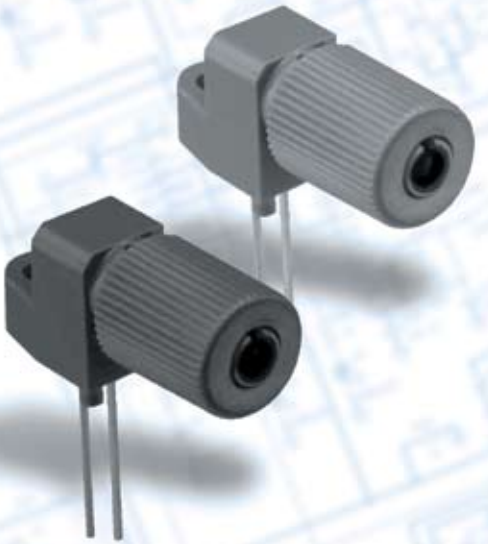
Industrial Fiber Optics, Inc.



Educational Products

Industrial Fiber Optics 627 South 48th Street, Ste. 100 Tempe, AZ 85281 480 804 1227 Fax 480 804 1229

Laser Classifications

All manufacturers of lasers used in the United States, must conform to regulations administered by the Center for Devices and Radiological Health (CDRH), a branch of the U.S. Department of Health and Human Services. CDRH categorizes lasers as follows:

Class	Description
I	A laser or laser system which does not present a hazard to skin or eyes for any wavelength or exposure time. Exposure varies with wavelength. For ultraviolet, .2 to .4 µm exposure is less than from .8 nW to .8 µW. Visible light exposure varies from .4 µW to 200 µW, and for near IR, the exposure is < 200 µw. Consult CDRH regulations for specific information.
II	Any visible laser with an output less than 1 mW of power. Warning label requirements — yellow caution label stating maximum output of 1 mW. Generally used as classroom lab lasers, supermarket scanners and laser pointers
IIIa	Any visible laser with an output over 1 mW of power with a maximum output of 5 mW of power. Warning label requirements — red danger label stating maximum output of 5 mW. Also used as classroom lab lasers, in holography, laser pointers, leveling instruments, measuring devices and alignment equipment.
IIIb	Any laser with an output over 5 mW of power with a maximum output of 500 mW of power and all invisible lasers with an output up to 400 mW. Warning label requirements — red danger label stating maximum output. These lasers also require a key switch for operation and a 3.5-second delay when the laser is turned on. Used in many of the same applications as the Class IIIa when more power is required.
IV	Any laser with an output over 500 mW of power. Warning label requirements—red danger label stating maximum output. These lasers are primarily used in industrial applications such as tooling, machining, cutting and welding. Most medical laser applications also require these high-powered lasers.

Product Index

Laser Safety

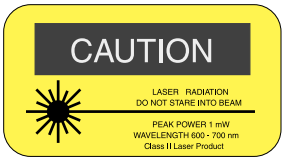
All lasers sold by Industrial Fiber Optics emit a visible beam of low power red light. No infrared, ultra-violet, x-ray or other non-visible radiation is emitted from these products.

With outputs of a few thousandths of a watt, these low-power lasers cannot be used to burn, cut or drill. Even so, you should use caution, because the beam is concentrated. It could become focused to a pinpoint within the human eye. ***Never look directly into the laser beam or stare at its bright reflections — just as you should avoid staring at the sun or other very bright light sources.***

Federal Regulations

The U.S. Department of Health, Education and Welfare regulates and classifies all laser products sold in the United States. Industrial Fiber Optics lasers comply fully with laser performance standards established by Center for Devices and Radiological Health (CDRH) Regulation 21, parts 1040.10 and 1040.11, Code of Federal Regulations.

All lasers described in this brochure fall within the limitations of Class II and Class IIIa of CDRH standards.



Class II Laser Labeling

Class II lasers may not exceed 1 milliwatt of output power, and must contain a pilot light and a beam attenuator. An example of the "warning logotype" label used for Class II lasers is shown on the left.

Class IIIa Laser Labeling

Class IIIa lasers have an output power limitation between 1 and 5 milliwatts, and require a pilot light and a beam attenuator. The "warning logotype" label required for this classification of laser is shown on the left.

Additional References

For more information about lasers and laser standards, contact your local U.S. Department of Health, Education and Welfare office, or write to the agency's headquarters at 1390 Piccard Dr., Rockville, MD 20850.

For U.S. guidelines on laser classifications and health standards, refer to the American National Standards Institute specifications governing lasers and laser safety. The guidelines are published by the Laser Institute of America, 12424 Research Parkway, Suite 130, Orlando, FL 32826.

Industrial Fiber Optics is a leading American manufacturer of low power educational lasers. We began making diode lasers in the early '90s as a preferred alternative to helium neon lasers, for communication demonstrations. From the early days our classic design was bright blue, see-through, impact-resistance acrylic enclosures (see photo at right). The color alone appealed to students interested in laser technology. We call this characteristic design our CT (for Cerulean Tech) laser series.

In 2004 we acquired the educational laser product line from Metrologic Instruments, long a major player in that market. Metrologic sold to us because of our commitment to the educational business and our high quality. (Metrologic now focuses on laser bar code scanning and related technology.) Since purchasing the Metrologic line, we have upgraded, improved many of the products and rewritten instruction manuals while retaining the conventional packaging that made these lasers so durable. This is the first catalog in which we incorporate Metrologic products with our own.

Our product laser line now includes:

- Diode communications lasers
- Full line of helium-neon lasers (CT series)
- Laser pointers (Class II and IIIa)
- Metrologic lasers & laser products

New additions to this catalog include expansion of our laser pointers to include a green laser pointer in a Class II power level; two kit versions of a full-size lab lasers; and a self-contained, battery-powered diode pumped solid state laser which is also a Class II power level. All of these products deliver exceptional value to the educational market while also serving as top-quality technical instruments.

* If you have any old or non-working Metrologic products, please contact our customer service department and we will do our best to repair or get replacement parts for you.

Laser Selection

Attempting to compare all the makes and models of lasers in today's market can be confusing at best. In general, helium neon lasers are the preferred choice if long coherence length and wavelength stability are needed for optical interferometric experiments. Diode lasers are the best choice for communications or fiber optic experiments. Questions? Industrial Fiber Optics' technical staff will be happy to help you select the correct laser for your specific needs. Monday through Friday, 8 a.m. to 5 p.m., Mountain Standard Time,

call 480 804 1227,

or e-mail info@i-fiberoptics.com

ML 800 Series

This series of laser is a tried and true laser design. Originally designed and manufactured by Metrologic Instruments, we are very proud at Industrial Fiber Optics to continue producing this outstanding line of lasers. Designed with a sturdy metal enclosure and along the lines of classic laser design with integrated power supply this laser is an excellent choice for an industrial or educational application.

Features:

- Hard seal laser tubes for long dependable life
- Shock resistant mountings
- Durable extruded aluminum housing that protects laser tube and power supply components
- Two-year limited warranty
- Solid-state power supply mounted on durable printed circuit board
- Standard 1/4-20 camera-type threaded hole in bottom of chassis for tripod or optical bench mounting
- Mechanical slide shutter over front aperture to block beam without having to turn off power supply (as required by CRDH)
- Rear end caps with power switch and indicator lamps, fuse holder, and line cord with 3 prong grounded plug
- Full-length rubber strips on the underside to prevent scratching and slipping on polished surfaces
- Labels and safety features to meet all U.S. CDRH regulations
- Integrated power supply
- Power requirements 105 – 125 VAC 60 Hz

Front view of the ML 800 series shows the mechanical beam stop and threaded optical mounts.

ML 800 .5 mW Laser

Class II CDRH Classification

The most economical laser in the classic ML 800 series

ML 810 .8 mW Laser

Class II CDRH classification

With output power of .8 mW, the ML 810 is our most popular model in the 800 series for any engineering or educational lab. Its beam width is visible in a normal or semi-dark room when conducting most optical experiments.

Characteristics:

Operating

Temperature ..... -20 to 50 °C

Optical

Wavelength ..... 632.8 nm
Polarization ..... random
Mode ..... TEM_{00}
Beam diameter ..... < 1 mm
Beam divergence ..... < 2 milliradians

Storage

Chassis dimensions .... 24 cm x 7.2 cm x 7.2 cm

ML 820, ML 840 and ML 850 have been discontinued. Suggested replacements are the IF HN20, IF HN35 and IF HN50, respectively, described on page 5.

Modulated Helium Neon Lasers

Industrial Fiber Optics' Classic ML 868 and ML 869 modulated helium-neon lasers contain all features of the standard product line, but they can also be modulated by varying their beam intensity. These lasers are capable of up to 15% intensity variations at rates up to 1 MHz. They are unquestionably the best red light-producing lasers in the product line.

Features:

- Smallest beam diameter and lowest beam divergence of the ML 800 series
- Output beam ranges from 85% to 100% of full power during modulation
- Lasers accept modulation signals from 50 Hz to 1 MHz, although video signals of higher bandwidth (such as color TV) will not be transmitted
- Effective signal transmission distance up to several hundred feet without a beam collimator. With collimator and detector, range increases to thousands of feet
- 3.5 mm phone jack accepts audio input signals at 100 mV peak-to-peak level and 8 kΩ impedence
- Two-year limited warranty

ML 868 .8 mW Laser

Class II CDRH Classification

The modulated ML 868 can do so much more than ordinary lasers! For example: Connect a microphone to this laser and send voice signals over the beam to a distant receiver. Or pulsate the transmission with a signal generator, reflect it from a distant mirror and measure the speed of light with a receiver and oscilloscope.

ML 869 1.5 mW Laser

Class IIIa CDRH Classification

The ML 869 provides nearly twice the optical power of the ML 868, greatly increasing the maximum useful distances for any experiment or demonstration. Increased brightness also helps students make better holograms. Small movements or vibrations are less likely to blur the picture with the ML 869's shorter exposure time.

Characteristics:

Operating

Temperature ..... 0 to 50 °C

Optical

Wavelength ..... 632.8 nm
Polarization..... random
Mode ..... TEM_{00}
Beam diameter ..... .66 mm
Beam divergence ..... 1.25 milliradians

Storage

Chassis dimensions .. 32.8 cm x 7.2 cm x 7.2 cm

Helium Neon Lasers

Industrial Fiber Optics is pleased to announce the expansion of its dependable and versatile helium neon lasers to include the 5 mW powerhouse. Within our standard product line we offer modulated and unmodulated models to choose from with powers ranging from .5 to 3.5 milliwatts. These lasers have the same great features as our diode lasers. You will easily recognize this laser as it is packaged it in a brilliant blue acrylic housing which is extremely durable and visually appealing to both industrial and educational users. The helium neon laser with its narrow and stable wavelength stability and long coherence length is ideal for:

- Holography and interferometry
- Voice communication
- Diffraction
- Single and double slit experiments

In addition, this laser can be used to conduct regular laser, optics and fiber optic experiments which demonstrate properties such as:

- Refraction
- Reflection
- Tyndall's light-guiding-in-water experiments
- Scattering of light
- Critical angle determination in materials
- Convergence and divergence of lenses
- Polarization of light
- Measurement of Brewster's angle

Characteristics:

Operating

Analog bandwidth..... 600 Hz to 20 kHz
Temperature ..... 0 to 40° C

Optical

Wavelength ..... 632.8 nanometers
Polarization..... random
Mode ..... TEM_{00}
Beam diameter ..... < 1 millimeter
Beam divergence ..... < 2 milliradians

Storage*

Chassis dimensions..... 5.8 cm × 7 cm × 36.7 cm
Weight ..... 820 grams

* Excluding 3.5 and 5.0 mW models

Features

- Hard-seal laser tube for long dependable life
- Fool-proof mechanical beam stop
- Bright laser pilot light
- Impact-resistant, see-through, two-tone blue acrylic case
- Tamper-resistant screws for safety
- Threaded mount for holding lenses, filters and diffraction gratings
- Tripod mount—¼ - 20 thread
- Rubber feet on chassis bottom for adhesion on slick lab surfaces
- Full-color operator's manual with safety information and common experiments
- Labeling and safety requirements compliant with U.S. CDRH regulations
- Standard 3.5 mm audio input jack (modulatable models)
- 110- and 220-VAC electrical voltage options
- 2-year warranty

Models

Stock No.*	Class[1]	Modulatable	Power Level
IF-HN05	II	No	.5 milliwatts
IF-HN08	II	No	.8 milliwatts
IF-HN08M	II	Yes[2]	.8 milliwatts
IF-HN15M	IIIa	Yes[2]	1.5 milliwatts
IF-HN20	IIIa	No	2.0 milliwatts
IF-HN35	IIIa	No	3.5 milliwatts
IF-HN50	IIIa	No	5.0 milliwatts

* 220-VAC 50 Hz power adapters available upon request
1 Laser classifications as defined by the Center for Devices and Radiological Health
2 Electrical input is industry-standard 3.5 mm audio jack

Helium Neon Specialty Lasers

Industrial Fiber Optics' ML 800 series includes two small-form factor helium neon lasers. Measurements of these two lasers are 18.7 x 4.0 x 4.7 cm, making them among the smallest combined laser-power-supply packages on the market. The ML 811 produces a visible optical beam of .5 mW/632.8 nm red light. The ML 815 produces visible green light with an optical beam of .05 mW at 543.5 nm.

With excellent beam quality and pointing stability, both lasers are excellent choices for general-purpose lab work involving experiments in interferometry, scattering, diffraction, refraction and general optical demonstrations. They also are excellent for presentation and demonstration purposes because they're small, lightweight, portable and easily set up.

The ML 815 is the most economical green light-producing helium neon laser on the market. (Despite the optical radiometric power of the laser being small, it produces very visually bright beam because the human eye is much more sensitive to green light than red light.) Its very low laser beam power also makes it the safest laser for educational settings. One of the more interesting experiments to conduct with this green laser would using an optical radiometer to measure the light from green and red helium neon lasers, record students' perceived visual brightness, then have them compare and explain their observations.

Model pictured is the ML815

Includes 110-VAC-to-DC power adapter and operators manual.

