ADVANCED FIBER OPTIC EXPERIMENTAL MODULES FOR GLASS FIBER

In the past few years, the commercial and industrial use of laser diodes has dramatically increased with some common applications in fiber optic communications. The optical characteristics, small size and ruggedness of laser diodes have allowed many users to use in commercial applications.

Compared to other types of lasers, laser diodes use very little power. Most laser diodes operate with voltage drop of less than 2 volts with power requirements determined by their current settings. Since laser diodes are made of semiconductor materials they do not require fragile glass enclosures; the resultant ruggedness and small size allow laser diodes to be used in all environments.

The most important parameter of laser diodes to be measured is the degree to which it emits light as current is injected into the device. As the injected current is increased, the laser first demonstrates spontaneous emission which increases very gradually until it begins to emit stimulated radiation. The current value at which this phenomenon takes place is called as threshold current.

When operated within their specifications, laser diodes have extremely long lifetimes. However, most failures occur from mishandling or operating the laser beyond their maximum ratings. Laser Diodes are highly static sensitive devices, hence we have used cabinet structure to mount laser sources and detectors so that their safety is maintained and at the same time students can use them to study their parameters without damage.

Avalanche photodiodes (APDs) are photodetectors that can be regarded as the semiconductor analogous to photomultipliers. By applying a high reverse bias voltage, APDs show an internal current gain effect due to impact ionization (avalanche effect). Since APD gain varies strongly with the applied reverse bias and temperature, it is necessary to control the reverse voltage in order to keep a stable gain. Avalanche photodiodes, therefore are more sensitive compared to other semiconductor photodiodes.

A PIN photodiode is a photodiode with an intrinsic (i) (i.e., undoped) region in between the n- and p- doped regions. The intrinsic region absorbs most of the photons, and carriers generated therein and it can efficiently contribute to the photocurrent. The most often used pin diodes are based on silicon. These are sensitive throughout the visible spectral region and in the infrared region. Compared with an ordinary p-n photodiode, a pin photodiode has a thicker depletion region, which allows a more efficient collection of the carriers and thus a larger quantum efficiency, and also leads to a lower capacitance and thus to higher detection bandwidth. For longer wavelengths up to about 1.7 nm,InGaAs PIN diodes are used.

With the advancement in fiber optic technology and its wide usability in all telecom & data communication applications, Falcon felt the necessity to develop advanced fiber optic experimental modules on glass fiber - the FOM series.

These modules are designed for university level graduates and post graduate students who would like to explore the various experimental possibilities in fiber optic technology. Industrial grade active and passive optical components are used which enables students to measure various parameters and test applications with better repeatability.

The FOM series with all its features is ideal for project work and is very modular. All the experimentation that is possible with the FOM series are listed in this catalog and we ensure that on completing the course the students would be inline with the industrial requirement.

FOM1: FIBER OPTIC SOURCE AND DETECTOR MODULES

FOM-1A: 850nm Fiber Optic LED Source And Detector Module

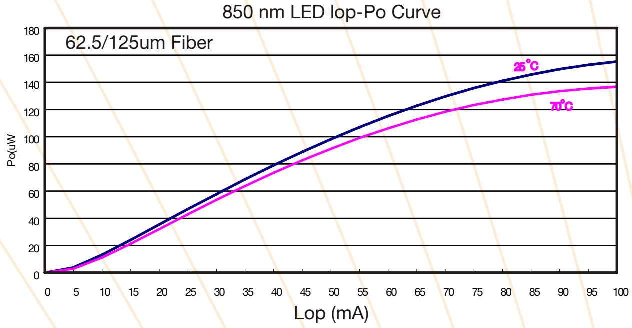
FOM-1A 850nm fiber optic LED source and detector module consists of one 850nm LED source at 850nm with APD and PIN detector. The Source has a provision for CW and External Modulation - both Analog & Digital. RS-232 interface is provided for Data Communication. Displays are provided to indicate forward voltage across and forward current flowing through LED source.

