Nos. (Siemens Fiber Optic LED-SFH 450V, SFH 756V)

Wavelength : 950 nm, 660 nm

Receiver : 5 Nos. (Siemens Photo Detector-SFH 250V, SFH350V,SFH551V)
Photo Diode with responsivity of 0.3 mA/mW,
Photo Transistor with responsivity of 80 mA/mW, Photo Detector with TTL logic output.

Reference Pulse Generator :

Frequency : 660KHz,
Amplitude : 2 Volt.

Noise Generator : White Noise Source.
Amplitude : 0 to 5Vpp.

PRBS Generator : 16-Bit switch selectable.
Clock : 32, 64, 128 KHz.

Analog Bandwidth : 2 MHz.

Modulation Techniques :
- Pulse Amplitude Modulation (Variable clock of 16KHz & 32KHz).
- Amplitude Modulation.
  i) Carrier Input : 1-500 KHz.
  ii) Modulating Input : 0.1-100 KHz.
  iii) Carrier Null : Adjustable.
  iv) Output Amplitude : upto 2Vpp.
- Intensity Modulation.
- Pulse Width Modulation (Variable clock).
- Pulse Position Modulation (Variable clock).
- Pulse Code Modulation (PCM) using Motorola MC 145502 CODEC

Multiplexing:

i) 4-Channel Analog Time Division Multiplexing & De-multiplexing.
Clock Frequency: 32KHz, Duty Cycle 50%.

ii) 2 Channel FDM.
Frequency : 1KHz, 2KHz.
Amplitude : 0 to 4 Vpp.
Frequency Modulator 1 : Variable Carrier Frequency from 1 to 15 KHz.
Frequency Modulator 2 : Variable Carrier Frequency from 1 to 30 KHz.
Mux Clock : 256KHz
Band Pass Filter 1 & 3 : Frequency range 8 to 12 KHz with 10KHz center frequency
Band Pass Filter 2 & 4 : Frequency range 18 to 22 KHz with 20KHz center frequency
FM Demodulator : 2 Nos. PLL detectors
i) Freq. 1 to 15KHz input signal upto 4Vpp.
ii) Freq. 1 to 30KHz input signal upto 4Vpp.

iii) 8-Channel Digital Time division Multiplexing & Demultplexing.
Data Rate : 512 Kbps.
Coding/ Decoding : Manchester Coding / Decoding Technique.
Frame Marker : Two 8 bit user selectable markers in alternate frames.

Signal Strength Meter:

8 LEDs to measure optical power strength.

Amplitude Demodulation:

Diode Envelope Detector with RC filter.

Filters : 6 Nos.

4th order Butterworth Low Pass Filter with 3.4KHz cutoff frequency.

Voice Communication :

Fiber Optic voice link using dynamic mic and speaker.

Voice PCM:

2 Channels with Telephone Hand sets (A Law).

Bit Error Rate Mesurement :

8 bit event counter with LED indication upto 255 count.

Audio Preamplifier:

Input Impedance : 600 ohms.
Voltage Gain : 1 to 100.

Audio Amplifier:

Input Impedance : 50 KΩ.
Output Voltage : Adjustable.
Speaker : 8Ω, 0.5 W.

PC-to-PC Communication:

PC to PC Communication using 660 nm LED using RS-232.

Baud Rate : Maximum 115200 Baud.

Fiber Optic Cable:

Type : 1000 micron Step Index, Multimode Plastic Fiber

length : 15cm (1 No.), 0.5meter (2 Nos.), 1meter (3 Nos.), 3meter (2 Nos.), And 20 meter (1 No.).

Switch Faults: 4 Nos. on FCL-01, 4 Nos. on FCL-02, 8 Nos. on FCL-03 and 8 Nos. on FCL-04 are provided.

Test Points: 115 Nos. test points are provided at various stages to observe intermediate signals.

Interconnections: 2mm Banana Sockets

Power Supply: 3 Nos.

Double connector (FCL-01 & FCL-02), Single connector (FCL-03) and Single connector (FCL-04) (GND,+5V, +12V, -12V.)