Features:

- Compact hand-size dimensions
- Hard-seal laser tube for long life
- Metal housing and end caps with durable powder coatings
- Meet U.S. CDRH Class II requirements
- Three-position switch to select off, continuous or momentary operation
- CE approved and marked
- Two-year limited warranty
- Meets U.S. CDRH class II requirements

Characteristics:

ML811 (red)

Power 0.5m
CDRH ..... Class II

Optical

Wavelength ..... 632.8 nanometers
Mode ..... TEM_{00}
Beam diameter ..... 0.48 millimeter
Beam divergence ..... 1.7 milliradians

ML815 (green)

Power 0.05m
CDRH ..... Class II

Optical

Wavelength ..... 543.5 nanometers
Mode ..... Multi
Beam diameter ..... 0.88 millimeter
Beam divergence ..... 2.35 milliradians

Diode Lasers

Industrial Fiber Optics offers two basic models of lab-sized (semiconductor) diode lasers. Our RL series of diode lasers is ideal for conducting voice and audio optical transmission experiments as well as common laser and optical experiments. Electrical connections for the analog and digital inputs are the industry-standard, durable banana jacks. In addition, the analog input has a 3.5 mm audio jack for audio and microphone inputs. This laser is also the only product on the market which features an externally-adjustable internal electronic amplifier with a variable gain from 1 to 50. This feature makes it suitable for communication experiements with low-voltage microphone inputs and higher amplitude signals from AM/FM radios.

Industrial Fiber Optics' VL series lasers offer wider electrical modulation bandwidth capabilities. They are suitable for video laser transmission and conducting standard voice and audio transmission experiments. Analog and digital inputs for these lasers are industry-standard RCA phono jacks.

Applications

- Voice and AM/FM radio transmission
- Laser leveling experiments
- Light shows
- Bar code scanning
- Particle counting
- Refraction & reflection measurements
- Polarization experiments
- NTSC Video transmission (IF-VL only)

Characteristics:

Polarization	linear
Beam diameter	2 millimeter
Beam divergence	2 milliradians
Chassis dimensions	5.6 cm × 7.5 cm × 22 cm
Weight	400 grams
Operating temperature	0 to 40° C

Features

- Semiconductor laser diode for long dependable life
- All solid-state electronic design
- Analog and digital modulation capabilities
- Internal overdrive protection on inputs
- Fool-proof mechanical beam stop
- Linear polarized light beam
- Impact-resistant, see-through, two-tone blue acrylic case
- Tamper-resistant screws for safety
- Threaded mounts for holding lenses, filters and diffraction gratings
- Tripod mount – ¼ - 20 thread
- Rubber feet on chassis bottom for adhesion on slick lab surfaces
- Full-color operator's manual with safety information and common procedures
- Labeling and safety requirements compliant with U.S. CDRH regulations
- 110- and 220-VAC electrical voltage options
- 4-year limited warranty

Models

Stock Number	Class[1]	Wavelength (nm)	Optical Power (mW)	Digital Bandwidth	Analog Bandwidth	Comments
IF-RL08-635	II	635	0.8	1-500 kHz	1-500 kHz	*Alternative to conventional HeNe lasers*
IF-RL30-635	IIIa	635	3.0	1-500 kHz	1-500 kHz	*A very bright modulatable laser for long-distance requirements*
IF-VL08-635	II	635	0.8	1-20 MHz	1-10 MHz	*Least expensive laser for transmitting video[2] signals*
IF-VL30-635	IIIa	635	3.0	1-20 MHz	1-10 MHz	*Brightest laser for transmitting digital and video[2] information*

1 Picture signals from color televisions, video cameras and camcorders

Diode Laser Pointer (modulatable and rechargeable)

The ML268 is one of the most popular lasers in our product line and remains as unique today as when it was introduced 15 years ago. It incorporates the best features of full- or lab-sized lasers in a convenient hand-size design only slightly larger than conventional pen-sized laser pointers. The laser is suitable for use in lectures and AV shows, transmitting video pictures over a laser beam, or as a lab laser for optical experimentation and demonstration. (Metrologic Instruments produced this laser until 2004. IFO redesigned and now manufactures an improved version.)

Features:

- Rechargeable nickel-cadmium batteries
- Small size conveniently fits the palm of the hand for use as a laser pointer
- High-quality beam as found in full-size lab lasers (improved over the original Metrologic design)
- Highly visible red beam
- 3-position power switch with a momentary switch for continuous or intermittent use
- Standard RCA-type phone jack accepts camcorder/VCR video signals or high-level audio signals; an amplifier circuit permits use of microphone or other low-level audio sources
- Tough impact-resistant metal chassis and end caps with durable powder coatings

Characteristics:

Optical Power (typical)	0.9 mW
Wavelength	650 nm
Electrical bandwidth	20 Hz To 4 MHz
Electrical input impedance (RCA jack)	~6.2 kΩ
Beam diameter	3.0 mm
Divergence	1.1 milliradians
Housing (L x W x H)	14.0 x 3.2 x 3.2 cm

Laser includes 115- to-9 volt power adapter and full-color manual

Stock # **ML 268**

ML 268 laser pointer with an additional mounting clamp that can be attached to any standard tripod, optics bench, or chemical ring stand with ½ -20 thread mounts.

Stock # **MK 268**

The ML268 operates directly from a 110-VAC-to- 9-VDC power adapter/charger, or from internal rechargeable batteries. When fully charged the batteries typically provide two hours of continuous operation. The optical beam can be electrically modulated via a standard audio RCA-type jack. The internal circuitry is electrically compatible with NTSC color video signals from a camcorder or VCR, or audio signals from low-impedance sources.* The solid-state visible laser diode and miniaturized electronic components make this the smallest modulated educational laser on the market. A decade and a half since its introduction, this laser pointer remains an innovative product with outstanding performance.

* With an additional amplifier circuit to amplify/buffer high-impedance audio sources, the ML268 can also be used for an optical audio transmission link.

ML 268 Optical Receiver

This two-channel audio/video receiver is a simple companion accessory to the ML 268. It combines a photodetector and amplifier circuit to convert electrically modulated optical beams to an electrical signal. The output is available on standard RCA audio/video jacks. When used with a suitably modulated laser the receiver provides an NTSC color composite video optical transmission link. (The receiver is also capable of demodulating audio signals from modulated Class IIIa or lower power lasers, but the recovered audio signals are small. An amplified speaker will deliver suitable audio volume). Powered by a 9-volt battery.

Stock # **45-725**

Diode Pumped Solid State Laser

Industrial Fiber Optics has created a very special laser for the educational market. The ML 825 is a small-form factor, solid state green laser. It uses cutting edge technology housed in a durable metal package standard to the ML 800 product line. The laser's bright green emission wavelength is achieved with an eye-safe CDRH Class II rating. The enclosure measuring 18.7 x 4.0 x 4.7 cm also contains the rechargeable batteries. It's among the smallest combined laser-power-supply packages on the market.

The brightness, optical power stability, good beam quality, and pointing stability make this laser an excellent choice for general-purpose lab and educational work. The ML 825 is suitable for basic optical experiments as well as those involving interferometry, scattering, diffraction and refraction. It also is ideal for presentations and demonstrations because of its battery (cordless) operation and handheld size.

Features:

- Compact handheld design
- All solid state components for long life and optical stability
- Very high quality optical beam
- Rechargeable nickel-cadmium batteries
- Three-position switch to select continuous or momentary operation
- Rugged metal housing and end caps with durable powder coating
- Meets U.S. CDRH Class II eye-safe criteria
- Two-year limited warranty

The ML 825 utilizes the latest in laser technology—Diode Pumped Solid State (DPSS). A high-efficiency near-infrared laser diode optically stimulates a crystal to lasing, and the lasing output is frequency-doubled (wavelength halved) in another crystal medium to generate a bright green emission at 532 nm. Output collimating and filtering optics complete the conversion to deliver a high quality, green laser beam. Although this process is indirect, use of high efficiency low-cost Infrared laser diodes (as used in the telecommunications industry) more than make up for the difference between typical direct and indirect modes. In addition, it is easy to control the optical output from laser diodes and therefore easy to control the lasers output power level. The result is an economical, efficient and stable green emission laser source.

Characteristics:

Power (typical)	0.9 mW
Wavelength	532 nm
Beam diameter	2.5 mm
Divergence	2 milliradians
Operating temperature	10-30 °C
Lifetime (MTTF)	5000 hours

Stock #
ML 825

Helium-Neon Laser Project Kit

Industrial Fiber Optics invites you to build your own helium-neon laser. You'll find everything you need In this kit, including schematics and step-by-step assembly instructions. This low-cost laser can be assembled in three to four hours. It is ideal for the student laboratory, as well as classroom demonstrations, laser shows and holography instruction. Features of the completed kit are identical to those of the ML 800 laser series. Optical characteristics are also very similar (see ML 800 specifications on page 2 of this catalog). This kit is an appropriate challenge for those who have previously assembled simple electronic kits – and it adds a very functional laser to your tools.

Characteristics:

Power (typical) ..... 0.5 mW
Wavelength ..... 632.8 nm
Polarization ..... random
Beam diameter ..... 0.48 mm
Beam divergence ..... 1.7 milliradians
Dimensions ..... 27.9 cm x 7.2 cm x 7.4 cm

Kit comes complete with hard-seal helium-neon tube, printed circuit board, electrical components, switch, fuse, laser tube mounts, transformer, high-voltage electrical wire, 3-prong electrical line cable, durable extruded aluminum housing and metal end caps with powder coating, screws, CDRH laser labels, assembly instructions, schematic, parts list and operating instructions. Does not include soldering iron or solder. (Some soldering experience is recommended for this project.)

Stock #
ML 801

Kit contains printed wiring board, electronic components, switches, laser diode, laser diode mount, collimating lens, impact-resistant acrylic enclosure (not shown) with end cap, beam shutter, CDRH labels, power adapter and step-by-step assembly guide, circuit schematic and parts list. Does not include soldering iron or solder. (We recommend some soldering experience and understanding of simple schematics to complete this project.)

Diode Laser Kit

For more adventurous electronics hobbyists, Industrial Fiber Optics now offers a semi-conductor diode laser in kit form. It has the same features as our RL series diode lasers shown on page 6. The completed laser is perfect for conducting a wide variety of voice, audio optical transmission and laser experiments. The easy-to-follow circuit schematic and assembly instructions create a captivating and dynamic class project in the basics of semi-conductor laser construction and operation. The completed laser is capable of audio transmission using a microphone, CD or AM/FM radio.

Stock #
IF RL08-K

Characteristics:

Power (typical) ..... 0.8 mW
Wavelength ..... 635 nm
Polarization ..... linear
Beam diameter ..... 3.20 mm
Beam divergence ..... 2.0 milliradians
Chassis dimensions ..... 22 cm x 5.6 cm x 7.5 cm

Laser Ray Box

Compact and powerful, the Laser Ray Box produces five parallel and sharply defined light beams ideal for demonstrating optical ray analysis and viewing. Five side-by-side 1mW diode lasers 1.6 cm apart create beams that are 650 nm in wavelength for high visibility (readily seen even in a typical well-lit room). With its commanding visual effects, the Laser Ray Box will easily and dramatically demonstrate the following light behaviors when used with the appropriate optics:

- Light bending due to refraction
- Focusing effects of refractive optics
- Reflections from mirrors
- Fresnel reflections from non-coated lens surfaces
- Monochromatic character of laser light
- Total internal reflection

The bottom of the Laser Ray Box has a magnetized surface for easy adherence to both horizontal and vertical metal surfaces such as steel white or chalk boards for classroom optical demonstrations.

Power to energize the lasing elements is provided by an internal NiCd cell that is charged with the VAC-to-DC power adapter provided

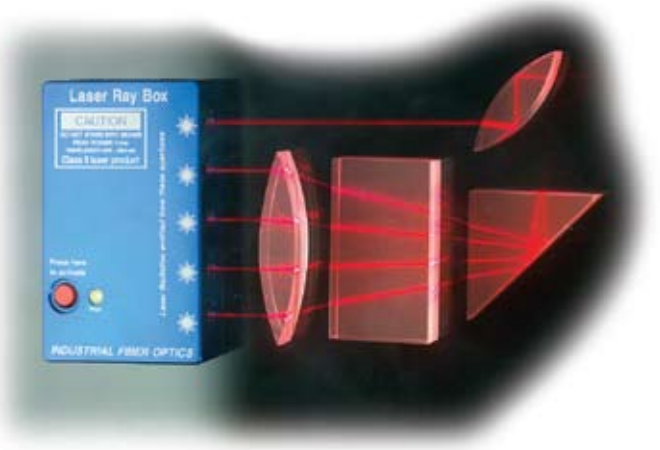
Models

Stock No.	Description
IF 550	Laser Ray Box
IF 583	Laser Ray Box with foam-lined container

(This device is rated as a Class II laser product by CDRH regulations because no single beam exceeds 1 mW of visible laser radiation or light.)

Features:

- Bright green pilot light for safety
- Laser engraved permanent labeling
- Labeling and safety requirements compliant with U.S. CDRH regulations
- Magnetic strip for adhesion to vertical surfaces
- Rechargeable, long life NiCad battery
- 1-year warranty
- Full-color operations manual with safety information and equipment set-up
- Linearly polarized light beam



Characteristics:

Operating

Input voltage, max ..... 12 volts
Input current ..... 75 milliamperes
Temperature ..... 0 to 40° C

Optical

Wavelength ..... 650 nanometers
Polarization ..... linear
Output power, max ..... .95 milliwatts
Beam diverted into rays

Storage

Chassis dimensions ..... 11 cm × 6 cm × 2 cm
Weight ..... 400 grams

Laser Pointers

Industrial Fiber Optics offers, for educational use, laser pointers that produce either green or red light. The pointers are CDRH-compliant and bear all required regulatory labels. Our product line is unique because we offer CDHR Class II power levels that most companies do not. (Class II lasers have a maximum peak power of 1 milliwatt [mW] in the visible range—the highest class rating that many school systems permit.)

The green light Class II pointer is new this year, joining our red light stylus pointer design. The table on the right compares brightness perceived by the human eye in response to various laser wavelengths of the same radiometric optical power. As shown, green light appears much brighter to the human eye than does red. Our 532 nm Class II green laser pointer, therefore, is an excellent solution for teachers who must comply with specific school regulations, but who wish to offer vivid optical demonstrations that Class II red light pointers cannot provide.

Wavelength nanometers (nm)	Brightness Perceived by the Human Eye
670 (red)	1 (reference)
650	3.4 x reference
635	7.2 x reference
632.8 (HeNe gas)	7.9 x reference
532 (green)	28.2 x reference

Lifetime: > 3,000 hours
Warranty: 6 months
Batteries: 2 AAA

		Class Power (mW)	*Stock Number*	*Wavelength (nm)*
Green Light		Class II < 1	IF 566	532
		Class IIIa < 5	IF 565	532
Red Light		Class II < 1	IF 563	645
		Class IIIa < 5	IF 560	645
Deluxe Red Light		Class IIIa < 5	IF 564	635
Stylus/Pen/Pointer*		Class IIIa < 5	IF 595	635

* Powered by 3 button cells

Sandbox Holography Kit

The Sandbox Holography Kit is the perfect way to introduce your students to the fascinating field of holography, then demonstrate many different aspects of how holograms are photographed and how they can be used. The kit includes instructions and all of the optical elements required to shoot a wide variety of different types of holographic setups. Starting out with simple Direct Beam Reflection and Transmission Holograms, the manual proceeds to instructions for shooting 360° Cylindrical Holograms and Multiple Beam Reflection and Transmission Holograms.