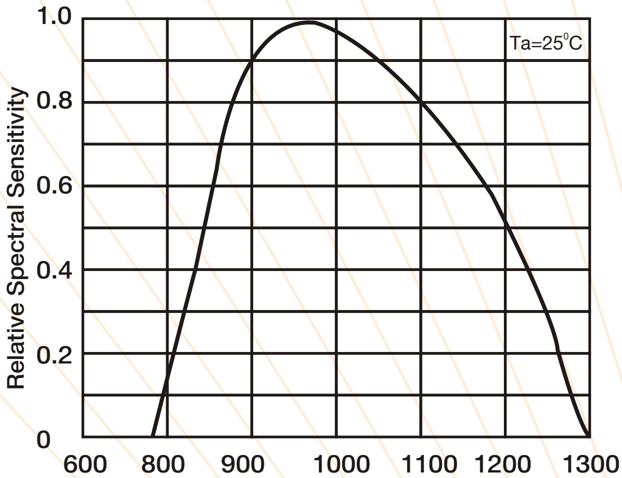
SPECIFICATIONS:

Source:

Type	: LED
Central wavelength	: 850nm
Spectral width	: 60nm
Coupled Power	: 125uw
Forward Voltage	: 1.8 to 2.2 Volts
Rise/Fall Time	: 4nS
Continuous Forward Current	: 120mA
Detector	: 1
Type	: Silicon PIN photodiode
Spectral Bandwidth	: 800nm to 1200nm
Responsivity	: 0.4A/W @850nm
Capacitance	: 6pF
Rise/Fall Time	: 10nS
Reverse Voltage	: 30Volt

Detector-2	:
Type	: APD
Spectral Bandwidth	: 800nm to 1200nm
Responsivity	: 0.4A/W @850nm
Display	: 3 Digit seven segment display indication for forward voltage and current
Input Selectable from	: CW, Analog, TTL and RS-232
Interface	: ST type connectors

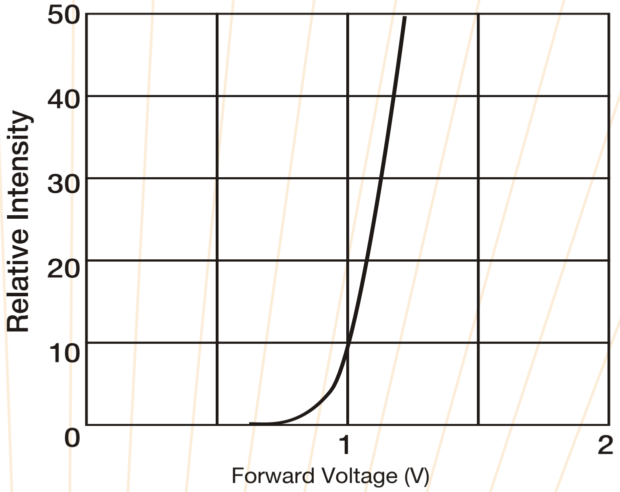




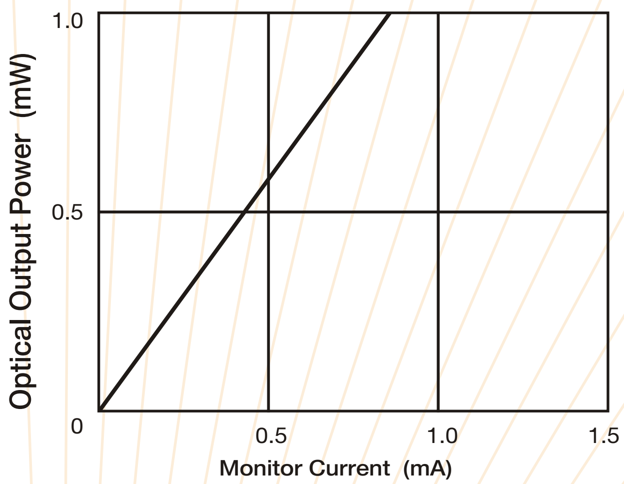
FOM-1B: 1310NM FIBER OPTIC LASER SOURCE AND DETECTOR MODULE

FOM-1B 1310nm fiber optic laser source and detector module consists of one laser source at 1310nm with PIN detector. The source has a provision for CW and External Modulation - both Analog and Digital. RS-232 interface is provided for data communication. Displays are provided to indicate forward voltage across & forward current flowing through LED source. Built in pulse generators are provided with pulse widths of 30ns & 100ns.

