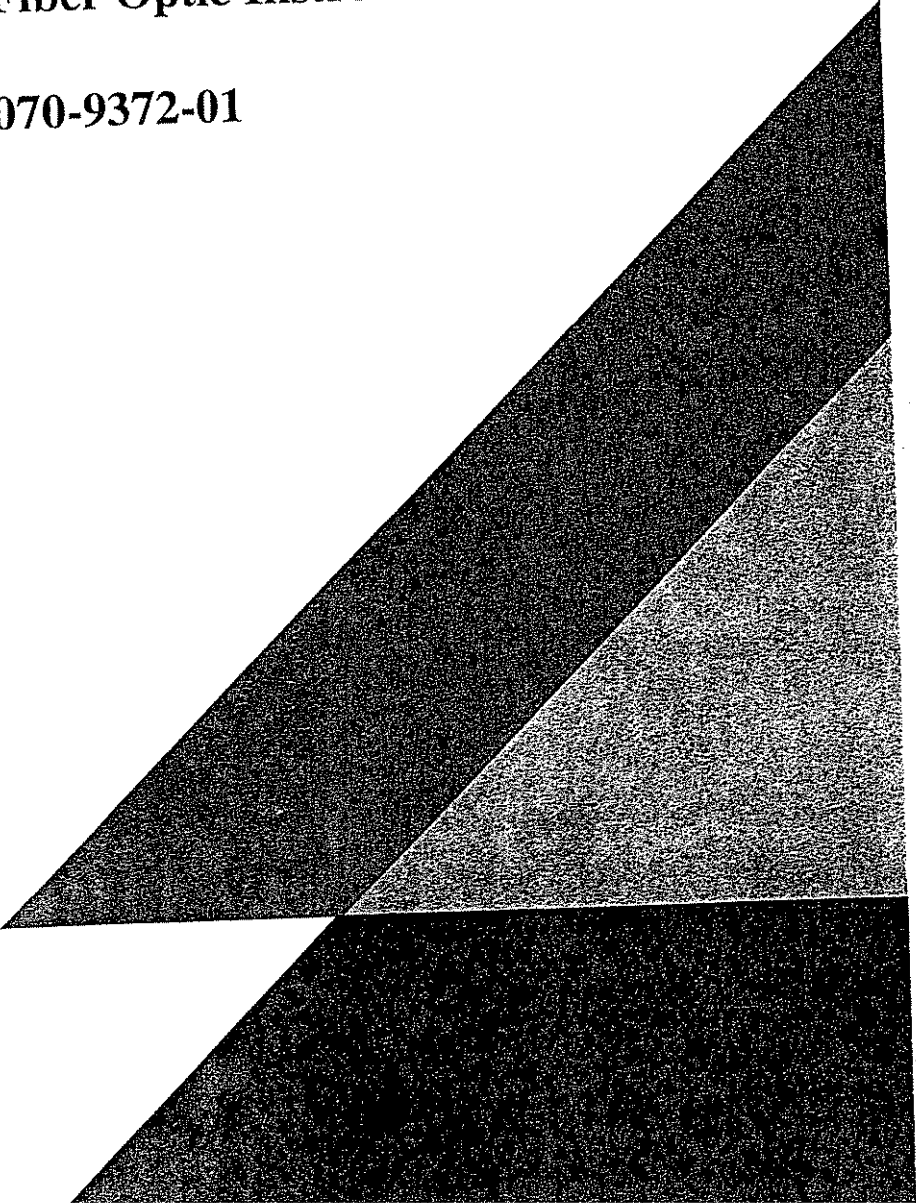

User Manual

Tektronix



**TOP 130, 140, 150, 160, 200, 300
Fiber Optic Instruments**

070-9372-01



User Manual

Tektronix

**TOP 130, 140, 150, 160, 200, 300
Fiber Optic Instruments**

070-9372-01

First Edition: July 1996

Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000 Tektronix, Inc., Beaverton, Oregon, USA
E200000 Tektronix United Kingdom, Ltd., London
J300000 Sony/Tektronix, Japan
H700000 Tektronix Holland, NV, Heerenveen,
The Netherlands

Tektronix, Inc., PO. Box 500, Beaverton, OR 97077
Printed in U.S.A.

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FCC Class A Device

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generated, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Changes or modification not expressly approved by Tektronix can affect emission compliance, and could void the user's authority to operate this equipment.

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Phone: 1-800-835-9433 (toll free USA/Canada)
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EC Declaration of Conformity

We Tektronix Holland N.V.
Marktweg
8444 AB Heerenveen
The Netherlands

declare under the sole responsibility that the

Tektronix *TOP130, TOP140, TOP150, TOP160*
Optical Light Sources
TOP200 Optical Power Meter
TOP300 Visual Fault Finder

meet the intent of Directive 89/336/EEC for Electromagnetic Compatibility.
Compliance was demonstrated to the following specifications as listed in
the official Journal of the European Communities:

EN 50081-1 Emissions:

EN 55022	Radiated, Class B
EN 55022	Conducted, Class B
EN 60555-2	Power Harmonics

EN 50082-1 Immunity:

IEC 801-2	Electrostatic Discharge
IEC 801-3	RF Radiated
IEC 801-4	Fast Transients
IEC 801-5	Surge

WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Safety Terms in this Manual

The **WARNING** heading in this manual explains dangers that could result in personal injury or death.

The **CAUTION** heading in this manual explains hazards that could damage these instruments.

In addition, a **NOTES** heading gives information to the user that may be beneficial in the use of these instruments.