The vast information storage capacity of Multiple Channel Holograms and the precise measurement capabilities of Holographic Interferometry are discussed along the way. As compared to the numerous "simple" holography kits on the market today, the 12 different holograph setups detailed in Sandbox Holography offer a far more comprehensive treatment of holographic techniques and uses.

The newly revised manual also includes instructions for building a rigid, massive "sandbox" used to dampen shocks and vibrations, providing a stable platform to set the holographic photography up on. The setup and use of a Michelson's Interferometer to test the rigidity and stability of the finished sandbox are also discussed. The study of this fascinating apparatus can be turned into an activity of it's own.

Instructions are also provided for the care and cleaning of the included optical elements.

The contents of the Sandbox Holography Kit include: 50:50 Beam splitter; two 38 x 25 mm first surface mirrors; 110 x 80 mm first surface mirror for redirecting a diverged beam; two mounted +7 mm diverging lenses; magnetic mounts for positioning all optical elements: film holder assembly; two beam test and shutter cards; green filter for a safe-light; sample transmission hologram; matte plastic mylar film for soft lighting effects; plastic jar, convex mirror and sample object to make and view 360-degree holograms; one package of extremely high resolution PFG-01 film for making holograms; set of ready to mix developing chemicals; 1/4" x 20 screw for sealing tripod mounting hole on bottom of laser from sand; foam lined carrying case; and an illustrated instructional booklet.

Stock #
45-633A

We recommend using the ML 869 laser with the Sandbox Holography Kit.
(See page 3)

Laser Pointer Education Kit

This economical kit is packaged so each student has his/her personal optics kit to study important concepts of light, color, and light waves using standard laser pointers. The multi-use kit is a collection of 15 demonstrations and nine experiments that require a few supplemental items found in a common science or physics lab. Activities include:

- Understanding color and color filters
- Understanding reflection of light
- Measuring the index of refraction
- Calculating the wavelength of a laser beam
- Scanning bar codes
- Investigating ophthalmology and paired muscle balance
- Exploring specular and diffused reflection
- Studying polarization of light

The kit contains a holographic diffraction grating; 2 polarized filters; two front surface mirrors; short and long focal length lenses; cylindrical lens; solar cell; rectangular prism; vinyl cap for mounting lenses to pointers; color filter set (red, blue, and green); and instruction guide. All are contained in a sturdy plastic hinged case.

Models

Stock No.	Description
45-211	Standard kit
45-311	Kit w Class IIIa 650 nm Pointer
45-315	Kit w Class IIIa 635 nm Pointer
45-317	Kit w Class II Green Pointer
45-318	Kit w Class II 650 nm pointer

Laser Optics Lab

The Laser Optics Lab contains more than 30 optical components and accessories for demonstrating the principles of optics in basic courses of physics and physical science. When used in conjunction with any HeNe laser,* the lab enables instructors to provide students an exciting and easily grasped learning experience in lasers and optics.

Laser Optics Lab includes three lenses, four mirrors, coated beam splitter, equilateral prism, optical beam spreader, air wedge, transmission hologram, diffraction mosaic, diffraction grating, fiber optic light guide, pair of glass interference plates, polarizing and color filters. The lab also contains an optics bench system consisting of metal component carriers, steel optical table, magnetic strips and a 68-page full-color instruction and experiment guide.

Sampling of Experiments:

- Investigate reflection, refraction and critical angle.
- Measure wavelengths of light using the techniques of Young, Michelson and Lloyd.
- Construct optical levers to detect and measure miniscule movements that are almost imperceptible to the human eye.
- Test a lens for defects, collimate light and evaluate a person's visual perception skills.
- Capture light in an arcing water jet or a optical fiber and investigate fiber optics phenomena.
- View a hologram, observe interference rings and measure diffraction patterns with a ruler.
- Determine the index of refraction of a liquid or transparent solid by measuring bending in the intense laser beam as it enters or leaves the material.
- Study characteristics of light: wavelength, interference, diffraction and polarization.

One key aspect of this lab is its simple optical bench system that consists of metal components and carriers magnetically attached to a steel optical table. Experiment set-up is easy, intuitive. The lab's cost also is exceptionally low when compared to that of many conventional optical rails and benches.

Included is a 68-page, fully-illustrated instruction guide that contains 34 optical, light and laser experiments. All experiments were developed by teachers and thoroughly tested in classrooms. Each experiment contains detailed instructions and illustrations to guide students to successful completion of each demonstration or activity. Experiments demonstrate the refractive, diffractive and other wave properties of light using the unique and visually dramatic characteristics of an HeNe laser. In addition to guiding the student through exercises in light and optics, the booklet also explains the theory of laser operation, aspects of laser construction and laser safety.

REVISED MANUAL

Complete lab and manual:
45-600

Manual alone:
45-700

** Diode lasers or pointers are adequate for completing some of these experiments, but they will produce less-than-adequate results in some experiments that require a very narrow optical spectrum.*

Physical Optics Lab

The study of image processing and Fourier transforms of optical formations can be practical for most high school and undergraduate physics classes when using the optics lab kit with any HeNe laser.* This product enables instructors to provide turnkey exercises to give students an efficient and exciting learning experience in lasers and optics. Using this unique collection of laser accessories with the instruction booklet can show students:

Sampling of Experiments:

- How double exposures, or even multiple exposures, on photographic slides can be separated into individual photographs
- How noise or other unwanted information can be eliminated from a transparency
- How diffraction patterns can be manipulated to form new images through the process of spatial filtering
- How to create a continuous tone photo from a half-tone (newspaper) photo
- How optical "noise" is removed from a laser beam by a spatial filter
- How optical components are manipulated to produce a collimated (parallel) beam of light
- How to create and compare Fresnel and Fraunhofer diffraction patterns
- How spatial frequency information is displayed in a Fraunhofer diffraction pattern
- How physical optics can serve as an excellent introduction to the study of Fourier series and Fourier transforms in optics and math courses

Complete lab and manual:
45-688

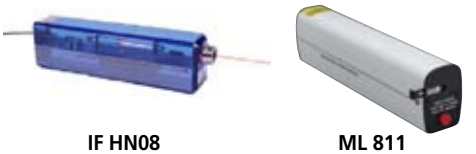
Manual alone:
45-788

Included is the 63 page, fully-illustrated instruction guide containing six activity modules structured to develop an experimental setup for demonstrating Fourier Transformation. The manual represents a series of optical laboratory activities typically not covered by introductory physics courses in high schools and universities. The goal of the activity series is to demonstrate Fourier Transformation in a way that bridges the gap between mathematical theory and real world application. Manual also includes information on laser safety, optical and Fourier Transforms and additional reference materials.

The Physical Optics Lab contains four mounted lenses, 8 magnetic mounts with magnetic tape, two mounted front surface mirrors, nine steel "L" mounts (to hold optical components), one 50 micron pinhole, a +15 mm focal lens in threaded cell, two mylar viewing screen, a set of 21 transparencies, a instruction booklet, and a padded carrying case.

* Diode lasers or pointers are adequate for some of the experiments, but will produce poor results for some of the experiments requiring very narrow optical spectrum.

** Suggested helium neon lasers to use with this lab:*



IF HN08 **ML 811**

One key aspect of this lab is its simple optical bench system that consists of metal components and carriers magnetically attached to a steel optical table. Mounting system allows for x, y, and z axis positioning of all lenses and mirrors. Experiment set-up is easy, intuitive. The lab's cost also is exceptionally low when compared to that of many conventional optical rails and benches.

The manual contains valuable appendices on optical theory.

Michelson Interferometer

This kit includes steel optical table, U-shaped carriers, L-shaped carriers, magnetic strips, beam splitter, small mirrors, short focal-length lens, laser pointer holder and instruction guide.

(Laser pointer shown is not include in standard kit.)

Industrial Fiber Optics' Michelson Interferometer Kit is the first truly inexpensive kit that faithfully re-creates the time-honored Michelson Interferometer. The Michelson Interferometer was/is a classic device that splits a beam of monochromatic light into two parts that travel along different optical paths, then are merged to produce interference fringes.

The fringes shift or change shape noticeably whenever one of the optical components in either optical path moves, even almost unperceptibly. They also shift when the effective length of one optical path changes slightly with respect to that of the second. These shifts make it possible to measure ultra changes of a medium's index of refraction, microscopic movements of components as well as the fundamental principle for items such as the laser ring gyroscope.

Before the advent of lasers with a visible beam, the alignment of interferometer components was very difficult to achieve under ordinary laboratory conditions. Now, using the brilliant red beam of an inexpensive Industrial Fiber Optics laser pointer, alignment can be achieved in just a few seconds.

The kit contains a set of optical components, optical table, mountings for easy assembly and a comprehensive instruction manual.

The manual includes additional exercises such as:

- Measuring the diameter of a human hair
- Measuring the coefficient of linear expansion of different metals
- Detecting vibrations using the interferometer as a seismograph
- Confirming the historic Michelson/Morely experiment that demonstrated the speed of light is not affected by the motions of planet earth through space

Models

Stock No.	Description
45-940	Michelson Interferometer with IF 560 laser pointer (red)
45-941	Michelson Interferometer with IF 564 laser pointer (green)
45-942	Michelson Interferometer without laser pointer
45-944	Michelson Interferometer with IF 566 laser pointer (green)

WBS Laser Communication Projects

The WBS Laser Communications Project is the ultimate educational laser project and contains the last laser you1ll need to purchase. Why? Because of it contains a versatile laser with very wide electrical modulation capability. The digital audio jack accommodates as low as 100 Hz for laser audio communication experiments and a RF video jack capable of frequencies as high as 70 megahertz for simultaneous transmission of color video picture and sound. With such fantastic versatility, this one laser can perform all of the following dynamic optical communication demonstrations:

- Voice communication
- AM/FM radio transmission
- Video from camcorder
- RF video from VCR
- Digital line-of-sight computer links

In addition, this laser in these projects can be used to conduct regular laser, optics and fiber optic experiments which demonstrate properties such as:

- Refraction and reflection
- Light shows
- Tyndall's light-guiding-in-water experiments
- Speed of light measurement
- Critical angle determination in materials
- Convergence and divergence of lenses
- Polarization of light
- Measurement of Brewster's angle
- Perimeter security using laser beams

Characteristics (Laser):

Operating

Analog bandwidth ..... 100 to 70 MHz
Temperature ..... -20 to 50° C

Optical

Wavelength ..... 635 nm
Polarization ..... linear
Output power ..... 0.8 mw
Beam diameter, max ..... 3.2 mm
Beam divergence, max ..... 2 milliradians

Storage

Weight ..... 400 grams
Chassis dimensions ... 5.6 cm × 7.5 cm × 22 cm

Features

- Semiconductor lasing element and all solid-state electronic design for a long dependable life
- Bright 635 nanometer wavelength laser beam
- Standard electrical input jacks
- Electrical overdrive protection on all inputs
- High visibility, fool-proof mechanical beam stop
- Linear polarized light beam
- Tamper-resistant screws for safety
- Impact-resistant, see-through, two-tone blue acrylic case
- Threaded mount for holding lenses, filters and diffraction gratings
- Tripod mount—¼ - 20 thread
- Rubber feet on chassis bottom for adhesion on smooth surfaces
- Full-color operator's manual with safety information and common experiments
- 4-year limited warranty

Models

As a special package offer, Industrial Fiber Optics will combine the WBS Laser with a free optical RF video receiver, interconnecting cables, power adapters and an instruction booklet for setting up a VCR-to-Laser-to-Receiver-to-TV link as a group package.

Stock #
IF UL08-635X

Industrial Fiber Optics also will offer the WBS Laser as a complete laser communication package with the items above, as well as a microphone, AM/FM radio, patch cords and an audio receiver.

Stock #
IF UL08-635Y

220 VAC Option available on request

Laser Audio Transmission Project

Wow your students with a visual demonstration of sound being transmitted over light waves from a laser beam. Simple and easy to set up, this state-of-the-art equipment package is a breeze to use. Simply insert the microphone into the jack at the rear of the laser, plug in the VAC-to-DC power adapters and aim the laser beam at the audio receiver's optical detector. Then talk, sing, hum or create almost any imaginable sound into the microphone. Equipment set-up is less than five minutes and the sounds are sent across the room and recreated within nanoseconds.

Students will be amazed that somehow voices are electronically and optically relayed from one remote point to another and converted back into sounds—without benefit of a "hard connector" in-between.

The project's audio receiver features total solid state design, adjustable volume control, self-contained and durable surface-mount electronics design, 110 VAC operation, and impact-resistant enclosure. Inside the receiver are the sensitive optical semiconductor detector, amplifier, power conditioning electronics and 10 cm (4 in.) speaker.

Package includes a choice of diode or helium neon laser, audio receiver, high-sensitivity electronic microphone, instruction manuals and two 110-VAC-to-DC power adapters. Also included is 3 meters of fiber optic cable for demonstrating the light- and information-carrying abilities of optical fiber.

Available with the general purpose .8 mW Class II Helium modulatable neon laser.

Stock # **IF 511**

With the smaller and highly linear .8 mW 635 nm Class II Diode Laser

Stock # **IF 512**

Laser Audio Receiver

Receiver for detecting light from any visible or infrared laser beam and converting modulated light signals to sound. (Shown in top right of photo above.)

Features:

- 110 VAC operation
- 100 mm (4 inch) internal speaker
- Adjustable volume control
- 100 to 15 kHz detection frequency range

Stock # **IF 513**

Laser Surveillance Project

The process of communicating by utilizing a modulated beam of light isn't a new idea. In the 1880s, Alexander Graham Bell experimented with something he called a photophone. The photophone had a mouthpiece that concentrated sound energy like that of the human voice on a reflecting diaphragm, which, in turn, modulated a beam of sunlight that was aimed at the diaphragm. When a remote receiver – consisting of a photovoltaic cell and a sensitive earphone – was positioned in the path of the beam, a person's voice could be heard clearly coming from the receiver.

During the 1960s the Soviet Union enhanced this technique and reportedly bugged conversations in offices of the U.S. embassy in Moscow by using an infrared laser. The laser beam supposedly was directed toward office windows in the embassy, and when the beam reflected off the windows it was optically focused on a very sensitive receiver. The windows, although rigid, vibrated slightly in response to the acoustic waves generated by US embassy personnel talking inside the offices. The slight movement of the windows caused the laser beam to be modulated (impressed with the unique vibrations of voices), which was picked up the laser receiver and then converted to sound, which reproduced the embassy conversations. With this project you can recreate that surveillance method and amaze your students with the power of lasers and technology.