FG-01 FUNCTION GENERATOR:

On-board Signals Sine, Square & Triangular Wave:

Frequency Range : 1Hz to 10Hz, 10Hz to 100Hz, 100Hz to 1KHz, 1KHz to 10KHz, 10KHz to 100KHz
Amplitude : 0 to 4Vpp
Fixed Frequency Sine Wave:
i) Frequency : 250Hz, 500Hz, 1KHz and 2KHz
ii) Amplitude : 0 to 4Vpp

FG-02 FUNCTION GENERATOR:

On- Board Signals:
Sine, TTL Square & Triangular Wave:
Frequency Range : 1Hz to 10Hz, 10Hz to 100Hz, 100Hz to 1KHz, 1KHz to 10KHz, 10KHz to 100KHz
Amplitude : 0 to 4Vpp (Except TTL Square Wave)

Fixed Frequency Sine Wave:

Frequency : 2KHz
Amplitude : 0 to 4Vpp

ACCESSORIES OF FCL-01 to FCL-04:

Red Short Links	: 38 Nos.
Red Long Links	: 02 Nos.
Crocodile Links	: 12 Nos.
Jumper to crocodile (2wire)	: 03 Nos.
Microphone & Speaker	: 01 No. Each.
N.A. Jig & Steel Ruler	: 01 No. each.
Angular Jig & EMI Jig	: 01 No. each.
Fiber Optic Cable	: 15 cm (1 No.), 0.5 meter with connector at one end (2 Nos.), 1 meter (3 Nos.), 3 meter (1 No.), 3 meter with connector at one end (2 Nos.), 20 meter (1 No.).
Connecting Plug	: 02 Nos.
Connecting Sleeve (Splice)	: 01 No.
Extra Jumper Caps	: 11 Nos.
RS-232 Cables	: 02 Nos.
Telephone Handset	: 02 Nos.
Screw Driver	: 01 No.
Copper Cable	: 01 No.
Experimental & Circuit Description Manual	: 01 Set.
Power Supply	: 01 Set.

OPTIONAL:

e-Manual Interactive Multimedia Software & Manual

LIST OF EXPERIMENTS USING FCL-01 & FCL-02:

- Initial fiber end preparation (Connectirization)
- Transmission through a gap between fiber.
- Fiber optic transmission sensors.
- Fiber optic reflection sensors.
- Measurement of Numerical Aperture.
- Study of losses in optical fiber :
  - Measurement of propagation loss.
  - Measurement of bending loss.
  - Measurement of connector loss.
- Study effect of Lateral & Longitudinal Displacement.
- Setting up Fiber Optic Analog link.
- Study of Pulse Amplitude Modulation (PAM) and Demodulation.
- Study of 4 Channel Time Division Multiplexing and Demultiplexing.
- Study of Amplitude Modulation and Demodulation.
- Measurement of length of fiber cable.
- To study effect of EMI interference on Copper medium and optical fiber medium.
- Study of characteristics of Fiber Optic LEDs and Detectors.
- Forming simple Fiber Optic voice link using MIC & Speaker.
- Effect of Switch Faults.

LIST OF EXPERIMENTS USING FCL-03:

- Forming simple Fiber Optic analog link.
- Forming simple Fiber Optic digital link.
- Study of Pulse Width Modulation(PWM), its transmission over Fiber link and Demodulation to receive original signal.
- Study of Pulse Position Modulation (PPM), its transmission over Fiber link and Demodulation to receive original signal.
- Study of Frequency Division Multiplexing & Demultiplexing.
- Forming PC-to-PC communication link using Optic Fiber link and RS-232 Interface.
- Effect of Switch Faults.

LIST OF EXPERIMENTS USING FCL-04:

- Forming simple digital link at 660 nm.
- Time Division Multiplexing using 8 data channels.
- Framing in Time Division Multiplexing.
- Study of Marker in Time Division Multiplexing.
- Study of Manchester coding and decoding.
- Study of PCM coding and frequency response of a CODEC chip.
- Measurement of Bit Error Rate.
- Study of Eye Pattern.
- Effect of Switch Faults.

FALCON

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