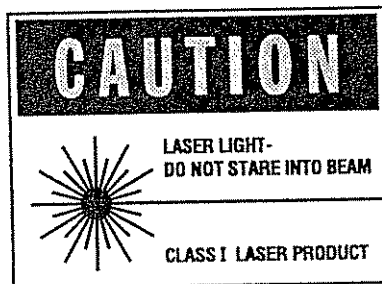
General Warnings and Cautions

The following general warnings and cautions are applicable to these instruments:

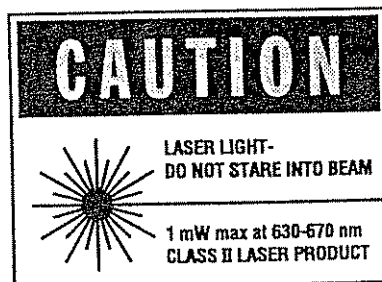
LASER SAFETY

The TOP140, 150, 160, and 300 are laser devices conforming to the requirements of CDRH, CFR 1040, Subchapter J. While there is no potential for eye damage due to unaided direct exposure, users should always avoid looking directly into the Output Port. The use of optical viewing instruments (such as microscopes, magnifiers, etc.) should always be avoided. The use of these devices around active fibers can focus a highly intense beam on to the retina which can result in permanent eye damage.

TOP140 / TOP150 / TOP160



TOP300



Specific Precautions

Power Sources. The TOP series is designed to operate from two AA alkaline batteries. Note proper orientation of batteries before turning the instrument on.

Battery Power. Do not expose battery to fire or intense heat, nor open or mutilate the battery. Avoid contact with electrolyte which is corrosive and may damage eyes, skin and clothing. Check with local codes for disposal instructions.

External Power. Any external power adapter is not recommended for the TOP series.

Laser Radiation. When making measurements on optical systems, avoid eye exposure to any open-ended fibers, optical connectors, optical interfaces or other sources, because they may be connected to laser transmitters

- Do not look into the optical port when a source is turned on.
- Keep the dust cap on the optical port when not in use.
- Avoid looking at the free end of a test fiber (the end not connected to the instrument). If possible, direct the free end toward a non-reflective surface.

Do Not Operate in Explosive Atmospheres. Do not operate the TOP series in an explosive atmosphere unless it has been specifically certified for such operation.

Do Not Remove Covers or Panels. Do not remove the instrument covers or panels, nor operate without covers and panels in place.

Repair. Refer all repair problems to qualified service personnel.

Specifications: Optical Dual LED Sources

Model Number	TOP130	
Center Wavelength (nominal)	850nm	1300nm
Wavelength Range (nominal)	830-870nm	1270-1340nm
Spectral Width (RMS)	≤55nm	≤160nm
Power Stability (1 hr max. deviation)	± 0.05dB	± 0.05dB
Power Output Into 62.5/125 GI MM fiber Into 9/125 SM fiber	-13dBm (50μW)	-20dBm (10μW) -38dBm (158nW)
Power Output Uncertainty	±1dB (Calibrated launch level into 62.5/125 GI MM Fiber)	
Functions	MOD (Modulated) output mode CW (Continuous Wave) DC output mode FREQ (Frequency) Selection switch accessible from battery compartment, setable to 270Hz, 1kHz or 2kHz	
Connector Interface	Snap-On Connector Interface (SOC), see Table 1.1 for available SOC adapters	
Operating Environment	-15°C to +55°C, 0-95% RH (non-condensing)	
Storage Environment	-35°C to +70°C, 5% to 95% RH (non-condensing)	
Batteries	Two AA size, alkaline (>20hrs battery life)	
Weight	240g (8.4oz)	
Size (W x H x D)	72 x 142 x 36mm (2.8 x 5.6 x 1.4in.)	

WARNING

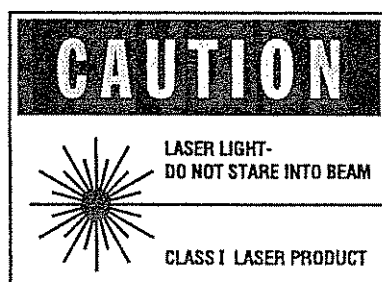
While there is no potential for eye damage due to unaided direct exposure, users should always avoid looking directly into the output port. The use of optical viewing instruments (such as microscopes, magnifiers, etc.) should always be avoided. The use of these devices around active fibers can focus a highly intense beam on to the retina which can result in permanent eye damage.

Specifications: Optical Laser Sources

Model Number	TOP140	TOP150
Laser Type	Fabry-Perot	Fabry-Perot
Center Wavelength (nominal)	1310nm	1550nm
Wavelength Range (nominal)	1280-1340nm	1520-1575nm
Spectral Width (RMS)	<5nm	<10nm
Power Stability ¹ (1 hr max. deviation)	± 0.03dB	± 0.03dB
Power Stability (24 hr max. deviation)	± 0.15dB	± 0.15dB
Power Output ^{1,2} (CW mode only)	-7dBm (100µW) into SMF-28/9µm core fiber	
Power Output ^{1,2} Uncertainty	± 0.5dB Calibrated launch into SMF-28/9µm core fiber	
Connector Interface	Universal Connector Interface (UCI), see Table 1.1 for available UCI adapters	
CDRH	Class I	
Operating Environment	-15°C to +55°C, 0-95% RH (non-condensing)	
Storage Environment	-35°C to +70°C, 0-95% RH (non-condensing)	
Batteries	Two AA size, alkaline (>80hrs battery life)	
Weight	230g (8.0oz)	
Size (W x H x D)	72 x 142 x 36mm (2.8 x 5.6 x 1.4in.)	