Stock #
IF 592

Project equipment includes laser receiver with power adapter, two magnetic optic mounts, magnetic tape, optics table, plano-convex lens, window simulator with speaker; AM/FM radio with batteries, 3.5 mm audio patch cord, tripod and full-color instruction guide. Requires a visible-light producing laser such as a diode or helium neon laser. Eavesdropping on anyone's private conversation without their permission is prohibited by law except in certain law enforcement activities. This project, as packaged and designed, will not function in a commercial eavesdropping application. It is suitable only as an instruction. tool for demonstrating the capabilities of laser technology.

Stock #
IF 593
With .8 mW diode laser
(IF RL08-635)

Laser Speed of Light/Receiver Project

In the last few years, lasers have become invaluable tools in thousands of scientific, medical and communications applications. This project, in several individual experiments, demonstrates a laser's unique ability to perform a variety of tests with deceptive ease. Included:

- Measuring the speed of light
- Transmitting & receiving audible signals using light as the transport medium
- Transmitting and detecting black-and-white video signals using light.

The modulated laser included with this kit can also be utilized for hundreds of other classroom and real-life projects. The instruction manual contains detailed instructions and diagrams that describe equipment set-up, as well as a historical journey into efforts to measure the speed of light. This is a great opportunity to learn not only about new technology, but also the very human history behind it.

Stock #
IF 593
Complete with laser
(IF VL-08635)

Included in the kit are a .8 mW diode laser, optical beam splitter, first-surface mirror, converging lens, optics mounts, microphone, electronic control/receiver box with 2-channel receiver and 1 MHz oscillator, 110 VAC-to-DC power adapter, optics table and step-by-step instruction book.

Not included but required for operation are a modulated laser, video camera and monitor and a dual-channel 40 MHz oscilloscope.We will substitute 220 VAC adapters upon request.

Receiver & Accessories ..... **IF LSL-1**

Digital Laser Power Meter

The model 45-545A digital laser power meter is a multi-purpose instrument with the degree of accuracy required for many research applications and CDRH compliance measurements. This unit features settings for standard and peak/hold radiometric measurements and percentage mode for calibrating/measuring to user-defined standards. The meter employs a low-power LCD with large, 12 mm-high numerals.

In standard and peak/hold radiometric modes, the meter's four ranges display full-scale readings of 19.99 µW, 199.9 µW, 1.999 mW and 19.99 mW.

The detector head is black anodized aluminum for durability, 25 mm in diameter and 30 mm in depth. A 0.5 m retractable, shielded cable electrically connects the detector head to the meter's internal electronics. A snap-mount on the side chassis secures the head when not in use. Optical sensor and filters in shock-resistant mounts are located inside the head.

An analog signal, proportional to the optical power on the detector, is available from a BNC output terminal. It may be used to drive strip chart recorders, oscilloscopes and other devices. Analog output ranges from 0 to +2 volts. Signals up to 100 kHz can be detected and amplified by the optical detector and internal circuitry. (This allows the meter to demodulate audio signals from lasers in educational demonstrations.)

Calibration is within 5 percent of full scale at intensity stabilized 635 nm diode laser light. For monochromatic light of other wavelengths within 500 to 950 nm, a built-in radiometric filter corrects to within 20 percent of standard. A chart in the manual lists nominal response from 450 to 950 nm.

Characteristics:

Operating

Display resolution ..... 3½ digits
Calibration Accuracy 635 nm..... 5 %
Temperature ..... 10 to 30° C
Battery lifetime ..... > 15 hours

Optical

Detector Active Area ..... 1 cm^2
Maximum Optical Input Power 100 mW000
Aperture Diameter ..... 7 mm
Acceptance Angle ..... 30°

Storage

Size ..... 20 cm x 914 cm x 9 cm
Weight ..... 1 kg
Temperature ..... -10 to 50° C

Industrial Fiber Optics' quality control department calibrates each meter and affixes a certificate of calibration to the meter housing. Calibration traceable to NTSC standards.

For more information about operating modes, calibration and specifications, please review the instruction guide for this product on our web site: http://www.i-fiberoptics.com/

Features

- Easy-to-read digital readout
- Zero offset adjustment to compensate for ambient light
- Provides peak readings for scanned laser beams
- Has a ratiometric mode in 100 percent offset control; displays readings directly as percentages
- Detachable detector head with threaded mounting hole for use on a ringstand or optical bench
- Calibration charts and instruction guide included
- Dual-powered (110 VAC or two 9V batteries for portability)

Stock #
45-545A

Digital Photometer

(Optical Power Meter)

A versatile and economical classroom tool for measuring power levels of laser beams, demodulating optical signals for audio applications and solar experiments. Photometers are essential equipment in any principles-of-technology or in-school research program. The battery power, portability and adjustable height detector of this model offer particular flexibility.

The photometer is powered by two standard 9-volt batteries and offers four digital measurement scales from 20 microwatts through 20 milliwatts. Output to two industry-standard banana jacks is a conditioned electrical voltage that is directly proportional to light incident upon the photodetector with a frequency range up to 10 kHz. (The analog output can be connected to a strip chart recorder for solar monitoring, to an oscilloscope for observing time-dependent optical signals or to an amplified speaker for voice transmission.) The photometer also will act as an audio receiver to demodulate laser signals, which are also output to industry-standard banana jacks.

Features:

- Large easy-to-read digital display
- Four measurement scales from 20 microwatts to 20 milliwatts
- Large active area detector
- Sensitive to visible and IR light
- Battery operation for portability (100-plus hours operation)
- Momentary switch for long battery life
- Adjustable detector height
- Impact resistant enclosure
- All solid state detector and electronic design

Optional Range model: 199 µW, 1.999 mW, 19.99 mW, and 199.9 mW

Stock # **IF PM**

Stock # **IF PM200**

(Photometer comes complete with storage container, metal optical stand for the detector, instruction manual and batteries.)

Characteristics

Operating

Input power ..... Two 9-volt batteries
Accuracy* ..... ± 10%
Ranges (4) ..... 19.99 µW, 199.9 µW
1.999 mW, 19.99 mW
Temperature ..... 10 to 30° C

Optical

Detector active area ..... 1 cm^2
Wavelength sensitivity** ..... 450 to 950 nm
Maximum optical input ..... 100 mW

Storage

Control/Display Unit ..... 16 cm × 9.5 cm × 6.5 cm
Detector Assembly/Stand ..... 16.5 × 5 cm
Weight ..... 750 grams

* Calibrated at 632.8 nanometers
** Special spectral response curve of photodector can be seen on our website seen on our web site.

Laser Safety Signs

Readily visible warning signs are suggested by the FDA in any area where lasers may be operating. Be proactive in promoting safety. No lab area should be without proper warning signs.

Sturdy laminated plastic signs, for Class II and Class IIIa lasers, measure 18 × 25 cm.

Class II **IF 140021**

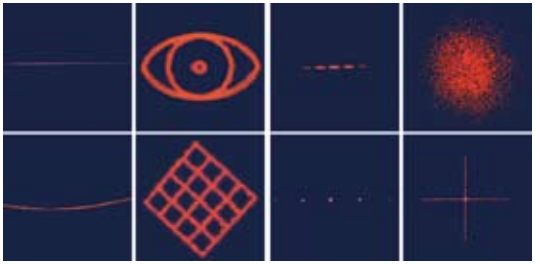
Class IIIa **IF 140020**

Laser Optics Kit

This innovative collection of nine unique optical mounts offers endless possibilities for exploring the many aspects of modern optical technology. Each optic element is color-coded for ease of use and creates a distinctive beam or pattern effect. Elements screw onto a laser's standard optic mount (¾ × 32 in. thread) to:

- Conduct experiments utilizing geometric principles and optics
- Examine polarization of laser beams
- Investigate basic and advanced diffractive principles and optics
- View light traveling through optical fiber
- Create real-world problem-solving exercises using geometry and trigonometry

Each of the nine optical mounts in the kit is precisely machined from a solid aluminum billet and designed with a recess hole for totally enclosing the optical component for mechanical durability and stability.



Kit contents: 16-page full-color illustrated manual, nine distinctive optic mounts, fiber optic cable, linear polarizing filter, padded snap-closure storage/carrying case. Laser not included.

All optical mounts are hardened amd protected with brilliantly colored scratch-resistant Type II anodizing. Each colored mount corresponds to the color codes described in the instruction manual. The 16-page full-color manual included contains step-by-step set-up instructions, actual photographs of images created with the optics mounts, explanations for each of the nine mounts, suggestions for labs and examples of real-world applications. In addition, four pages of technical references explain the basics of geometric and diffractive physics, polarization and fiber optics.

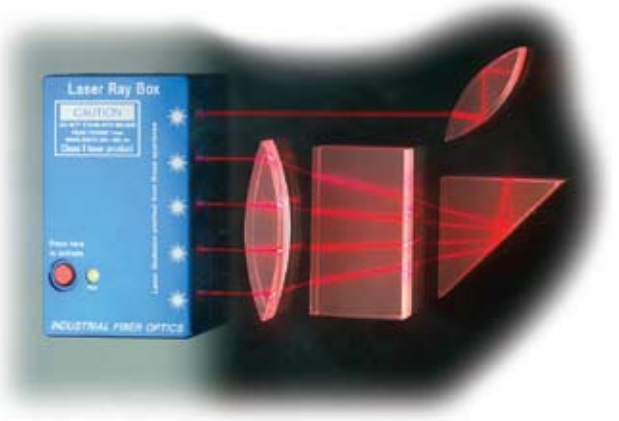
Stock #
IF 535

Cylindrical Lens Set

High quality acrylic lenses designed for use with the Laser Ray Box. Specially formulated material allows the visualization of laser beams traveling through optical element. Allows the direct observation of refraction, Fresnel Reflections and internal reflection within the optical element itself. Set includes four 20 mm thick optical elements listed below:

- Double convex, 50 mm, focal length 50 mm
- Double convex, 76 mm, focal length 100 mm
- Right Angle Prism, 70 mm on oblique side
- Rectangular Block, 70 mm × 28 mm

Stock #
IF 551



(Pattern Generator comes with control head, 110 VAC-to-12 VDC power adapter and operator's manual. An external lasing source is required.)

X-Y Pattern Generator

The X-Y Laser Pattern Generator is the creative educational vehicle to captivate student interest in the dynamic world of laser technology. When used with any laser, this device creates endless combinations of patterns and shapes, similar to those created for large and expensive laser light theatrical presentations.

Applications:

- Create students' own laser light shows
- Dynamically contrast stereo and mono audio sounds
- Mimic the use of laser beams in cutting applications
- Meet the special lighting needs of small theaters
- Demonstrate laser beam control with motors and mirrors
- Create infinite numbers of "Lissajous" and quadrature patterns

The generator is housed in a see-through cool-blue acrylic case for easy viewing and alignment, and can be used in conjunction with any HeNe, diode or visible light laser. Laser light patterns can be generated with either the internal electronics or patched to an audio signal to create light images from sound.

Stock #
IF XYP

Light Ray Viewing Kit

The Light Ray Viewing Kit is a small "liquid laboratory." When used with any of our lasers it creates underwater light ray patterns and diagrams that constitute the basics of all introductory optic studies. In a complementary series of activities in the accompanying instruction guide, students can observe, and more readily understand, principles and equations such as:

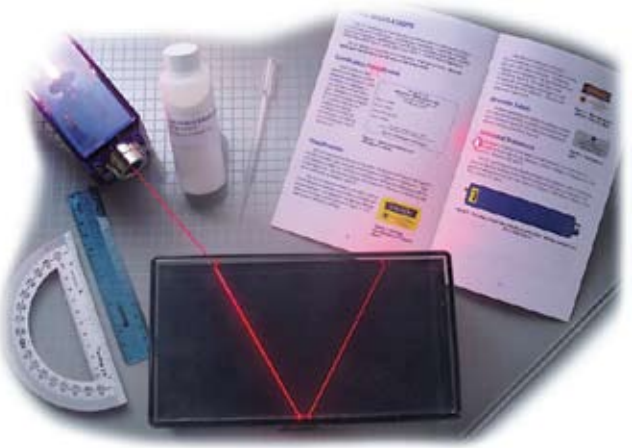
- Snell's Law
- Total internal reflection
- Equal angles of incidence and reflection
- Brewster's Angle
- Determining critical angle

Models

Stock No.	Description
IF 548	Viewing kit
IF 549	Viewing kit with.5 mW helium neon laser

Consumables:

Four ounces scattering solution . . . . . **IF 850005**



Set-up for each experiment requires less than five minutes and costs only a few pennies. ("Just add water!") Project equipment includes impact-resistant observation tank; four ounces of scattering solution; first-surface mirror; stirring rod; ruler; protractor; and an eight-page full-color instruction guide. Suitable for grades 6 and above.

Laser Beam Stop

An inexpensive apparatus for ensuring and practicing safe laser usage in the classroom. The apparatus acts as a diffuse surface to avoid any specular reflections. One side is matte white for maximum visibility and the other side is matte black for maximum absorption. Applicable to all Class II, IIIa and IIIb laser beams. Acrylic base with rubber feet for stability and adhesion.

3x4 inch upright beam stop
IF LBS1

Photonics Wall Chart

Our Photonics Wall Chart is the perfect visual aid for easily and accurately studying the characteristics of lasers, opto-electronics and light.

In four vibrant colors it portrays:

- The linear full-color visible light spectrum
- Commercial laser emission spectra
- A chart of the complete photonic electromagnetic spectrum
- Photodetector spectrum detection ranges

Laminated in heavy plastic for durability, this is a superb complement to any science class or laser curriculum. Dimensions are 56 x 82.5 cm (22 x 32 in).

Stock #
IF PWC-L

Fiber Optic Rod

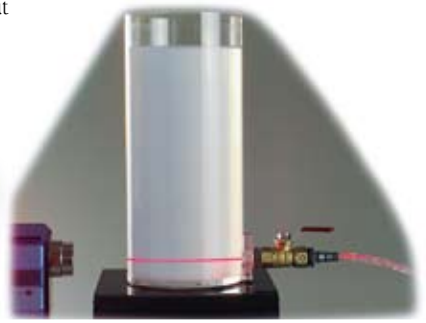
A specially formulated acrylic waveguide for demonstrating the basics of fiber optics when used with a visible light laser. To illustrate, merely align the end of the rod at an angle and watch the laser light rays "bouncing" down the acrylic bar. Ideal for inexpensive but dramatic demonstrations of Snell's Law and total internal reflection in action.

