

FIBRE OPTIC LABORATORY SYSTEMS



BENCHMARK

- **Single-source solution for setting up a fully-fledged Fibre Optics Laboratory**
- **Ideal for structuring training courses in fibre optics & digital communications**
- **Designed to guide students through stages of Fibre Optics education up to building real-world systems**
- **Ideal for projects and prototype development**

Fibre Optics has revolutionised the way the world communicates today. It has made possible the new information superhighway that is poised to bring in interactive multimedia communications across the world. It has rapidly replaced conventional communications in telecoms and several other key areas including railways, defence, aerospace, industrial automation and medical applications.

Fibre Optic training has assumed great importance in this scenario of widespread fibre optic usage. The BENCHMARK OFS series of Fibre Optic Laboratory Systems provides Fibre Optic user organisations with a range of solutions for training their personnel in Fibre Optic concepts and practices.

The OFS is designed to provide comprehensive training to students and all levels of scientific and technical personnel in digital communications and engineering aspects of Fibre Optics.

OFS users will be well equipped to work with large scale real-world Fibre Optic Systems.

The various OFS Systems can be used for demonstration, training, and experimentation, and can form the basis for more advanced student and research projects and prototypes.

They span a wide area of fibre optics and related topics, including:

- **Basics of Fibre Optics**
- **Fibre Optic Devices**
- **Principles of Fibre Optics & Digital Communications**
- **Analogue & Digital Fibre Optic links**

FEATURES

- Each OFS System is configured with fully compatible Fibre Optic equipment and components to carry out a series of structured experiments
- The OFT Optical Fibre and Digital Communications Trainer demonstrates integrated voice/data communication link, TDM and digital communication principles. It offers unlimited experimentation using on-kit circuitry and external interfaces, including an RS-232 add-on
- 650/850/1300nm LED Light Source with variable optical power output, continuous wave, external modulation, internal word PRBS generation
- Power meter calibrated at 650, 850 and 1300nm with read-out in dBm/microwatts
- Links using plastic and glass fibre - for experimentation, and as interface modules for other digital circuitry
- Connecting and Splicing kits - to provide students with hands-on experience in connecting and splicing of glass fibre
- Range of LEDs, detectors, fibres, connectors, adapters and receptacles - for custom development of links, and for study of fibre optic devices and fibre-handling
- Specially designed component insertion PCBs for link construction - for repeated use by students
- Comprehensive lab manual - to guide students through series of experiments

OFS SUB MODULES

OFT

OFT Optical Fibre & Digital Communications Trainer - for demonstration, training and experimentation in basic and advanced concepts.

- Principles of fibre optic communication
- Basics of digital communication including TDM, voice codecs, timing recovery, etc
- Advanced experimentation and development in fibre optic digital communications
- RS-232 interface option is included with system

Fibre Optic Links

Plastic and glass fibre links for experimentation and interfacing to other digital circuits.

- 850nm, 1.5Mbps, 5m plastic fibre optic link
- 650nm, 4Mbps, 20m plastic fibre optic link
- 850nm, 2Mbps, 100m 50/125 μ glass fibre optic link
- 1300nm, 34Mbps, 500m single-mode glass fibre optic link
- Power Supply units provided

Series 2000 Desktop Light Source

For testing and trouble-shooting Fibre Optic links, studying eye pattern of optical receivers, etc.

- 850nm LED source module with SMA & ST interfaces
- 1300nm ELED source module for Single-mode and Multimode fibre with ST interface
- Continuous wave output, external modulation, internal word & PRBS generation

Series 2000 Desktop Power Meter

Essential for measurement of fibre, splice and connector losses, characterisation of LEDs, Photodetectors, etc.

- Forms a powerful test-set with Series 2000 Light Source
- Calibrated at 650 & 850nm with large area Si photodetector
- Calibrated at 850 & 1300nm with large area Ge photodetector
- Universal adapter with SMA & ST interfaces

Fibre Optic Components & Accessories

- Loose jacketed glass fibre, plastic fibre, connectors, adapters, receptacles; LEDs & detectors for 650, 850 and 1300nm operation
- Specially designed PCBs for plastic and glass fibre Analogue & Digital links, with self-explanatory schematic diagram and observation posts for study of links. Completely assembled sample modules and sets of reusable PCBs (with sockets for component insertion) provided.
- Patch Cards

Connecting & Splicing Kits

- Connecting Kit for connecting glass fibre with SMA or ST connectors
- UV and Mechanical Splicing Kit for splicing multimode glass fibre

OFS SERIES SYSTEMS

OFS Series System 1

OFS System 1 teaches fibre optic and digital communication principles with the OFT, introduces standard lab equipment such as the Light Source and Power Meter, and gives a feel for work with glass fibre using the link provided. This system is well-suited for a small-budget venture into fibre optics and for students to start working straight away with off-the-shelf equipment.

System 1 Item List

- OFT with RS-232 interface (2 Sets)
- Series 2000 Light Source (850nm SMA)
- Series 2000 Power Meter (650 & 850nm -Si)
- Glass Fibre Link FOTR 300 (100m)
- Power Supply for Link
- Manual

OFS Series System 2

OFS System 2 provides initial training on the OFT, then introduces the student to full-fledged work in fibre optics ranging from glass fibre connecting to the actual design of fibre optic links. Necessary fibre optic components have been provided to enable the user to configure his own links. Specially designed reusable component insertion PCBs allow students to construct links repeatedly without using up PCBs and components, with assembled samples provided for reference and demonstration. System 2 provides adequate infrastructure for students to undertake projects in fibre optics. This system has been designed as a standard fibre optic laboratory kit. Upgrades and replenishments are available when required.