Specifications subject to change without notice.

Notes: 1 Within specified ambient environment +20°C to +25°C
2 In MODulated mode, output power is 3dB lower.



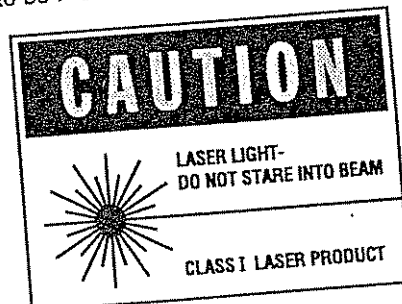
WARNING

The TOP 140 and 150 are devices conforming to the requirements of CDRH Class 1, CFR 1040 Subchapter J. While there is no potential for eye damage due to unaided direct exposure, users should always avoid looking directly into the output port. The use of optical viewing instruments (such as microscopes, magnifiers, etc.) should always be avoided. The use of these devices around active fibers can focus a highly intense beam on to the retina which can result in permanent eye damage.

Specifications: Dual Optical Laser Source

Model Number	TOP160	
Center Wavelength (nominal)	1310nm	1550nm
Laser Type	Fabry-Perot	Fabry-Perot
Wavelength Range	1280-1340nm (nominal)	1520-1580nm
Spectral Width (RMS)	≤5nm	≤5nm
Power Stability ^{1,3} (1 hr max. deviation)	± 0.05dB	± 0.05dB
Power Stability (24 hr max. deviation)	± 0.15dB	± 0.15dB
Power Output ^{1,2,3} (CW mode only)	-7dBm (200μW) into SMF-28 / 9μm core fiber	
Power Output ^{1,2,3} Uncertainty	± 0.75dB Calibrated launch into SMF-28/9μm core fiber	
Connector Interface	Universal Connector Interface (UCI), see Table 1.1 for available UCI adapters	
CDRH	Class I	
Operating Environment	-15°C to +55°C, 0-95% RH (non-condensing)	
Storage Environment	-30°C to +60°C, 0-95% RH (non-condensing)	
Batteries	Two AA size, alkaline (>50hrs battery life)	
Weight	230g (8.0oz)	
Size (W x H x D)	72 x 142 x 36mm (2.8 x 5.6 x 1.4in.)	

- Notes: *Specifications subject to change without notice.*
- 1 Within specified ambient environment +20°C to +25°C
 - 2 In MODulated mode, output power is 3dB lower.
 - 3 Return Loss to be > 30 dB



WARNING

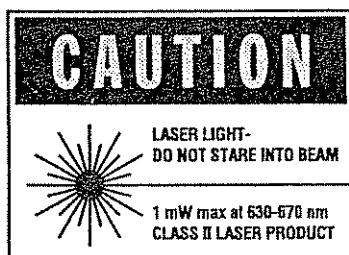
The TOP 160 device conforms to the requirements of CDRH Class 1, CFR 1040 Subchapter J. While there is no potential for eye damage due to unaided direct exposure, users should always avoid looking directly into the output port. The use of optical viewing instruments (such as microscopes, magnifiers, etc.) should always be avoided. The use of these devices around active fibers can focus a highly intense beam on to the retina which can result in permanent eye damage.

Specifications: Optical Power Meter

Model Number	TOP200
Detector Material	InGaAs
Calibration Wavelengths	850,1300,1550nm
Power Range	+3 to -60 dBm
Absolute Accuracy	±0.25dB at Calibration Conditions Traceable to U.S. N.I.S.T. (Boulder, CO)
Display	LCD, simultaneously displays power to 0.01 dB, mode and wavelength range. Low battery & calibration annunciators.
Calibration Data	Data stored in non-volatile memory
Connector Interface	Snap-On Connector Interface (SOC), see Table 1.1 for available SOC Adapters
Operating Environment	-15°C to +55°C, 0% to 95% RH (non-condensing)
Storage Environment	-35°C to +70°C, 0% to 95% RH (non-condensing)
Batteries	Two AA size, alkaline (>100hrs battery life)
Weight	250g (8.9oz)
Size(W x Hx D)	72 x 142 x 36mm (2.8 x 5.6 x 1.4in.)

Specifications: Visual Fault Finder

Model Number	TOP 300
Central Wavelength (Mean FWHM)	
Nominal	635nm
Range	615nm-660nm
Spectral Width (RMS)	< 1.2nm
Stability	
1 hour max. deviation	±0.15dB
10 hours max. deviation	±0.25dB
Power Output SMF-28 Fiber	-5dBm (Class II)
Connector Interface	Universal Connector Interface. See Table 1.1 for available UCI adapters.
Operating Environment	-15°C to +40°C, 0-95%RH (non-condensing)
Storage Environment	-35°C to +70°C, 0-95%RH (non-condensing)
Batteries	Two AA alkaline batteries (>20 hours battery life)
Weight	230g (7.6 oz)
Size (W x H x D)	72 x 142 x 36 mm (2.8 x 5.6 x 1.4in.)



WARNING

The TOP300 is a device conforming to the requirements of CDRH Class II, CFR 1040 Subchapter J. While there is no potential for eye damage due to unaided direct exposure, users should always avoid looking directly into the output port. The use of optical viewing instruments (such as microscopes, magnifiers, etc.) should always be avoided. The use of these devices around active fibers can focus a highly intense beam on to the retina which can result in permanent eye damage.