Stock #
IF ACR

Tyndall's Historical Experiment – Laser Style

Recreate the historical experiment demonstrating the fundamental concept that lead to transmitting light through optical fiber. In 1870, before the skeptical British Royal Society, Irish researcher John Tyndall successfully demonstrated how light could be guided in a stream of falling water. It was the first recorded observation of light being guided by "total internal reflection" and it still is a visually fascinating experiment today. Using modern components, demonstrate this basic principle of light's behavior when it enters a constricting optical channel. A visible-light laser with optical power of .5 mW or greater is required for use, but not included.

Stock #
IF 514



Laser-to-Fiber Adapter w/ Fiber

With lasers and fiber optics classes frequently being taught together it is often desirable to direct light from a laser beam into an optical fiber. With this component, mating optical fibers to the standard optical mounts of many educational helium neon (HeNe) and diode lasers (Industrial Fiber Optics, Laser Master, Metrologic, Scientific Laser Connection) is easy. Threads on the fiber adapter are 32 threads per inch and 3/4-inch in diameter. Included: 1.5 meters of unjacketed 2000 µm core plastic fiber with factory-tooled and polished termination.

Stock #
IF LFA

Optic Rail

Industrial Fiber Optics' Optical Rail Kit is an uncomplicated and economical system for conducting basic experiments with optical components and lasers. Designed for classroom use, the bench is easy to set up and requires little or no training, making students' laboratory time more productive. The kit includes mounts that permit use with most lasers, light sources, mirrors, lenses, gratings and filters. It's perfect for any introductory science or physics laboratory or hobbyists.

All components are fabricated from aluminum and anodized for durability and longevity. The mirror and lens holders are black powder coated to reduce stray reflections. All treads and mounts utilize SAE ¼-20 so users can create their own mounts and fixtures as desired.

The Optical Rail Kit comes complete with mounting accessories for performing a multitude of optical and laser experiments with lenses, mirrors and lasers. Replacement components and additional accessories to enhance capabilities are available from Industrial Fiber Optics.

Stock #
45-225

The Optical Rail Kit includes: two 0.6 meter benches, two leveling- base sets, two end cap sets with attachment screws, two ring mounts for holding lenses, two adjustable mirror holders, four standard pin-carriers with pins, adjustable laser holder and heavy-duty pin carrier with pin. (See components list below for more detailed descriptions of individual components.)

Replacement Components

Optical Rails*
Extruded and anodized aluminum optical rails.

Two .6 m rails
45-202

One 1 m rail
45-201

Leveling Base Set:
One set required for each rail.

Stock #
45-221

End Cap Set:
One set required for each rail. Includes attachment screws.

Stock #
45-221

Standard Pin Carrier:
Solid aluminum and black powder coated for reduction of specular reflections. Includes adjustment and locking screw with standard pin.

Stock #
45-212

* Custom lengths available upon request.

Heavy-duty Pin Carrier:
Same as standard pin carrier, but with greater depth for stability. For use with laser holder. Includes adjustment and locking screw with standard pin.

Stock #
45-212

Pin Set:
Set of three 60 mm pins for standard and heavy duty pin-carriers. Can be screwed together to extend length.

Stock #
45-214

Laser Holder/Adjuster:
Holder for mounting, tilting and positioning lab-sized lasers on optical rails. Black anodized aluminum construction. Includes thumbscrew for tilt.

Stock #
45-208

Ring Mount:
Black anodized aluminum mount for cylindrical components 6 to 50 mm in diameter. Includes three brass adjustment screws and cushioned tips.

Stock #
45-122

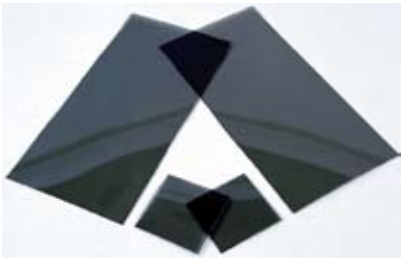
Mirror Holder:
Black anodized 75 × 75 mm aluminum mounting plate to which mirrors can attached; 360 degree vertical and horizontal rotation. Includes support and mounting screw that attaches to standard pin and carrier.

Stock #
45-209

Deluxe Filter Set

Contains 14 different colors of filter in 35 mm slide mounts. Colors are light blue, medium blue, daylight blue, dark blue, golden amber, medium green, light green, green-blue, light red, medium purple, orange, medium yellow, medium red and frost. All filters are individually mounted on plastic mounts as shown.

Stock #
IF FS4



Polarizing Film

A general-purpose linear polarizing film for use with visible and near-infrared light. Thickness is .75 mm. Extinction ratio is greater than .01%. Useful for reducing glare, conducting optical experimentation and increasing contrast in sensors. Film is easily cut, punched or drilled and is resistant to heat, impact and abrasion.

Size (mm)	Quantity	Stock Number
50 × 50	2	IF PF1
50 × 50	100	IF PF2
100 × 200	2	IF PF3
475 × 625	1	IF PF4

RGB Filter Set

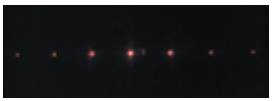
A set of three individual colored filters mounted in standard 35 mm slide holders. Ideal for use in optical transmission measurements, solar monitoring and exploration, attenuation of laser beams and demonstrations of laser light's monochromacity. Set includes one red, blue and green filter.

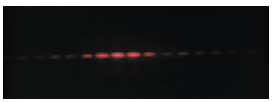
Stock #
IF FS!

Diffraction Mosaic

The diffraction mosaic is a precision array of seven different slots/grids designed for use in performing laser double- and multiple-slit diffraction experiments. The mosaic contains four double-slits and three multiple-slit arrays on an opaque film with clear apertures. Double-slit separations range from 45 to 100 µm in width. The gratings are 25, 50 and 100 lines/mm. The mosaic is inexpensive and mounted in easy-to-use 35 mm slide holder. Includes 12-page full-color instruction guide for conducting and understanding light diffraction experiments.

Stock #
IF 508





Unbreakable Mirrors

An inexpensive solution to the problem of glass mirror breakage in classrooms. Substrate is acrylic with an aluminum coating for the reflecting surface. Ideal for younger students.

Size (inches)	*Stock Number*
2.5 × 3	IF AM1
5 × 7	IF AM2
10 × 12	IF AM3

Fiber Optic Demonstration System

This is Industrial Fiber Optics' introductory fiber optic technology module. This tried and proven academic module comes complete and ready to use. All an instructor needs is a classroom and students. This curriculum includes the very latest in the rapidly changing fiber technology field such as:

- Fusion splicing techniques
- Fiber connector technology
- Optical power splitters
- Wavelength division multiplexing
- Fiber termination tools and procedures
- Fiber optic testing and test equipment

The curriculum is a full-color manual precisely formatted into 10 independent activities in 144 pages with more than 60 real-world illustrations and industry photos. An extensive list of references and a working glossary of fiber optic terms is included. Each activity includes:

- Historical and technical reading assignments
- Hands-on working experience and experiments with fiber optics and associated components
- Problem solving and student worksheets
- Team activities
- Homework and investigative research
- Web fiber optic tours and projects

Hands-on activities immerse students in the technological aspects of:

- Voice transmission over fiber
- Analog and digital data transmission
- Morse Code over fiber optics
- Optical fiber characterization
- Fiber sensors and applications
- Bending losses in optical fibers
- Optical fiber termination and polishing
- Attenuation in optical fiber

(Available in glass and plastic fiber models and includes the following items: two fiber optic analog/digital transceivers, eight fiber lengths 1 to 10 meters, 40 µm and 3 µm polishing film, 110 VAC-to-12 VDC power adapters, electrical interconnecting leads, AM/FM radio, sensor reflection and indicator cards, two permanently bound student manuals, instructor's manual in a sturdy 3-ring binder with answer sheets.)*

*220 VAC adapters will be furnished upon request.

Sample curriculum available for download on web site.

Features:

- Versatile curriculum format (metric and SAE dimensions)
- 10 comprehensive activities including lighting, sensor and communication fiber applications
- Full-color student and instructor manuals
- Solid-state, low profile, surface-mount transceivers capable of analog and digital operation
- Low-voltage transceiver operation
- Color-coded electrical connections
- Low-power LED technology for safety
- Suitable for grades 7 through 12
- Instructor's manual includes color-coded answer sheets

The glass version of this module utilizes industry-standard 62.5/125 µm data communication fiber and high performance IR (infrared) LEDs with easy-to-use locking ST® fiber terminations (the same high quality components used by many standard data communications networks).

Glass Model
IF DS100G

EXTRAS

Student Manual..... **IF 120027**

Instructor's Manual..... **IF 120026**

Our plastic fiber model utilizes inexpensive connector-less fiber design. The customized inter-connecting system with 1000 µm plastic fiber and red visible LEDs is ideal for educational purposes.

Plastic Model
IF DS100P

EXTRAS

Student Manual..... **IF 120255**

Instructor's Manual..... **IF 120250**

Fiber Optic Splicing & Connector Module

The Connector and Splicing Module is a supplemental curriculum. It is written and designed to augment our best industry selling Fiber Optic Demonstration System training product. This new module is an ideal hands-on training curriculum for industrial technology and vocational education studies in two of the most sought after industry technical skills today—splicing a fiber optic cable and installing of fiber optic connectors inthe field.

Features:

- Comprehensive and challenging activities
- Complete self-contained curriculum
- Color-coded activity tabs
- Low cost per student
- Uses safe, large-core 1000 µm plastic opticalfiber
- Full 4-color instructor and student manuals
- Many graphic illustrations add clarity to instructions
- Removable and photocopyable sheets in the Instructor's Manual

The Fiber Optic Connector and Splicing Module is a 3-activity module with the following activities:

- Equipment and Component Familiarization
- Methods for Installing a Fiber Connector
- Methods for Splicing Fiber Cable

Although this module was written as a supplemental curriculum for the *Fiber Optic Demonstration System*, it also can be used as a stand-alone instructional package. The module is fully compatible with both the plastic and glass versions demonstration system. In addition, this module is also compatible with a product manufactured for Scientific Laser Connection, which is referred to as Module 2.

The comprehensive Instructor's Manual that comes with the module also includes answers to quiz and worksheet questions and a list of replacement parts, which are consumed in activities.

This module includes the following items: fiber inspection microscope, hot knife and stand, fiber optic crimping tool, professional fiber cutter, stainless steel polishing puck, polishing slurry, Micro-strip fiber stripper, glass polishing plate, tool box, 2 ounces index-matching gel, 2000 grit sandpaper, 3 µm polishing film, 2 ST® mating sleeves, set of two interconnecting fibers, 4 ounces isopropyl alcohol, two Student manuals, one Instructor's manual, 15 2-meter lengths of 1000 µm-core plastic fiber, 15 fiber splices and 30 ST® fiber connectors.

Each activity includes:

- Advance reading assignments.
- Actual hands-on, step-by-step procedures for assembling components, then testing them for degree of technical performance. Discussions of applicability to real-world environments such as communications systems put the procedures in industry perspective.
- Assessment of the strengths and shortcomings of various components as system requirements change.
- Worksheets/quizzes that test students' knowledge as well as their ability to apply that knowledge to conceptual situations.
- Homework assignments (using Internet or library resources).

Stock # **IF 505**

Consumables Kit:
15 2-meter plastic core fiber cables, 15 fiber splices, 30 ST® fiber connectors, 40 µm and 3 µm polishing film.

Stock # **IF 528**

Fiber Optic Communications & Networking Module

The Fiber Optic Communications & Networking Module is Industrial Fiber Optics' newest fiber optic technology module. It's a 10-activity, intermediate-level product developed for teaching at a higher level than other modules, emphasizing fiber optic communications and networking technology. The curriculum addresses the most recent advances in the rapidly changing fiber communications and networking technology fields, including:

- Fundamentals of fiber optic technology
- Optical fiber manufacture
- Optical fiber construction: single- and multi-mode
- Dispersion and attenuation
- Fiber cable comparisons
- Generation IV fiber connection technology
- Fusion splicing techniques
- Fiber couplers and optical power splitters
- Wavelength division multiplexing
- Fiber optic tools, testing and test equipment

The module curriculum guide is a comprehensive manual comprising 10 exciting activities, with technical reading assignments for each. Accompanying Fiber Optic Reference Guides contain 14 chapters with several hundred illustrations in 199 pages. An extensive list of references and a working glossary of fiber optic terms are included. Each activity features:

- Real-world applications
- Hands-on working experience and experiments with fiber optics and associated components
- Problem solving and student worksheets
- Homework assignments and investigative research
- Web fiber optic tours and projects

Hands-on experiments and networking activities include:

- Color picture with sound signals over fiber
- Optical fiber characterization
- Losses in optical fiber
- Fiber optic switching networks
- Optical and electrical multiplexing
- Fiber termination polishing and splicing
- Infrared light conversion

Sample curriculum available for download on web site.

This module comes complete with 3 fiber optic wide-bandwidth video transceivers, 110 VAC- to-12 VDC power adapters, 15 2-meter 1000 µm core plastic fibers, 15 fiber splices, 30 ST® fiber connectors, crimping tool for splices and connectors, 40 µm and 3 mm polishing film, optical inspection scope, index-matching gel, DC motor, optical multiplexer, fiber cutter, polishing plate, polishing slurry, ST® barrel connector, 1 × 2 fiber star coupler, 1, 3, and 10- meter fiber optic cables, fiber optic multi-meter, 2 dynamic microphones, 2 AM/FM radios, scale, infrared indicator card, coax cable, hot knife and stand, Micro-strip fiber stripper, 4 ounces isopropyl alcohol, Photonics Wall Chart, 2 Fiber Optic Reference Guides, 2 bound student manuals and an instructor's manual in a sturdy 3-ring binder.*

*220 VAC adapters will be furnished upon request.

Features:

- Versatile curriculum format (metric and SAE dimensions)
- Full-color student and instructor manuals
- Completely self-contained curriculum
- Curriculum pretest and post test
- Instructor's manual with color-coded answer sheets
- Solid-state, low profile, surface-mount transceivers with audio and video transmission capabilities
- Low-voltage transceiver operation with optical detection
- Multiplexed switching input/output transceiver
- Low-power LED technology for safety
- Three transmit wavelength operation

Complete Lab
IF 527

EXTRAS

Student Manual..... **IF 120265**
Instructor's Manual..... **IF 120260**

Consumables Kit:
15 2-meter plastic core fiber cables, 15 fiber splices, 30 ST® fiber connectors, 40 µm and 3 µm polishing film.