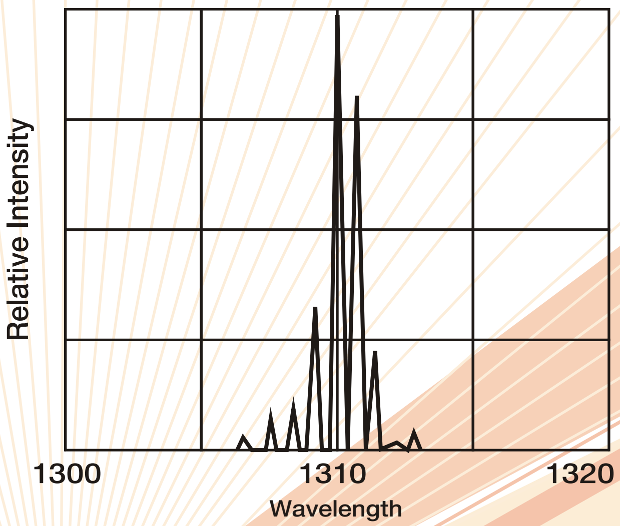
FORWARD CURRENT vs FORWARD VOLTAGE



OPTICAL OUTPUT POWER VS. LD MONITOR CURRENT



LONGITUDINAL MODE



SPECIFICATIONS:

Source:

Type	: Laser
Central wavelength	: 1310nm
Spectral width	: 1nm
Output power	: 0.9mW
Forward Voltage	: 1.1 to 1.5 Volts
Rise/Fall Time	: 0.7nS
Continuous Forward Current	: 2mA

Detector:

Type	: PIN photodiode
Spectral Bandwidth	: 1250nm to 1600nm
Capacitance	: 0.8pF
Rise/Fall Time	: <1nS
Reverse Voltage	: 30Volt

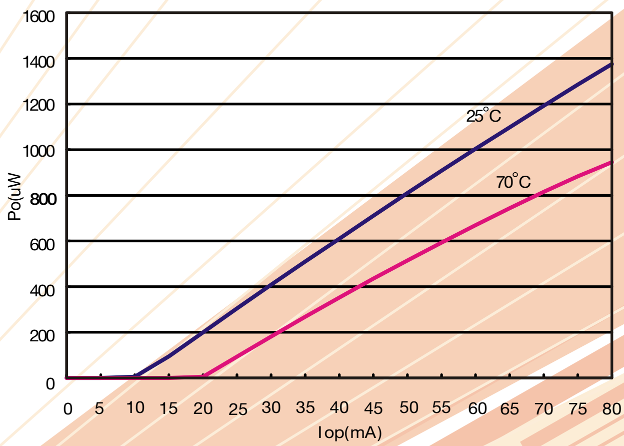
Pulse Generator:

Pulse width	: 30ns & 100ns
Pulse amplitude	: 4Vpeak
Display	: 3 Digit seven segment display indication for forward voltage and current
Input Selectable from	: CW, Pulse, Analog, TTL and RS-232

FOM-1C: 1550NM FIBER OPTIC LASER SOURCE AND DETECTOR MODULE

FOM-1C 1550nm fiber optic laser source and detector module consists of one laser source at 1550nm with PIN detector. The source has a provision for CW and External Modulation - both Analog and Digital. RS-232 interface is provided for data communication. Displays are provided to indicate forward voltage across and forward current flowing through LED source. Built in pulse generators are provided with pulse widths of 30ns and 100ns.

1550 nm FP LD FIBER-COUPLED POWER VS. DRIVE CURRENT

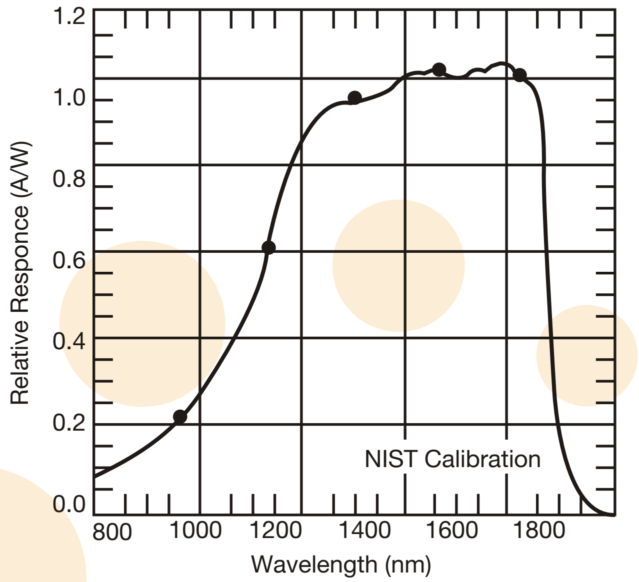


SPECIFICATIONS:

Source:

Type	: Laser
Central wavelength	: 1550nm
Spectral width	: 1nm
Output power	: 0.9mW
Forward Voltage	: 1.1 to 1.5 Volts
Rise/Fall Time	: 0.7nS
Continuous Forward Current	: 2mA
Threshold Current	: 50mA Max