Section 1

General Information

Overview

1.1.1 The TOP Optical LED Source

The Tektronix TOP130 Dual-Wavelength (850/1300nm) Optical LED Source is a small, rugged handheld instrument for use in installing and testing attenuation of both singlemode and multimode fiber optic links, including telephony, datacom, CATV, FDDI and LAN applications. The instrument provides two calibrated outputs at 850nm and 1300nm to speed up transmission loss measurements. Providing both CW and MODulated outputs, the user can internally set the modulation frequency to match the frequency signatures (270/1000/2000Hz) required by fiber identifiers and signal tracers.

The palm-sized TOP130 provides the flexibility in a single unit to interface to all industry standard fiber-optic connectors with high throughput, repeatability and stability. This optical interface of this instrument features the precision snap-on connector (SOC) interface. A wide range of push-pull SOC adapters are available covering all popular industry-standard fiber-optic connectors (including FC, ST, SC, SMA, E2000, DIAMOND, etc.).

The TOP series LED source is powered by two common AA alkaline batteries which provide over 20 hours of portable life. The front panel Status LED blinks when the batteries are low. Together with the TOP200 optical power meter, the fiber optic technician possesses the smallest, high-performance fiber optic test set in its class.

Overview

1.1.2 The TOP Optical Laser Sources

The Tektronix TOP Series comprise a range of palm-sized, single and dual wavelength laser sources supporting the 1310nm and 1550nm windows. This series was developed in response to requests from the fiber optic industry for small, rugged light sources for use in installing, maintaining and researching singlemode SONET/SDH, CATV, ATM and other types of fiber optic links. The TOP140 (1310nm) and TOP150 (1550nm) were developed for applications requiring only a single wavelength source. Where loss measurements at both windows are required, the TOP160 also offers the added convenience of a single output port.

The optical interface of the TOP series optical laser sources is the high performance, universal connector interface (UCI). The UCI interface is ideally suited to the unique requirements of optical instrumentation whether in the most-demanding outside plant (OSP) or lab environment. First, being truly universal, the UCI interface is complemented by a full range of UCI screw-on/screw-off connector adapters supporting a broad range of industry-standard PC connector types (FC, SC, ST, D4, DIN, E2000 and more). Second, where cleaning connectors is an especially important and routine step in the optical fiber world, the UCI interface offers direct access for routine cleaning. Third, the durable tungsten carbide ferrule outperforms and outlasts traditional ceramic ferrule connectors.

In addition to the overall advantages of the UCI interface, the output signal performance is characterized by two useful features. One, the absolute output power is calibrated which can speed up transmission-loss measurements. The user can always be assured that the output level will be consistent every time the unit is powered on. Furthermore, this reproducibility is matched by the multiwavelength reference storage of the TOP200 optical power meter (see section 3.4 - TOP200 and section 4.6 - Dual Wavelength Testing). Two, using the user-selectable CW or MODulated function, the user can also internally set the MOD frequency to match the frequency signatures (270/1000/2000Hz) required by fiber identifiers and other types of optical signal tracers.

Together with the Tektronix TOP200 optical power meter, the fiber optic technician possesses the smallest and high performance test set in its class.

1.1.3 The TOP200 Optical Power Meter

The palm-sized Tektronix TOP 200 optical power meter covers an extensive range of optical fiber applications. It is engineered for field and lab personnel requiring a high-performance, cost-effective, compact and rugged optical power meter.

This power meter family incorporates the precision and repeatability of the snap-on connector interface (SOC) which interfaces to all industry standard fiber optic connectors via a complete line of simple, push-on/pull-off SOC adapters. The novel design of these power meters combines a state-of-the-art signal processor and microcomputer electronics to provide superb performance as well as simple and elegant operation. Only three controls are used: ON/OFF, dBm/dB and λ (wavelength).

The TOP200 optical power meter incorporates a state-of-the-art InGaAs photodiode for optimum IR wavelength performance. InGaAs detectors provide wide dynamic range and improved temperature stability as compared to the Ge detectors. The TOP200 also features non-volatile memory together with an internal CAL function allowing the user the option to recalibrate the instrument in his/her own lab. The power meters are powered by two common AA batteries which provide over 100 hours of operating life. The custom LCD provides simultaneous display of both wavelength and dBm/dB units as well as battery status. Together with the Tektronix TOP series sources, the fiber optic technician possesses the smallest and highest-performance fiber optic test set in its class.

1.1.4 The TOP Fiber-Optic Visual Fault Finder

The Tektronix TOP300 answers the request from the industry for a small, rugged and truly versatile visual fault finder (VFF) for use in the installation, maintenance and troubleshooting of fiber optic systems.

This palm-sized visual fault finder features both CW and MOD (blinking) output modes. The blinking mode is used for finding faults and breaks in any fiber. The blinking light enhances viewing contrast, light loss can easily be detected by the human eye. Steady CW light output may be used for measuring fiber loss in the visible 630nm wavelength region. The VFF may also serve as a substitute for HeNe gas laser applications.

The TOP300 employs a hermetically sealed laser diode coupled to the fiber interface. Two AA alkaline batteries power the unit for a minimum of 20 hours. Like the TOP140/150/160 optical laser sources, the TOP300 also features the precision universal connector interface (UCI) which interfaces to all standard fiber optic connectors via a complete line of simple, screw-on/screw-off UCI adapters.

1.2 Scope of this Manual

Please carefully read this instruction manual before using these instruments. Be especially careful to observe the warnings and cautions throughout this manual. If any operating instructions are not clear, contact Tektronix, Inc.

This instruction manual contains the necessary information for operation and maintenance of the Tektronix TOP series fiber optic instruments as well as information for troubleshooting and obtaining service if necessary.