Stock #
IF 528

Intermediate Fiber Optic Classroom & Lab Course

An intermediate fiber optics curriculum, for vocational and trade schools, industrial arts and university levels. Courses can be tailored in length from 10 to 15 weeks. Recommended prerequisites: a basic understanding of electronics and mathematics. Course includes a text for classroom or lecture, lab course containing a comprehensive series of student experiments, and lab kit with all required components.

Part One of the classroom text places fiber optics into perspective as a transmission medium and describes its advantages over other media. Part Two examines fiber sources, detectors, and connectors, in contrast to the distinctly different characteristics of their electronic counterparts. Part Three explains in detail how fiber optic systems are designed and assembled. It covers link system design, installation, special fiber optic hardware, applications and equipment. (Hands-on experiments provided by Lab Course and Lab Kit are described on page 34 of this catalog.)

Stock #
IF SC11

"Instructor's Edition" contains the items pictured above, plus answer guides for text and lab manual, samples of different types of optical cable, image guides, LEDs and detectors.

Stock #
IF SC11INS

Fiber Optic Minicourse

A short course covering the basic concepts of fiber optic communications and industrial applications, intended as a supplement to other more general electronics classes. Class length is variable, to meet instructors' time constraints: five to ten 1-hour periods, plus two 2-hour experimental sessions.

The course begins with "The History of Fiber Optics," followed by sections describing fiber optic communications systems and their individual components. Also included are a list of additional reading references and a helpful fiber optic glossary. Experimental sessions involve students in assembling and testing a fully functional fiber optic digital communication link with separate transmitter and receiver modules.

Manual available for previewing on web site.

Stock #
IF MC10

Course comes complete with a full-color classroom manual and kit containing all required electronic components, including printed wiring boards, fiber optic LED, photodetector and cable. No prior fiber optics experience or special tools are needed for assembly and demonstration.

"Instructor's Edition" contains the items above, plus an additional reference book, answer guide, lecture file of figures and experiments, assortment of optical cable, image guides, LEDs and detectors.

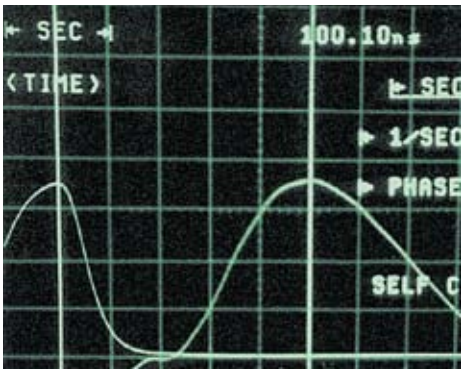
Stock #
IF MC10INS

Speed of Light Apparatus

With Industrial Fiber Optics' Speed of Light Apparatus, measuring the speed of light is now easy and quite accurate. Such was not the case for many centuries. The famed Galileo—after he attempted to measure the speed of light with an unlikely arrangement of lanterns and flags on tall towers—decided that light must travel at infinite speed. Later, Armande Fizeau used an elaborate mechanism with mirrors, lens and a huge rotating cogwheel to determine if the speed of light was, in fact, not infinite. He got close. After many years we now know light does not travel at infinite speed, but rather 299,792.4562 meters per second in a vacuum.

With the proper combination of electronics, electro-optics and fiber optics this once-difficult measurement is simple and can be conducted in any lab or classroom. All that's needed is a 60 × 100 cm table, 110 VAC electrical power, oscilloscope and the Speed of Light Apparatus.

To conduct this experiment, first apply 110 VAC power to the oscilloscope and Speed of Light Apparatus, then connect oscilloscope probes to apparatus test points. After calibration, the oscilloscope monitors the reference and delayed pulses, the time delay is measured and the speed of light calculated.



A typical oscilloscope display depicts the reference signal and the delayed optical signal through optical fiber (100 ns of delay through 20 meters of optical fiber.)

The apparatus consists of an electronics circuit board in protective plastic enclosure, two fiber optic cables, test connections for all outputs and a 110 VAC-to-DC power adapter. The optical fibers terminate in simple cinch-collet connectors for easy assembly and efficient coupling. A 20 MHz oscilloscope is required.) Adapters for 220 VAC will be furnished upon request.

An integral part of the Speed of Light Apparatus is an easily understood full-color, often lighthearted manual. It begins by tracing the early steps of technical pioneers in their quest to understand light. The manual also includes detailed step-by-step set-up and measurement instructions and examples with equations for calculating the speed of light. In addition, assembly instructions are included for those who purchase this as a kit.

Features:

- All solid-state transmitter/receiver design
- Low-voltage electronics operation
- Fiber optic delay requires no optical alignment
- Safe, visible LED light source
- Quick set-up and measurement
- Impact-resistant, protective enclosure
- Rubber feet on chassis bottom for adhesion on smooth surfaces
- Contained light beam is ideal for small areas
- 28-page full-color manual with step-by step assembly, operation instructions and sample oscilloscope displays

Kit version **IF SLK**

Assembled version **IF SLA**

Just for Kids! - Adventures in Fiber Optics Kit

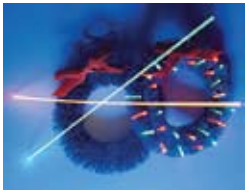
Welcome to the fascinating world of fiber optic technology!

Complete exciting fiber optic projects like these:

Image Magnifier

Lighted Constellation Map

Fiber Optic Wand



Fluorescent Holiday Wreath

Not long ago fiber optics was little more than a laboratory curiosity. Physicists and scientists in research labs were the only people doing much work in this field.

In the last 20 years all that has changed. From its obscure beginnings in the back of a lab, fiber optics has become an important and rapidly changing technology. It employs many of the world's brightest scientists and business people.

With this kit anyone can follow the exploits of famous experimenters such as Galileo, Franklin, Tyndall and Gould, begin to explore fiber optics starting with the very basics and learn more about the fascinating potential of fiber optical technology. Requires no electronics or optics experience.

The kit is suggested for ages 10 and above. It contains materials and an instruction manual to complete five unique projects and 20 exciting experiments such as:

- Bending a Light Guide
- Fluorescence
- Tyndall's Prestigious Light-in-Water Experiment
- Special Fiber Optic Lighting
- Art of Polishing Glass
- Making Your Own Image Conduit
- Creating a Holiday Ornament

Kit items include penlight, rubber light hood, six different optical fiber types, Ulexite image transfering rock, three coherent fiber optic components, color gel filters, lens, star/constellation map, polishing film and other miscellaneous components.

Manual available for download on web site.

Manual now in Color!

Stock # **IF E60**

Optical Voice Link

This Industrial Fiber Optics kit "favorite" may have earned more high grades and scholastic honors for student science projects than any other. For students and experimenters alike, the Optical Voice Link is the ideal introduction for an electronics hobbyist first learning about the marvels, mysteries and science of light transmission through optical fiber. There is something fascinating, indeed, about hearing your own voice, after it has been converted into light and then coupled into, through, and out of an optical fiber.

The Optical Voice Link is suitable for science projects; home projects for the hobbyist; short audio fiber optic curricula for schools; inexpensive classroom demonstrations; hands-on industrial training; and voice transmission in critical electrical isolation applications.

Kit includes: printed wiring boards, switches, electronics, microphone, 8-ohm speaker, three meters of plastic fiber optic cable, and an uncomplicated tutorial and step-by-step assembly instruction manual. No prior fiber optics experience, special tools or training are needed to build, use and enjoy the multiple applications of this kit. Some experience with soldering is recommended for completion of the unassembled version.

Features:

- High-quality audio circuits
- On-board microphone
- Visible LED optimized for plastic optical fiber
- 9-volt battery operation
- High-quality multilayer PCBs
- Plastic optical fiber with simple terminations
- Extendable to 20 meters
- 32-page full color instruction booklet

Kit
IF OVL10-K
Assembled Version
IF OVL10-A

Duplex Kit
IF OVL20-K
Assembled Version
IF OVL20-A

Kit contains red LED and photodetector, one meter of optical fiber, printed wiring boards, polishing film, oscillator chip, electronic components and instruction booklet. Suitable for students in grades 9 and above.

We recommend some soldering experience for assembly.

Educational Communication Kit

This is our most popular kit, providing students the opportunity to examine fiber optic communication technology at its basics. It's a great hands-on educational product as well as an opportunity for the serious investigator/ experimenter to explore fiber optic technology inexpensively. The Communication Kit is an easy-to-assemble, digital link for experimenting and beginner science projects. (This digital link also can be used to construct high-voltage isolation for telephones, modems and computers.)

Features:

- Visible fiber optic source and detector
- Built-in oscillator for testing and demos
- TTL and CMOS logic-compatible inputs and outputs
- Low-voltage operation
- Utilizes plastic optical fiber with simple terminations
- 32-page comprehensive booklet covering assembly, schematics, experiments, fiber optic fundamentals and circuit operation.

Stock #
IF E22

Lab Course and Lab Kit

The Lab Course is a 68-page guide that contains nine fascinating fiber optics experiments – now in its 5th edition with full-color illustrations throughout. With the Lab Course, instructors can avoid having to create their own fiber optics or opto-electronics experiments and thus spend more time with their students. Do-it-yourself experimenters will learn valuable practical experience about fiber optics. Each of the nine experiments contains activities which use state-of-the-art opto-electronic components. Along with learning about unique fiber optics procedures, these activities later can be used in dealing with practical, real-world situations. Experiments begin with the basic physics and progress toward solutions for design and circuit problems.

Experiments includes:

- Making a light guide
- Fiber optic cable transmission
- Characteristics of connectors and splices
- Index-matching procedures
- Speed of opto-electronic devices
- Fiber optic transmitter
- Receiver design
- Fiber termination techniques

Lab Course
IF LM
(manual alone)

Lab Kit contains all the fiber optic and electronic components required to complete the experiments in the Lab Course manual, including optical light pipe, fiber optic cable, splices, connectors and polishing film, with LEDs, photodetectors, transmitter and receiver electronics.

No special tools or training required.

Lab Course with Lab Kit
IF LMH

Industrial Fiber Optics also has available a 26-page answer guide for the Lab Manual containing tables of typical experimental data derived in our labs, plus answers to all questions and homework assignments.

Answer Guide
IF LMA

Answer guide can be downloaded at no charge from our web site.

Science Project Kit

Learn about fiber optics the easy way by experimenting and building fascinating, functional projects. No prior optical experience is needed. Our practical, 224-page text begins with easily grasped discussions about fiber optics fundamentals. Next are eight lab experiments and a final section with five intriguing projects, including "Getting Acquainted with a Light Pipe," "AM Fiber Optic Receiver," and "Fiber Optic Light-Pen Cable." Finished products such as an analog voice link and a light pen have many daily uses and applications to further study.

(Kit includes all necessary fiber optic components, connectors and cable. Ideal for science projects in advanced junior high and high school classrooms.)

Stock #
IF E33

Fiber Optic A/D Kit

This is our premier kit for high school and technical instructors who require the ability to demonstrate analog and digital fiber optics communications principles with a single, economical product. When assembled, the kit provides a unique arrangement of dual-purpose analog and digital transmitter and receiver modules. The transmitter features an on-board microphone for an audio analog signal source and a built-in 15 Hz oscillator for digital signals. It also has input connections for external analog and CMOS-compatible signals. The receiver also incorporates a dual-purpose analog/digital design with a power amplifier driving a 10 cm speaker, digitized circuitry for signals and flashing LED. Unlike other fiber optic kits, this one requires no oscilloscope and is powered by two 9-volt batteries, eliminating the need for external power supplies. The kit includes:

- Transmitter and receiver printed wiring boards
- All required electronic circuit components
- Plastic fiber optic cable and connectors
- Complete instructions on how to assemble components and complete all projects.
- Full-color 40 page instruction manual.

The only accessories required but not included are a soldering iron, tools needed for assembly of the kit, and two 9-volt batteries. Economical for both individual students and group projects. A detailed component list can be found on the Industrial Fiber Optics web site.

Stock #
IF 545

Experimenter's Kit

Our least expensive basic kit—ideal for designing experiments, original science projects and short-distance optical isolation applications. Included are one meter of 1000 µm plastic optical fiber, matched IR LED and photodetector (IF E91A and IF D92 respectively) with integral fiber optic connectors, instructional design information and application hints.

Stock #
IF E10

Designer's Kits

A "creativity-friendly" kit for technicians, experimenters, scientists and enterprising students who are searching for a quick solution for prototypes or special-purpose interfaces requiring fiber optics capabilities. This very low-cost "active link" requires a single +5-volt power supply and interfaces with all TTL/CMOS logic. It includes 10 meters of 1000 µm plastic optical cable; efficient dry, non-polish connectors, bulkhead interfaces, and splices; integrated photodetector(s) and LED(s); and top-quality multi-layer printed wiring boards. Full instructions and technical data sheets complete the package. The operable range of both kits can be extended to 60 meters with additional cable purchased separately. Designer's Kits have been the basis of many fiber optics "brainstorms" and technical solutions.

Simplex Kit
(Single Channel)
IF SD11

Duplex Kit
(Bi-Directional)
IF DD11

Magic Optic Rock (TV stone)

Nature created its own fiber optic material long before scientists even dreamed of today's highly refined optical fiber. It is a rare, naturally-occurring mineral called ulexite. The stones are composed of thousands of tiny, parallel, hairlike crystals that transfer an image just like the coherent faceplates and light guides described elsewhere in this catalog. Ulexite often is known by the name of TV stone because of its image-transferring properties. Stones are approximately 13 mm (½ inch) thick and 19 × 19 mm (¾ × ¾ inches) across the face.

Stock #
IF C-FOR

Optical Waveguide Set

Illustrate the basics of light wave guide transmission with two specially formulated Lucite bars. The straight bar demonstrates how light travels loss-lessly down the wave guide by internal reflection. With the curved bar demonstrate how light in waveguides can be made to travel around curves and corners as is implemented in fiber optics. Both bars are 1 × 2 × 23 cm. Laser or laser beam box required to create light beams.

Stock #
IF 547

Fluorescent Fiber Kit

Demonstrate the properties of fluorescence in a single kit. For demonstrating the light guiding properties of optical fiber without messy powers or liquids. Fluorescent material is imbedded in plastic optical fiber for easy and safe use Includes lengths of red and green fluorescent fiber and clear undoped fiber.

Stock #
IF 567

Optical Sample Kit

A kit expressly created for teachers wanting to demonstrate fiber optics in a classroom and anyone beginning to experiment or develop fiber optic products. Each kit contains an assortment of fiber core diameters and construction. The Optical Sample Kit whose contents are listed below includes fibers and fiber lengths commonly used for illumination projects and model airplane, auto and railroad building.