System 2 Item List

- OFT with RS-232 interface (2 Sets)
- Series 2000 Light Source (850nm SMA & ST)
- Series 2000 Power Meter (650 & 850nm - Si)
- 4 Mbps plastic fibre link FOTR 200 (20m)
- Glass Fibre Link FOTR 300 (100m)
- Connecting Kit BCK 140 (SMA & ST)
- Loose jacketed fibre (multimode) 200m
- Plastic Fibre (50m)
- LEDs & Detectors (10 off)
- Low-cost LEDs, Detectors (Plastic Fibre) 10 off
- Connectors (SMA & ST) 10 off
- Receptacles (SMA & ST) 10 off
- Adapters (SMA & ST) 5 off
- Patch Cards
- SMA-SMA (1m x 2, 10m x 1)
- ST-ST (1m x 2, 10m x 1)
- Power Supplies for Links
- Special PCBs:
- Plastic Fibre Analogue & Digital Tx & Rx, 1 set assembled & 5 sets PCBs
- Glass Fibre Analogue & Digital Tx & Rx, 1 set assembled & 5 sets PCBs
- Manual

OFS Series System 3

OFS System 3 is the complete fibre optic laboratory environment for training in all aspects of fibre optic communication. This kit gives the student more hands-on experience from the component level to simple system design level. In addition to the complete functionality of Systems 1 and 2, it features experiments with high-end 1300nm components and high speed 1200nm single mode links. The laboratory manual clearly explains a complete set of experiments that can be performed, and suggests various projects. This kit is ideally suited for the development of prototypes for industrial & research applications.

System 3 Item List

- OFT with RS-232 interface (2 Sets)
- Series 2000 Light Source (850nm & 1300 single mode)
- Series 2000 Power Meter (850 & 1300nm - Ge)
- Glass Fibre Link FOTR 300 (100m)
- 34 Mbps 1300nm SM Glass Fibre Link (500m) FOTR 500
- Connecting kit BCK 120 (ST)
- UV & Mechanical Splicing kit BSK 60
- Loose jacketed fibre (multimode) 500m
- LEDs & detectors (10 off)
- 1300nm LEDs & Detectors in ST receptacle (2 off)
- Connectors & receptacles (ST) 20 each
- Adapters (ST) 5 off
- Patch Cords (ST-ST)
- 2 x 1m multimode
- 1 x 10m multimode
- 1 x 10m single mode
- 2 x Power Supplies for Links
- Special PCBs
- Glass Fibre Analogue & Digital Tx & Rx
- 1 set assembled & 5 sets PCBs
- Manual

EXPERIMENTS & PROJECTS

The laboratory manual clearly explains various experiments and suggests projects that can be performed with the various systems.

System 1 Experiments

- All OFT experiments
- Study of TDM, Manchester Coding & Decoding, Voice Coding, effect of EMI interface, Clock recovery, Numerical Aperture, etc.
- Multimode Fibre Optic Link - Sensitivity and Power Budget
- Multimode Fibre Optic Link - Bit Rate Measurement
- Fibre Optic Link - end to end operation

System 2 Experiments

- All System 1 experiments
- Connecting of Optical fibre
- Loss Measurement
- Mounting of LEDs and Detectors
- LED Characteristics
- PIN Photodetector characteristics
- Fibre Optic Link design using Plastic Fibre, Analogue Link & Digital Link
- Analogue Fibre Optic Transmitter & Receiver
- Digital Fibre Optic Transmitter & Receiver
- Frequency Response of Optical Receiver

System 3 Experiments

- All System 1 experiments
- Connecting of Optical fibre
- Splicing of Optical Fibre
- Loss Measurement
 - at 850 & 1300nm
 - Splice Losses
- Mounting of LEDs and Detectors
- LED Characteristics - at 850 & 1300nm
- PIN Photodetector Characteristics
 - Si at 850nm operation
 - Ge at 1300nm operation
- Analogue Fibre Optic Transmitter & Receiver
 - at 850 & 1300nm operation
- Digital Fibre Optic Transmitter & Receiver
 - at 850 & 1300nm operation
- Frequency Response of Optical Receiver
 - at 850 & 1300nm operation
- High speed single mode link
 - sensitivity & power budget
- High speed single mode link
 - Bit Rate Measurement

OFS - A ONE OF A KIND PRODUCT

Setting up a fibre optics laboratory is no easy task. It requires sustained effort to:

- i) identify the equipment and components required;
- ii) locate suitable vendors for each item;
- iii) study the specifications and ensure perfect compatibility;
- iv) procure them from multiple vendors.

Even after this difficult exercise, there is no guarantee of full compatibility, support or cost-effectiveness. Benchmark provides a single-source solution that fully addresses these issues. The user can start working in the laboratory right from day one. What is more, the experiments have been designed to guide the students through the various stages of Fibre Optics technology.

Ordering Information

Fibre Optics Laboratory System 1	OFS1
Fibre Optics Laboratory System 1	OFS2
Fibre Optics Laboratory System 3	OFS3