This information is divided into the following sections:

Section 1 provides general information about this manual and about the power meters and sources. It contains general product descriptions and gives the options that are available.

Section 2 explains the basic operating procedures common to the TOP series instruments, including battery replacement, changing connector adapters, and cleaning the optical interface.

Section 3 describes how to operate the various TOP series fiber optic instruments.

Section 4 describes various applications of the TOP series fiber optic instruments, including component insertion loss, link loss, and visual fault finding

Section 5 provides information about obtaining service.

Tektronix fiber optic instruments are carefully assembled, and inspected mechanically, electrically, and optically before shipment. Your instrument was shipped with an adapter, two AA batteries and this instruction manual. Upon receiving this instrument, check for any obvious signs of physical damage that might have occurred during shipment. Report any such damage to the shipping agent immediately. Retain the original packing materials in case reshipment becomes necessary.

1.3 Unpacking and Inspection

Unpacking

The TOP series instruments are shipped to you with the following equipment:

The TOP series instruments are shipped to you with the following equipment. The connector adapter type is as identified in Table 1.1.

TOP130 and 2x SOC Adapters
TOP140 and 1x UCI Adapter
TOP150 and 1x UCI Adapter
TOP160 and 1x UCI Adapter
TOP200 and 1x SOC Adapter
TOP300 and 1x UCI Adapter

Operator manual (070-9372-01)

AA alkaline battery, Qty. 2

If the contents of the shipping container are incomplete, contact your Tektronix representative.

If shipping resulted in damage to the TOP instrument, notify the carrier and your Tektronix representative.

Initial Inspection

This Tektronix TOP instrument was inspected mechanically, electrically and optically before shipment. If it fails to perform satisfactorily, contact your Tektronix representative immediately or in the U.S. and Canada telephone toll free 1-800-TEK-WIDE (835-9433).

If the TOP instrument must be returned to Tektronix for service:

- 1) Use the original carton, or equivalent with dimensions at least six inches greater than the unit to allow for cushioning.
- 2) Cover the instrument with polyethylene sheeting to protect its finish.
- 3) Cushion the instrument equally on all sides with packing material. Seal the carton with shipping tape or an industrial stapler.
- 4) Ship insured to:

Tektronix, Inc., CNA Division,
Attn: Customer Service
625 SE Salmon Ave. BLDG X7
Redmond, OR 97756

Include name of your company, person to contact, telephone number, and description of problem.

1.4 Accessories and Adapters

The following adapters and accessories are available. Please contact your Tektronix representative if you cannot find the desired adapter or connector that matches it.

Connector Types	TOP Order Option	SOC Series Adapters Used on: TOP130 LED Source TOP200 Power Meter	UCI Series Adapters Used on: TOP140 Laser Source TOP150 Laser Source TOP160 Laser Source TOP300 Visual Fault Finder
Biconic	30	119-5168-00	119-4515-00
D4-PC	32	119-5167-00	119-4514-00
DIAMOND-2.5	37	119-5171-00	119-4556-00
DIAMOND-3.5	36	119-5172-00	119-4558-00
DIN-PC	35	119-5166-00	119-4546-00
DIN-APC/HRL-10	35	119-5166-00	—
E2000-PC		119-5165-00	119-5164-00
E2000-APC		119-5165-00	—
FC-PC	31	119-5146-00	119-4516-00
FC-APC	31	119-5146-00	—
SC-PC	38	119-5145-00	119-4518-00
SC-APC		119-5145-00	—
SMA 905/906	33	119-5169-00	119-4557-00
SMA-2.5	39	119-5170-00	119-4517-00
ST-PC	34	119-5144-00	119-4513-00

Table 1.1 Connector Adapter Selection Chart

Connector Types

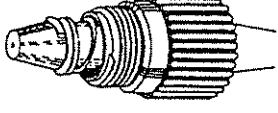

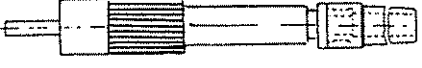


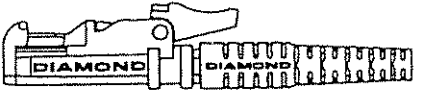


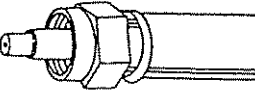



Biconic	
D4-PC	
DIAMOND-2.5	
DIAMOND-3.5	
DIN-PC, DIN-APC/HRL-10	
E2000-PC, E2000-APC	
FC-PC, FC-APC	
SC-PC, SC-APC	
SMA 905	 
SMA-2.5	
ST-PC	

Figure 1.1 Connector Identification Chart

Section 2 Basic Operation

2.1 Introduction

This section describes how to use the Tektronix TOP series optical power meters and sources. We suggest that you take the time to read this material carefully, so that you can take full advantage of the wide variety of applications for these instruments. If you are required to service and maintain these instruments, then please contact your Tektronix representative for technical assistance.

2.2 Battery Installation or Replacement

These instruments are designed to operate on two common 1.5V AA alkaline batteries. The units come with two batteries for installation by the customer. With long life alkaline batteries, your instrument will typically operate for more than 100 hours for the TOP200 optical power meter and more than 80 hours for the TOP140/150 optical laser sources. The typical operating life for carbon zinc batteries would be reduced by 30-40%.

For the optical power meters, LOW BATTERY status is indicated by a "B" annunciator appearing in the upper left-hand region of the LCD. When the "B" first appears, the operator has at least five hours before the batteries must be replaced.

For the sources, LOW BATTERY status is indicated when the front panel LED indicator is blinking. You may continue to operate the source until the front panel LED shuts off. However the optical output may not be stable while the battery discharges past this LOW BATTERY point.