Jacketed		Unjacketed	
Diameter	Length (m)	Diameter	Length (m)
1000 µm	1.5 m	250 µm dia.	1.5 m
1500 µm	.6 m	500 µm dia.	.6 m
2000 µm	.6 m	750 µm dia.	.6 m
16 × 265 µm bndl	.3 m		
32 × 265 µm bndl	.3 m		
48 × 265 µm bndl	.3 m		
64 × 265 µm bndl	.3m		

Stock #
IF 53883

Fiber Assortment Kits

An economical assortment of six different types of fibers that would be very costly if purchased individually. Assortment may include glass fibers, jacketed and unjacketed plastic fibers, multi-fiber light guides and coherent fiber bundles. An exceptional value!

Stock #
IF FGB

Twelve different types of fibers and samples like those in the kit above, plus the addition of fluorescent fibers, fiber optic "TV" stone and coherent light guides.

Stock #
IF FGB2

Optical Fiber

For schools and teachers, the challenge is often how to be able to teach the basics principles of science, physics and technology with economical budgets, a shortage of time and to do so safely. Nothing replaces lectures and books like students being able to visualize things for themselves. With optical fiber sometimes being perceived as an exotic technology it is often thought impossible to bring this technology or samples to the classroom and that is far from true.

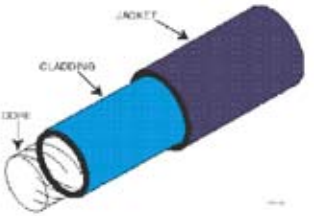
Industrial Fiber Optics offers a variety of plastic optical fibers that are simple and safe letting the student focus on the more intriguing aspects of light technology. The fibers listed below are made from common plastic materials that can be found in any home. They are easily cut using a single-edge razor blade and are ideal for projects such as:

- Demonstration of light principles
- Optical communication devices
- Visual displays and lighting

Optical Fiber Materials:

Optical fiber is manufactured from silica (highly refined glass) or polymer (plastic). Each has advantages for various applications, but glass fiber when it breaks can produce dangerous and nearly invisible small glass shards. Polymer fiber is more flexible, easily trimmed, and safer to handle. For these reasons Industrial Fiber Optics provides this exclusively in its educational kits and is what we recommend for the classroom environment.

A typical fiber cable (depicted in figure) consists of a specially formulated acrylic core, Teflon®-like coating and a polyethylene jacket.



Bare Fiber Strands

Diameter (mm)	Stock Number
.25	IF C U250
.50	IF C U500
.75	IF C U750
1.0	IF C U1000
1.5	IF C U1500
2.0	IF C U2000
3.0	IF C U3000

Fiber Cable
(jacketed)

Diameter core/jacket (mm)	Stock Number
.50/1.0	810115
1.0/2.2 *	IF C E1000
1.5/3.0	IF C E1500
2.0/3.3	IF C E2000

* Cable that is used in most of the educational kits we produce and the most common industry used product.

Fluorescent Fiber
1 mm diameter

Color	Stock Number
Red	IF 810087
Green	IF 810087

Fiber Bundles

Fiber number/ diameter (mm)	Stock Number
16/.265	IF C LG16
32/.265	IF C LG32
48/.265	IF C LG48
64/.265	IF C LG64

For complete engineering specifications on the fibers above, visit our web site: www.i-fiberoptics.com.

Videos and CDs — Fiber Optic Technology Series

The Fiber Optics Technology Series offers an in-depth overview of the fascinating world of fiber otics. The high-quality videos & CD's explore everything from fiber optic theory to system design and installation. This series is designed for anyone wishing to learn more about fiber optics—from engineers, technicians, consultants, sales and management personnel. For details, visit our web site: www.i-fiberoptics.com.

Plastic Optical Fiber

Plastic Optical Fiber (POF) technology can be used for voice, video and data requirements. It also allows for simplified connectorization, testing and splicing techniques. Plastic Optical Fiber demonstrates how POF is manufactured and explores its current and potential applications

Length: 23 minutes

Stock # **150001** (CD) **150002** (VHS)

History of Fiber Optics

The evolution of Fiber Optics from the 19th century to the present is a fascinating story of scientific development and perseverance. This video/cd-rom is especially beneficial for new employees, students and to those who want to learn about how optical and fiber communication evolved.

Length: 35 minutes

Stock # **150003** (CD) **150004** (VHS)

Fiber Optic Cable

With the proliferation of fiber optics in thousands of applications, manufacturers have developed numerous types of fiber optic cables to meet the challenges of current optical applications. Fiber Optic Cable reviews cable types, their structure and how it relates to various applications. The relationship between building codes and installation is covered. On site footage of cable manufacturing helps make this video/cd-rom especially interesting!

Length: 17 minutes (3rd revision)

Stock # **150013** (CD) **150014** (VHS)

Fiber Optic Safety

Fiber Optic Safety provides a detailed explanation of the many safety issues for field and lab applications working with fiber. It has numerous examples of good safety practices and standards as well as areas of particular concern. Fiber Optic Safety is a great supplement to an organization's internal safety program!

Length: 26 minutes (3rd revision)

Stock # **150009** (CD) **150010** (VHS)

Fiber Optic Applications

Worldwide communication requirements are growing at an amazing rate. Fiber optics are key to this growth. Fiber Optic Applications provides an overview of voice, video, and data communications. Anyone, from the front desk receptionist to the corporate president, will find this video/cd-rom interesting and beneficial.

Length: 43 minutes (2nd revision)

Stock # **150005** (CD) **150006** (VHS)

Dense Wavelength Division Multiplexing

This video/cd-rom provides a thorough explanation of DWDM—an amazing technology! Learn the roles of the components and how they are integrated into a DWDM network. In addition, gain an understanding of types of fibers utilized and the impact of these fibers in designing and implementing DWDM systems. The video's superior production quality and its use of high quality graphics clearly demonstrate the important concepts of four wave mixing, dispersion characteristics, dispersion compensation and optical multiplexing and demultiplexing techniques.

Length: 34 minutes Stock # **150021** (CD) **150022** (VHS)

Fiber Optic Couplers Switches and Isolators

Use this video to review the broad family of coupler products and technologies. Learn how optical components can split, tap, direct, switch, multiplex, demultiplex and guide light. In the transparent optical networks of the future, couplers, switches and isolators are the components that will allow for true optical flexibility.

Length: 30 minutes Stock # **150019** (CD) **150020** (VHS)

Fiber Optic Connectors, Connectorization and Patch Panels

This video reviews the 15 most common connector styles, the four basic bonding techniques, and the differences between multimode and singlemode applications and polishes. It also demonstrates the different types of connector assemblies, proper use of tools, inspection equipment and testing basics. The video ends with a review of patch panels, including panel types, designs, cable routing and connector related issues.

Length: 34 minutes Stock # **150033** (CD) **150032** (VHS)

Fiber Optic LEDs, Lasers and Detectors

Fiber Optic LEDs, Lasers and Detectors covers the active components used in transmitters and receivers to convert electrical circuits to optical circuits and vice versa. It addresses the components and their operation, wavelength compatibility, cost issues, packaging and industry trends. Newer technologies such as tunable lasers, optical amplifiers and Vertical Cavity Surface Emitter Lasers (VCSEL) are included.

Length: 37 minutes Stock # **150015** (CD) **150016** (VHS)

Fiber Optic Installation

Today's designers and installers must address a host of changing building codes, environmental issues, proper design, routing and topology concerns when building a fiber network. Fiber Optic Installation covers the numerous issues involved with the proper placement of optical communication systems for LANs, WANs and MANs.

Length: 41 minutes Stock # **150017** (CD) **150018** (VHS)

Fiber Optic Splicing and Splicing Closures

The installation of a fiber transmission system would be impossible without some way of connecting individual fibers with low signal loss. Splicing of optical fiber is much more involved than splicing copper wire. The technician must have special knowledge and perform skills under controlled conditions. In Fiber Optic Splicing and Splice Closures you'll learn what types of mechanical splicers are available, their applications and how they work. Tools, splice closures, splice trays and associated hardware and installation issues are reviewed and demonstrated.

Length: 22 minutes Stock # **150037** (CD) **150036** (VHS)

Fiber Optic Testing, Troubleshooting and Documentation

Today's fiber technician needs to be well versed on the various measurement instruments available and the procedures used in the practical testing of fiber optic networks. Fiber Optic Testing, Troubleshooting and Documentation will help you to understand the wide variety of fiber optic test equipment available as well as the importance of complete testing and documentation of optical components when designing, installing, operating and maintaining a fiber optic network.

Length: 37 minutes Stock # **150035** (CD) **150034** (VHS)

Fiber Optic System Design

The careful design of fiber systems is critical to reliable, long term operation. Fiber Optic System Design shows how to design a fiber transmission system that will suit your requirements now and for years to come. The video/CD-ROM focuses on the issues in designing local, metropolitan and wide area networks. Areas covered include the physical layout and calculating loss budgets for multimode and singlemode networks.

Length: 35 minutes Stock # **150039** (CD) **150038** (VHS)

Introduction to Fiber Optic Theory and Fiber Structure

Understand the basics of optical theory and its relationship to optical fibers. The video is comprehensive, informative and educational to watch. Follow the evolution of the many fiber types and their applications. The fiber, and industry come to "life" with the use of animations, graphics, actual film footage of fiber production, and many diverse fiber applications. Introduction to Fiber Optics provides the novice with a good explanation of fiber theory and it is an excellent review for the experienced fiber professional. An excellent staff development tool for those who work with or around the fiber industry.

Length: 35 minutes (4^{th} revision) Stock # **150007** (CD) **150008** (VHS)

The How-To Series offers step-by-step instruction in the application of fiber optic technology. The eight videos in this series focus on specific fiber optic disciplines, providing "how-to" instruction relating to testing, cleaving, splicing, restoring, inspecting, terminating and loss budgets. These videos are designed for instructors, technicians and crafs-people who work directly with specific fiber optic disciplines.

How To Cleave and Splice Optical Fibers

In any signal transmission system, splicing of optical line segments to acehive minmal loss of signal is fundamental to optimal performance and reliability. The precise nature of fiber optics demands a high level of skill and attention to detail on the part of the fiber technician. Unlike copper wire that relies on simple contact for a low attenuation splice, optical fibers must be correctly aligned and held in position to transfer a maximum amount of light across the splice. In addition, because glass fiber is vulnerable at the splice point, it must be protected from the elements and mechanical stresses. This video demonstrates the correct methods of preparing, cleaving, splicing, and protecting optical fibers. Learning the proper techniques is essential for any successful fiber technician.

Length: 26 minutes (2nd revision) Stock # **150051** (CD) **150050** (VHS)

How to Create an Optical Loss Budget

When designing a fiber optic system, one of the most important design elements is the "Optical Loss Budget." In essence, the Optical Loss Budget is a statement of how the optical power available will be used. Learn how to do optical loss budgets for Local Area Networks per the TIA/EIA 568B standard, Wide Area Networks in telecommunications, and CATV networks using singlemode fiber. The video also demonstrates how to create "not to exceed" loss budgets for contractors are demonstrated.

Length: 35 minutes Stock # **150025**(CD) **150026** (VHS)

How to Perform Optical Loss Testing

This video focuses on the optical light source and power meter and how they are used to perform optical loss measurements in Local Area and Wide Area Networks (both singlemode and multimode). The video/cd-rom demonstrates the advantages and disadvantages of various testing methods.the video emphasizes the importance of accurate documentation.

Length: 19 minutes Stock # **150023** (CD) **150024** (VHS)

How To Cleave, Polish, and Inspect a Fiber Optic Connector

Today's designers and installers must address a host of changOver the years many techniques and products have become available for cleaning optical fibers and connectors.

This video demonstrates the use of various products and the advantaged/disadvantages of each. It shows, through real-life examples and graphics, potential problems and symptoms of various types of problems and how to resolve them through cleaning. A special portion of the video is dedicated to cleaning connectors used in DWDM applications.

Length: 29 minutes (2nd revision) Stock # **150045** (CD) **150044** (VHS)

How To Perform a Fiber Acceptance Test

Before the first meter of cable is installed, it is of vital importance that the cable meets or exceeds the manufacturer's specifications. This can only be verified by a process called acceptance testing. In How to Perform a Fiber Acceptance Test, you'll learn the critical issues as well as the equipment and techniques needed to successfully perform an acceptance test.

Length: 16 minutes Stock # **150047** (CD) **150046** (VHS)

How to Clean a Fiber Optic Connector

In the past, the purpose of cleaning fiber optic connectors was to prevent damage to the fiber during mating of the fiber ends to each other. However, today's more advanced and faster transmission systems that use higher power lasers require even more attention to cleaning of the connection surfaces. This video reviews the products, applications and their proper usage. It shows the causes of contamination when using various cleaning techniques and demonstrates different cleaning products.

Length: 31 minutes Stock # **150027**(CD) **150028** (VHS)

How To Prepare Fiber Optic Cables

Correct preparation of fiber optic cable is of paramount importance. Improper handling, incorrect tools and poor techniques may cause fiber abrasion. The damage may not be immediately apparent and may cause the network to fail suddenly in the future. This video will help the fiber craftsperson gain the proper knowledge and skill to work with fiber optic cable.

Length: 18 minutes Stock # **150043** (CD) **150042** (VHS)

How To Prepare A Fiber Optic Patch Panel

This video demonstrates proper techniques for dressing the three most common cables into patch panels typically used in the fiber industry. Cable types include loose tube outdoor cables, indoor distribution and breakout cables and fanout kits. Panel types include patch, distribution and splice panels in both rack and wall configurations.

The video addresses installation issues that are dealt with including proper routing and securing of cables in order to avoid damage or long term degradation, proper grounding of armored cables to satisfy NEC requirements, proper routing of fiber and buffer tubes in splice trays, good fiber management practices, and helpful accessories and techniques that will ensure a professional result that is mechanically and optically effective.

Length: 30 minutes Stock # **150053** (CD) **150052** (VHS)

Understanding and Using the Optical Time Domain Reflectometer

Does the following terminology and theory confuse you when operating OTDR?

- Index of Refraction (I.R.)
- Fresnel and Rayleigh backscatter
- Averaging (I.C.)
- 2 Point and auto (LSA) loss measurements

If so, this video would be beneficial to you and your organization. The OTDR is one of the most widely used yet least understood instruments in fiber optics. Understanding and Using the OTDR will take you through a step-by-step explanation that demonstrates how the OTDR works and its role in fiber optic measurements. Learn how to use the OTDR for acceptance testing, splice monitoring and emergency restoration applications.