Detector	:
Type	: PIN photodiode
Spectral Bandwidth	: 1250nm to 1600nm
Capacitance	: 0.8pF
Rise/Fall Time	: <1nS
Reverse Voltage	: 30Volt
Pulse Generator:	
Pulse width	: 30ns & 100ns
Pulse amplitude	: 4Vpeak
Display	: 3 Digit seven segment display indication for forward voltage and current
Input Selectable from	: CW, Pulse, Analog, TTL and RS-232
Interface	: ST type connector



FOM-1D: DUAL WAVELENGTH FIBER OPTIC LASER SOURCE AND DETECTOR MODULE

FOM-1D Dual wavelength fiber optic laser source and detector module consists of two laser sources at 1310nm & 1550nm each with two PIN detectors. The Source has a provision for CW and External Modulation - both Analog and Digital. RS-232 interface is provided for Data Communication. Displays are provided to indicate forward voltage across and forward current, flowing through LED source. Built-in pulse generators are provided with pulse widths of 30ns and 100ns.

SPECIFICATIONS:

Source-1:	
Type	: Laser
Central wavelength	: 1310nm
Spectral width	: 1nm
Output power	: 0.9mW
Forward Voltage	: 1.1 to 1.5 Volts
Rise/Fall Time	: 0.7nS
Continuous Forward Current	: 2mA
Threshold Current	: 40mA Max
Source-2:	
Type	: Laser
Central wavelength	: 1550nm
Spectral width	: 1nm
Output power	: 0.9mW
Forward Voltage	: 1.1 to 1.5 Volts
Rise/Fall Time	: 0.7nS
Continuous Forward Current	: 2mA
Threshold Current	: 50mA Max
Detectors	: 1 and 2
Type	: PIN photodiode
Spectral Bandwidth	: 1250nm to 1600nm
Capacitance	: 0.8pF
Rise/Fall Time	: <1nS
Reverse Voltage	: 30Volt
Pulse Generator	:
Pulse width	: 30ns &100ns
Pulse amplitude	: 4Vpeak
Display	: 3 Digit seven segment display indication for forward voltage and current
Input Selectable from TTL	: CW, Pulse, Analog, and RS-232
Interface	: ST type connectors

FOM-2: FIBER OPTIC PASSIVE COMPONENT MODULE

FOM-02 consists of Industrial Grade passive components like coupler, isolators, attenuator and WDM to study the characteristics of these passive Optical Components.

One type of fiber optic component that allows for the redistribution of optical signals is a fiber optic coupler. A fiber optic coupler is a device that can distribute the optical signal (power) from one fiber among two or more fibers. A fiber optic coupler can also combine the optical signal from two or more fibers into a single fiber. Fiber optic couplers attenuate the signal much more than a connector or splice because the input signal is divided among the output ports. For example, with a 1X2 fiber optic coupler, each output is less than one-half the power of the input signal (over a 3 dB loss).

Fiber optic couplers can be either active or passive devices. The difference between active and passive couplers is that a passive coupler redistributes the optical signal without optical-to-electrical conversion. Active couplers are electronic devices that split or combine the signal electrically and use fiber optic detectors and sources for input and output.

Optical isolators are passive optical devices that allow light to be transmitted in only one direction. They are most often used to prevent any light from reflecting back

down the fiber, as this light would enter the source and cause backscattering and feedback problems. Optical feedback degrades signal-to-noise ratio & consequently bit-error rate. Ideally, an isolator would pass all light in one direction and block all light in the reverse direction.

Fiber optic attenuators are devices that reduce signal power in fiber optic links by inducing a fixed or variable loss. They are used to control the power level of optical signals at the outputs of light sources and electrical-to-optical (E/O) converters. They are also used to test the linearity and dynamic range of photo sensors and photo detectors. Fiber optic attenuators use several methods of attenuation. Examples include air gaps, microbends, acousto-optic modulators, & electro-optic modulators.

Wavelength division multiplexers (WDM) are passive devices that combine light signals with different wavelengths, coming from different fibers, onto a single fiber. They include dense wavelength division multiplexers (DWDM).