To replace the battery, follow these steps:

Step 1

To replace the battery, remove the protective rubber jacket.

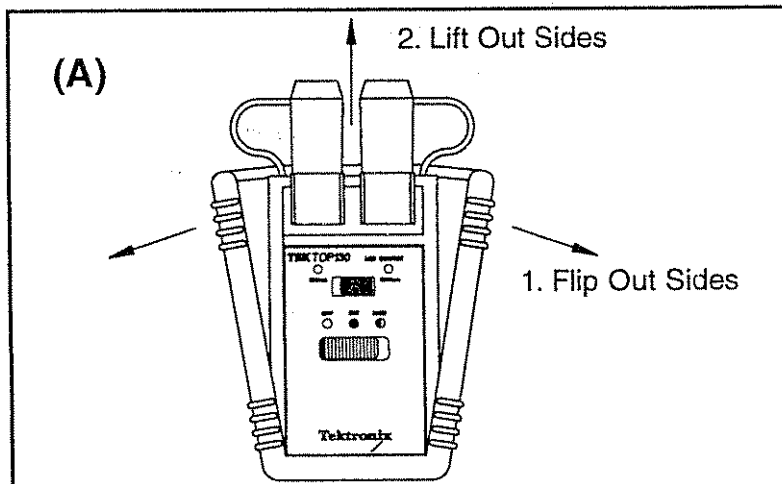


Fig 2.1 Removing the Protective Cover

Step 2

Turn the instrument on its front face and remove the battery cover by pressing on the center of the cover while pulling on its sides

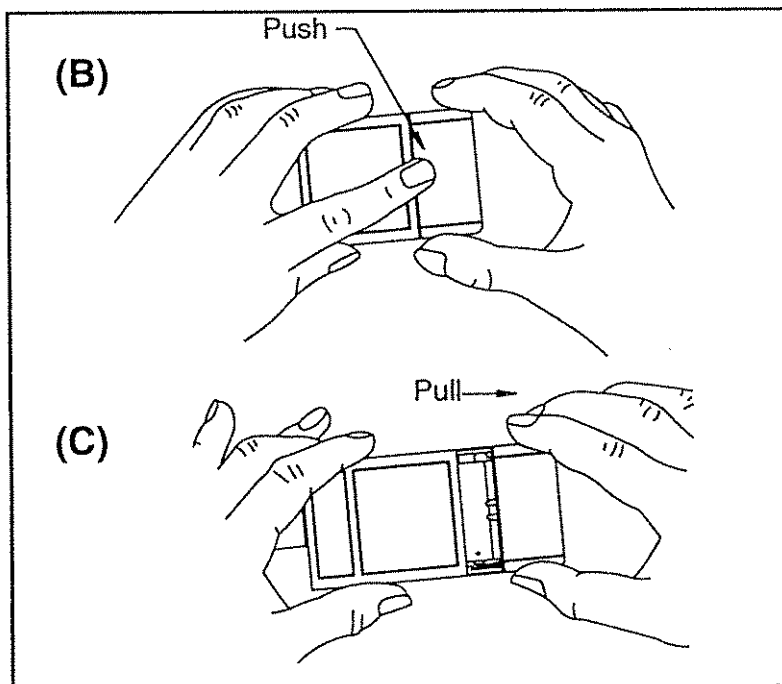


Fig 2.2 Opening the Battery Compartment

Step 3

Remove the used batteries and replace them with fresh new batteries. Observe the correct polarization as indicated in the bottom of the battery compartment. Failure to properly install the batteries in the correct orientation may cause damage to the instrument.

2.3 Interchanging the Connector Adapter

Your Tektronix TOP series instruments are equipped with either a SOC or UCI universal interface which allow the user to quickly adapt to all popular industry standard fiber optic connectors. Select the appropriate adapter and attach it to the front end of the instrument as follows:

UCI Interface: TOP140/150/160/300 Sources

Instructions:

1. Firmly press the adapter over the interface ferrule until it reaches the stop.
2. Rotate the adapter body until the anti-rotation pin engages.
3. Firmly tighten the knurled adapter shell.
4. To remove, simply unscrew the adapter.

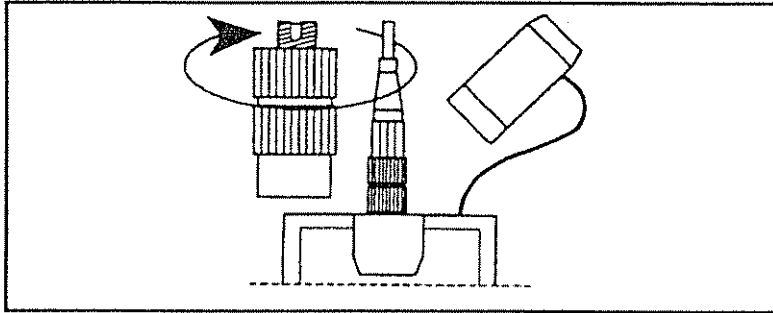


Fig 2.3 Interchanging the UCI Connector Adapter

SOC Interface: TOP130, TOP200

Instructions:

1. Locate the anti-rotation key on the instrument's connector.
2. With the keyway properly aligned, slip the adapter over the interface until fully locked into place indicated by a "snap."
3. To remove, simply pull adapter off the instrument.