Length: 24 minutes Stock # **150041** (CD) **150040** (VHS)

Singlemode Fiber Optic Emergency Restoration

Emergency restoration! These words strike terror in network and outside plant managers. This video examines common cable damage scenarios and shows you how to adopt an effective maintenance posture that allows you to locate faults and quickly return damaged cables to service.

Length: 37 minutes Stock # **150049** (CD) **150048** (VHS)

These menu-selectable DVDs allow an instructor to tailor the course and subject matter to a specific audience, as applicable. In addition, each DVD includes added bonus materials such as instructor and student quizzes.

For detailed information on the videos, visit our web site: www.i-fiberoptics.com.

Fundamentals of Fiber Optics

This DVD is a logical starting point for anyone who's getting newly acquainted with fiber optic technology. The information presented is pertinent to a wide variety of applications, including LANs, WANs, SANs, MANs, industrial controls, residential optical fiber networks and security systems. Discussions begin with the history and evolution of optical fibers, including their advantages over typical metal conductors. Various types of fiber, including glass, plastic and specialty versions (for example, dense wavelength division multiplexing, or DWDM), are addressed, along with their common core, cladding and coating components. Then follows a foray into basic fiber optic theory. It deals with aspects of wavelength, refraction, reflection, adsorption, scattering, numerical aperture, attenuation and optical dispersion as they affect optical performance. The presentation concludes with a description of real-world applications in which fiber optics, often in tandem with lasers, have dramatically improved information-carrying systems.

Length: 80 minutes Stock # **150055** (DVD)

Troubleshooting A Fiber Optic Link

When fiber optic links fail, the cause can be any of several culprits - or a combination of them. This DVD presentation takes a close look at both interior and exterior optical fiber systems and typical problems that can bedevil them. Even better, it describes specifically how to go about searching for faults, and which types of equipment are best suited to different troubleshooting tasks. Procedures are detailed in "identify, locate and resolve" sequences. Faults are broken down into different locales (span, splice and connection for both receivers and transmitters). Detection tools range from OTDRs (optical time domain reflectometers) to spectromicroscopy (SM) beamlines. Specific types of problems described in the discussions run the gamut from contamination, crossovers and mis-keying to misengagement, microbends and macrobends. Among the less complex aspects of this presentation are its emphasis on daily procedures such as visual inspection, cleaning, documentation and keeping accurate records that can help avoid costly system down time.

Length: 90 minutes Stock # **150061** (DVD

Fiber Optic Connectors

The numbers and types of connectors used in fiber optic systems can be daunting to a first-time acquaintance. This DVD takes the pain out of making that acquaintance by describing all the receptacles, plugs, adapters, alignment sleeves, ferrules, attenuators, loopback devices, terminal ends, multi-fiber arrangements and other connector hardware apt to be encountered when assembling or evaluating optical fiber arrays. Included are very specialized connectors often restricted to narrow fields of application such as aerospace and the military. In addition to assessing components' optical and mechanical tolerances (and the impacts of those properties on optical performance), the presentation covers aspects of care and construction that are integral to connector operation. Included in that realm are the important roles of bonding, scribing, polishing, cleaning and visual inspection, as well as attenuation and reflectance specifications and potential mechanical and environmental requirements.

Length: 118 minutes Stock # **150068** (DVD)

Fiber Optic Splicing

Procedures for splicing optical fibers have been with us since the 1970s; however, processes today are far more sophisticated than they were four decades ago. Evolution of splicing in fact was mandatory if fiber optics was to become a meaningful transmission technology. And that technology had to be able to rely on splices that were low in cost, high in mechanical strength and reliable over the long term. This DVD discusses the characteristics of modern fusion and mechanical splices (for example, PAS, LID and fixed V-groove splicers for ribbon, FTTx and premise applications). It also describes the correct techniques for preparing, cleaving, splicing, protecting optical fibers and making emergency restorations. Lab, manufacturing, field and close-up footage and detailed graphics depict splicing processes and procedures in easy-to-follow steps. One chapter is devoted to specialty splicing, and quizzes are included for both students and instructors.

Length: 95 minutes Stock # **150065** (DVD)

OTDR Theory and Operation

Optical time domain reflectometers, better known as OTDRs, are an essential fiber optic system testing tool. This DVD describes the evolution of these tools and variations now in use, including mainframe models, break locaters, mini-OTDRs, and specialty versions with optical subassemblies. A major discussion topic is platform OTDRs (used for testing PMD, CD and DWDM) that incorporate OTDR modules, optical switches and visual inspection scopes for use with both standard and advanced fiber technologies. After its presentation about physical characteristics of test tools, the DVD conducts an in-depth review of how OTDRs are actually used, and what users should test for when performing acceptance tests, examining splice performance (as when checking for potential light loss) and optical return loss values, and when conducting total span testing for both exterior plant and in-premises installations. The latter discussions include test procedures for local area networks and optical splitters.

Length: 86 minutes Stock # **150057** (DVD)

Fiber Optic Test Equipment and Testing Fiber Optic Links

Fiber optic test equipment comes in a wide variety of sizes, shapes and capabilities. This DVD offers an overview of them all (unlike more targeted companion DVDs such as the one here that deals exclusively with OTDRs). The presentation begins with a discussion of test equipment theory and operation, then moves on to descriptions of different types of gear. Those include optical loss test sets, reflectometers, visual tracers, fiber identifiers, fiber optic talk sets and visual inspection equipment. Once the equipment array has been defined, the discussion turns to procedures such as acceptance testing and maintenance, and recording and documenting test results. Two specialized areas address testing multimode and single-mode premise applications, and the unique challenges encountered when testing single-mode in outside plant environments. The DVD includes a section that advises users how to select test equipment best suited to their system needs, and it takes a look at emerging technologies and disciplines that may affect this field.

Length: 81 minutes Stock # **150059** (DVD)

Fiber Optic Cable

Probably the most obvious visual aspects of fiber optic technology are the fiber cables that transport information from transmitter to receiver, often over significant distances. The different types of optical fiber, and its varied structure, are the focus of this DVD. The presentation begins with a description of manufacturing processes, then moves on to instructions for preparing various types of cable for splicing, and terminating them at appropriate lengths. The fact that cable comes in so many varieties means that a system for cataloging them is essential. That subject is addressed here under the heading of interpreting cable specifications. Continuing descriptions cover the manufacture of both loose- and tight-buffered cables, and procedures for cabling fiber from acceptance to final assembly. “How to” sections tell how to attach a fan-out kit for loose tube cables, and also how to perform a mid-entry into loose and tight structures. Final sections of the presentation involve utility company applications that require special all-dielectric self-supporting aerial cables (ADSS) and optical fiber composite overhead ground wire (OPGW).

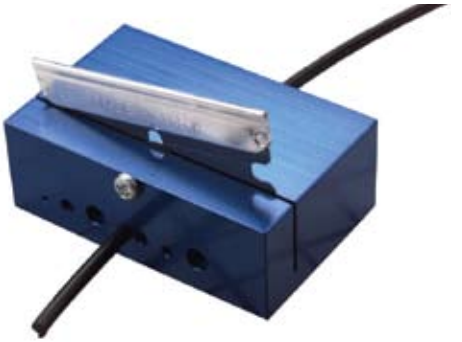
Length: 106 minutes Stock # **150063** (DVD)

Fiber Optic Patch Panels, Closures and Pedestals

Connectors and splices are critical components of nearly all fiber optic systems, but exposure to stress and the elements would quickly render them useless were it not for enclosing structures to protect them. Such structures - and complementary equipment - are the subject of this DVD. Splices, when complete, are typically organized in splice trays that are in turn enclosed in patch panels or kindred housings. Those housings can include splice panels, distribution panels, entrance cabinets, LAN panels, fiber management bays, splice closures and pedestals. This presentation describes how each housing is specifically designed to accommodate critical cable grounding, strain relief and fiber routing requirements. Following the product descriptions come procedural descriptions for preparing distinct types of cable arrangements such as loose tube and tight tube. The DVD makes a strong point: A chain is only as strong as its weakest link. Careful attention to splice and connector enclosures will make the difference of whether an optical fiber system operates reliably or fails miserably.

Length: 100 minutes Stock # **150067** (DVD)

Professional Fiber Cutter



This fiber cutter produces precise cuts and fiber ends that exceed quality produced by other cutting tools, plus it is many times faster than polishing. It is very easy to use – insert the fiber and press down on the blade. This device uses standard single-edge razor blades that are replaced by removing a single screw. Each blade is good for at least 50 cuts of simplex communication fiber, which puts your per-cut cost at about .2 cent.

The fiber cutter features six different apertures for cutting the most popular sizes of fiber such as:

- .75 and 1.0 mm simplex and duplex jacketed fibers
- .75, 1.0, 1.5, 2.0 and 3.0 mm bare fibers
- 16-, 32-, 48- and 64-fiber light guides

In addition, this fiber cutter splits 1000 µm core duplex fiber jacket precisely down the middle during insertion, eliminating one step and the risk of nicking the fiber cladding.

The aluminum cutter body is precisely machined to securely hold fiber and blades at right angles for ideal cuts. The aluminum body features a bright blue anodized coating for durability. Comes complete with fiber cutter body, five "Extra KEEN" razor blades, and instruction guide with aperture and fiber selection chart.

Stock #
IF FC1

Standard-edge razor blades are suggested for cutting 2-mm diameter and above bare fibers and for extra-long use.

Stock #
IF FC1-RP2

(pkg of 100)

Replacement Blades:

"Extra KEEN" razor blades produce the best cuts and are suggested for cutting all fibers except 2 mm diameter and above solid-core fibers.

Stock #
IF FC1-RP1

(pkg of 100)

Disposable Fiber Cutter

This versatile, inexpensive and easy-to-use fiber cutter complements our professional model shown above. A perfect tool for installations where a technician may need to make only a few terminations, then go quickly on to another job. The cutter features apertures for cutting fiber such as:

- .750 and 1000 µm simple and duplex jacket fibers
- .750 and 1000 µm bare fibers
- 16-fiber light guides

Stock #
IF FC4

Hot Knives

An inexpensive tool for producing clean cuts through plastic fiber of all types and diameters as an alternative to polishing. Used like a soldering iron or wood burning tool. The 25-watt heating element plugs into a standard 110 VAC 3-prong outlet and has 4-foot cord. Replacement blades are standard X-ACTO® type. Suitable for fiber diameters up to 1.5 mm.

Stock #
IF 370011

60-Watt Heavy Duty Hot Knife with brass cutting edge. Suitable for solid core fiber 2.0 mm and larger.

Stock #
IF 370012

Fiber Optic Test Set

A versatile and rugged fiber optic test instrument specifically designed for use with plastic optical fiber. It features capabilities for:

- Performing fiber continuity checks
- Measuring fiber output power
- Calibrating and screening detectors
- Measuring LED power
- Measuring fiber attenuation

The Fiber Optic Test Set uses a silicon photodetector to measure optical power, which is calibrated at the two most commonly used wavelengths in plastic fiber – 660 (red) and 850 (infrared) nanometers. Optical power upon the photodetector is displayed in an easy-to-read 3 1/2 LCD display that can be set in four different power ranges: 20 µW, 200 µW, 2 mW and 20 mW. The test set includes a 660 nm LED for fiber attenuation measurements, activated by a separate switch with automatic turn-off circuitry to save battery life.

The detector and LED are both housed in industry-standard ST® female input connectors. The connectors permit measurements with any plastic fiber in an ST® male connector or connector-less fiber with an outer diameter of 2.5 mm or less.

This meter is inexpensive enough for classroom budgets, yet offers the range, features and durability required for industrial applications.

The Test Set comes with two 9-volt batteries, sturdy storage container, test cable and easy-to-read full-color instruction manual.

Operator's manual available on our website

Stock #
IF FOM

POF Fiber Optic Tool Kit

Industrial Fiber Optics has put together a general purpose tool kit that will get you started working with plastic optical fiber and cable .

Kit is suitable for working with the following optical fiber:

- Jacketed and unjacketed
- Diameters ranging from .25 to 3 mm
- Single strands or multi-fiber bundles
- Polishing, simple cutting or hot knife terminations
- Connector-less or connectorized

Operator's manual available on our website

Stock #
IF TK4

Kit contains fiber optic stripper, hot knife, professional fiber cutter, water dispenser, glass polishing plate, 2000 grit and 3 µm polishing film, replacement blades, ST® fiber polishing puck, rugged storage container and full-color procedure guide.

Inspection Microscope

Now available is the IFO Universal Microscope. Insert any 2.5 mm fiber ferrule into the microscope, turn on the light and inspect the end surface with ease. The microscope is provided with an ST®, FC and SC universal faceplate. It is perfect for all multimode plastic and glass fiber, plus it is easy to use. An exceptional value.

Stock # **IF 370050**

Infrared Detection Cards

These cards are used to convert 850nm or 950 nm infrared light to the visible spectrum.

Stock # **IF 850052** 850 nm

Ideal for testing/verifying operation of IF-E91 IR devices. Active area is 2.54 × 2.54 cm.

Stock # **IF 850053** 950 nm

Fiber Polishing Kit

Prepackaged polishing films and instructions for plastic optical fiber and cable. Kit containing two sheets 10 x 14 cm of 2000-grit and 3µm polishing film and polishing instruction guide.

Stock # **IF C-PK**

Polishing Slurry

4 oz of special formulated liquid to improve fiber polish and extend the life of polishing films, reduce polishing time.

Stock # **IF 370060**

Polishing Pucks

Polishing disks for terminating POF fiber connections. The plastic disk is light weight and low in cost. Limited to approximately 50 polishes.

Plastic Polishing Puck for ST® — Stock # **IF 370041**

Generic polishing puck with a custom-drilled hole anywhere from .75 mm to 8 mm in diameter. Suitable for POF of all types and diameters.

Generic Polishing Puck — Stock # **IF 370044**

The metal disk is slightly more in cost, but is also more durable and capable of performing 1000+ polishes.

Metal ST® Polishing Puck — Stock # **IF 370042**

Metal SMA Polishing Puck — Stock # **IF 370043**

Micro-Strip® Stripping Tools

Micro-Strip® tools strips 2.2 mm jacketed fiber with a 1 mm core quickly and easily. Convenient fiber stripping tool contains standard handles with 1 mm cutter blade sets and 2.2 mm fiber guides.

Micro-Strip tools can be fitted for other fiber core/cladding or jacket diameters as you specify.

Stripper for POF cable with .5 mm core and 1.0 mm OD diameter jacket — Stock # **37 0091**

Stripper for POF cable with .75 mm core and 2.2 mm OD diameter jacket — Stock # **37 0090**

Stripper for POF cable with 1.0 mm core and 2.2 mm OD diameter jacket — Stock # **37 0075**

Replacement blades can be found on our web site.