SPECIFICATIONS:

COUPLER:

Dual window wide band
Low insertion loss
High uniformity
Environmentally stable
Coupling ratio:50:50

WDM 1&2:

Dual window wide band
Low insertion loss
High uniformity
Environmentally stable
High port isolation
Operating wavelength 1310nm & 1550nm

ISOLATORS I & II:

Polarization independent isolator
Environmentally stable
Ultra high isolation
Minimum polarisation dependent loss (PDL)
Polarisation mode dispersion free
Optical path epoxy free
Low insertion loss
Isolator I at 1310nm
Isolator II at 1550nm

ATTENUATOR I & II:

Attenuation of attenuator I 5dB
Attenuation of attenuator II 10dB
Utilizes filter technology
Vibration and temperature resistant

FOM-3 FIBER OPTIC CABLE MODULE

Since fiber optic cable is made of glass & is very brittle, students may not handle it carefully. Hence uniform lengths of fibers are provided inside the cabinet and end points are provided on the front panel making it easy for the students to handle long lengths of fiber.

FOM-3A: MULTIMODE FIBER OPTIC CABLE MODULE

SPECIFICATIONS:

Length of fiber-1	: 100 meter
Length of fiber-2	: 500 meter
Length of fiber-3	: 1000 meter
Type of fiber	: Multimode

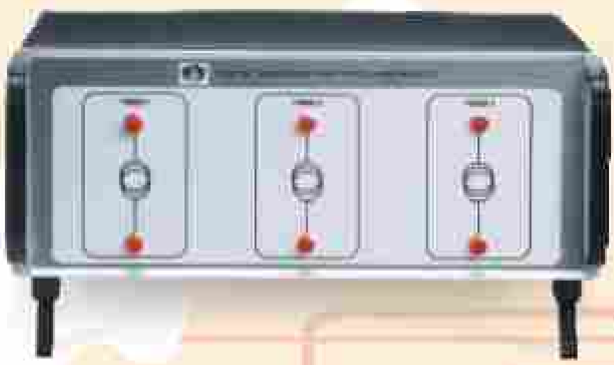
FOM-3B: SINGLEMODE FIBER OPTIC CABLE MODULE

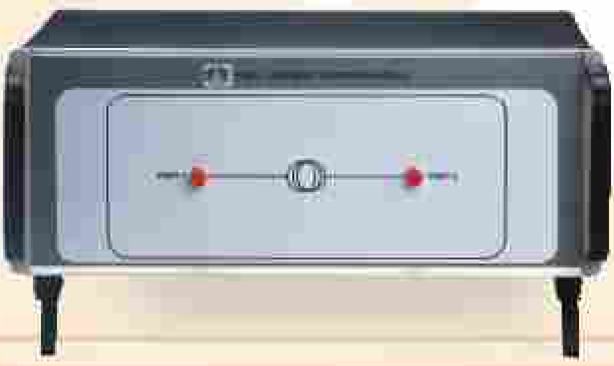
Length of fiber-1	: 100 meter
Length of fiber-2	: 500 meter
Length of fiber-3	: 1000 meter
Type of fiber	: Singlemode

FOM-4: CHROMATIC DISPERSION MODULE

Chromatic Dispersion module is specially designed to measure chromatic dispersion in a optical fiber. A special purpose fiber is provided for laboratory use to make the study more perfect and easy.

SPECIFICATIONS:





LIST OF EXPERIMENT	FOM-1A	FOM-1B	FOM-1C	FOM-1D	FOM-2	FOM-3A	FOM-3B	FOM-4
• I-V characteristics of LED	√							
• P-I characteristics of LED	√							
• Conversion efficiency of LED	√							
• I-V characteristics of LASER		√	√	√				
• P-I characteristics of LASER		√	√	√				
• Measurement of dark current of photo diode detector	√	√	√	√				
• Measurement of responsivity of photo diode detector	√	√	√	√				
• Measurement of rise and fall time of photo diode detector	√	√	√	√				
• Load dependent response of photo diode detector	√	√	√	√				
• Measurement of dark current of APD detector	√							
• Measurement of responsivity of APD detector	√							
• Measurement of rise and fall time of APD detector	√							
• Gain measurement of APD detector relative to PIN photo diode detector	√							
• Measurement of chromatic dispersion				√	√			√
• Audio signal transmission	√	√	√	√				
• Digital data transmission	√	√	√	√				
• Intrinsic loss and return loss in isolator		√	√	√	√	√	√	
• Measurement of Attenuation, Return loss using attenuator		√	√	√	√	√	√	
• Coupling Efficiency, Return Loss using coupler		√	√	√	√	√	√	
• Wavelength division multiplexing & demultiplexing of analog / digital signals over 1310nm & 1550nm wavelengths				√	√			
• Building block of OTDR		√	√	√	√	√	√	
• Measurement of isolation between signals over 1310nm & 1550nm wavelengths				√	√			

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