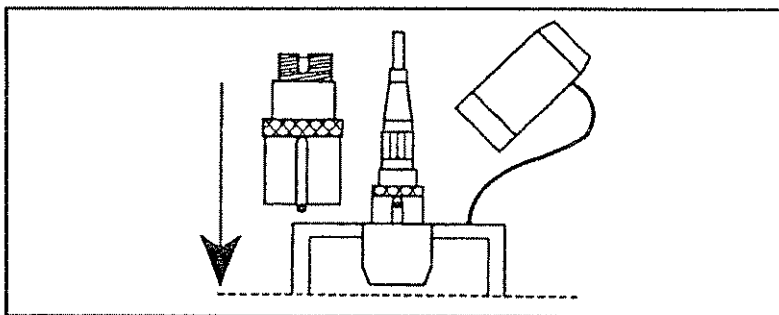


Fig 2.4 Interchanging the SOC Connector Adapter

Please refer to Section 1.4 for a list of available adapters. For additional information or other connector types contact Tektronix, Inc. or your local Tektronix representative.

2.4 Cleaning the Connector Interfaces

To ensure absolute measurement integrity, it is absolutely essential that the instrument interfaces be cleaned before each major use. **MOST IMPORTANTLY IT IS ABSOLUTELY CRITICAL THAT MATING CONNECTORS BE CLEANED EACH AND EVERY TIME BEFORE CONNECTING OR RECONNECTING TO ANYTHING - INSTRUMENT INPUTS/OUTPUTS, TRANSMISSION EQUIPMENT, PATCH PANELS, ETC.**

Without proper maintenance practices, fiber optic equipment and systems will fail to function properly. These performance degradations take many forms:

- Measurement errors
- Poor analog transmission quality, critical to CATV and microwave-on-fiber applications
- Digital bit error rates increase
- Coupled light power is reduced
- Receiver input power outside optimum operating range
- Dirty connectors may cause damage to their mated counterparts

Tektronix TOP series instruments are equipped with either a SOC or UCI universal interface which allow the user to quickly adapt to all popular industry standard fiber optic connectors.

TO CLEAN INTERFACE:

Remove the adapter as described in Section 2.3. Clean the exposed ferrule tip (UCI) or optical window (SOC) with a dry lintfree cloth (TEXWIPE TX404 or equivalent) per Figure 2.5. In severe cases you will need to use reagent-grade isopropyl alcohol (IPA). Finally, make sure that all residual alcohol is removed by wiping again with a fresh wipe.

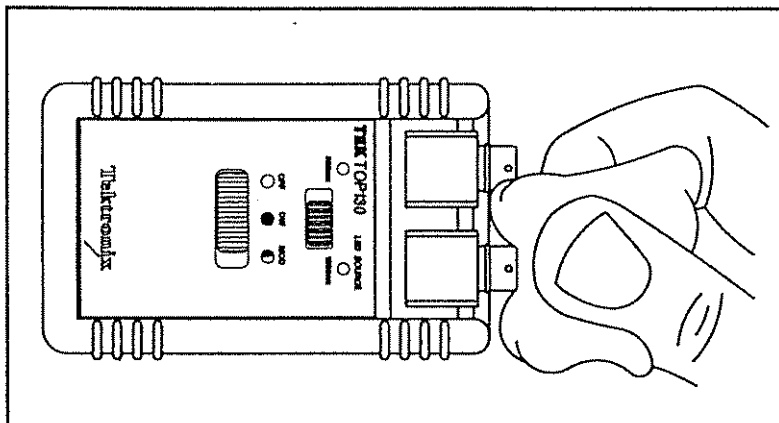


Fig 2.5 Cleaning the Connector Interface

2.5 Cleaning the Connector Adapters

Both the UCI and SOC adapters should be inspected and cleaned on a routine basis.

TO CLEAN ADAPTER:

Using a clean lintless swab (RIFOCS #946 or equivalent), insert a swab into the thru-hole of the adapter.

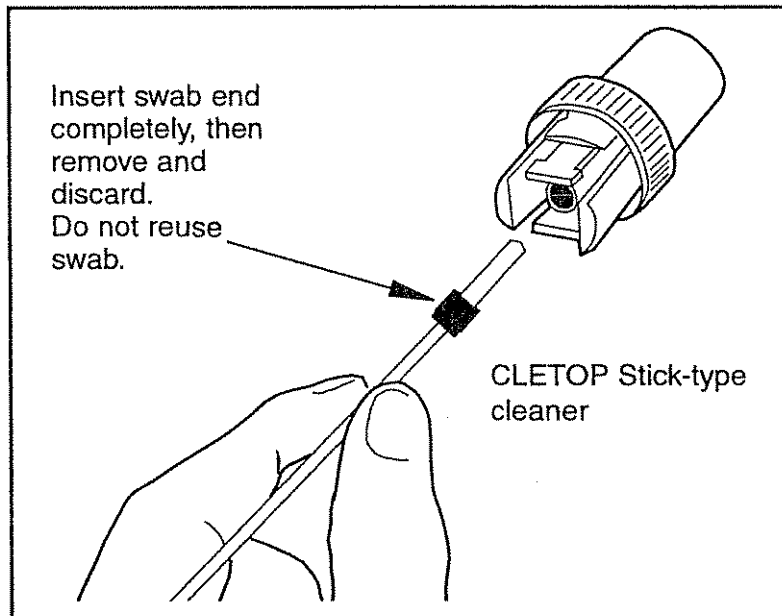


Fig 2.6 Cleaning of the Adapter

Clean exterior surfaces using a lintfree cloth (such as TEXWIPE wetted with reagent-grade isopropyl alcohol). Finally, make sure that all residual alcohol is removed by wiping again with a fresh wipe.

2.6 Cleaning Connectors

To achieve the desired performance from connectors, it is important that they be cleaned each and every time before connecting or reconnecting to anything—i.e. transmission equipment, test equipment, patch panels, other connectors, etc.

The conventional method of cleaning optical plug ferrule endfaces is worker-skill dependent, and generally requires use of expensive and difficult-to-transport consumables such as alcohol, solvents, wiping tissue and/or freon gas. However, the CLETOP All-In-One Connector Cleaner (RIFOCS 945 or equivalent, see Figure 2.7) replaces the conventional cleaning method and its easy-to-use operation produces consistent results in one self-contained unit. In addition, mating adapters (a.k.a. butt joint adapters or alignment sleeves) can be easily cleaned using the CLETOP stick-type cleaner previously described in Figure 2.6.

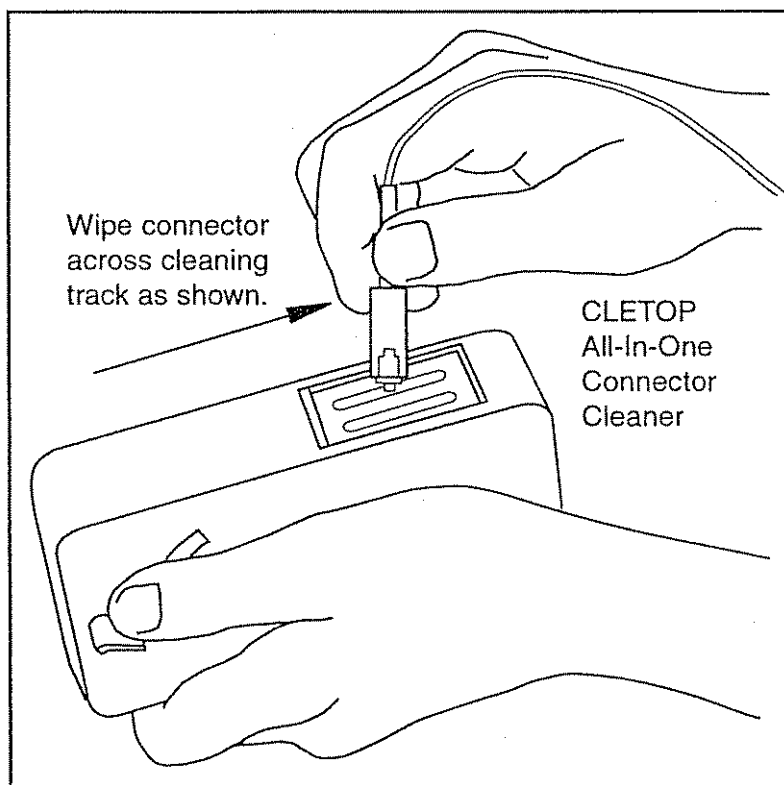


Fig 2.7 Cleaning a Connector

Section 3 Instrument Operation

3.1 TOP130 Optical Dual LED Source

WAVELENGTH SELECT	This switch determines which LED is active.
850nm INDICATOR	This indicator is on when the 850nm LED is on.
1300nm INDICATOR	This indicator is on when the 1300nm LED is on.
OFF/CW/MOD	This switch turns the unit off or selects continuous (CW) or modulated (MOD) "blink" (~1Hz) mode.
ON and LOW BATTERY INDICATOR	This LED indicator is on when the unit is turned on. It will blink to indicate a low battery condition.
FREQUENCY SELECT	This switch, located inside the battery compartment, sets the modulation frequency. (See Figure 3.2)
OUTPUT CONNECTOR	This is the optical output connector interface. The TOP130 is equipped with a snap-on connector (SOC) interface. See Table 1.1 for a list of available adapters.

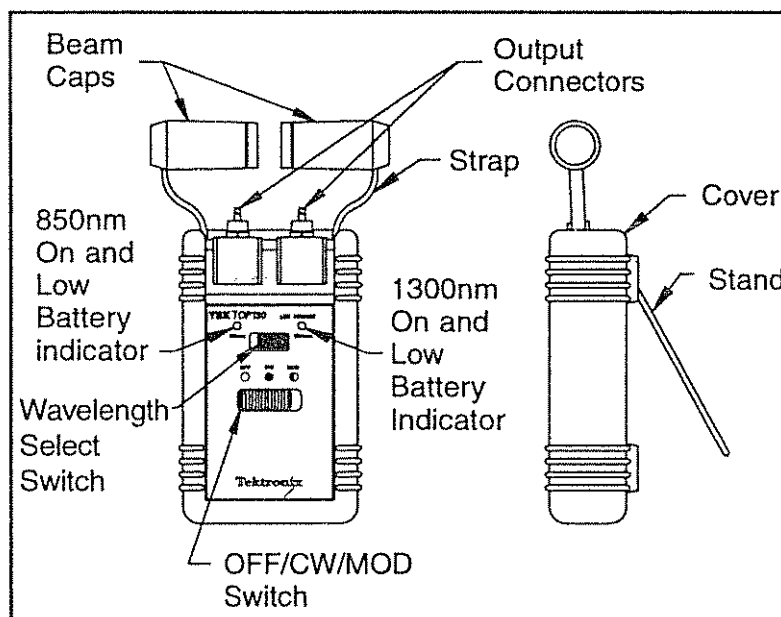


Fig 3.1 TOP130 Controls and Indicators

NOTE:

These Source instruments are shipped with the modulation frequency switch set to 1kHz. To change this setting simply remove the two AA batteries and set the switch to the desired position (see Figure 3.2). Replace the batteries, battery cover, and protective instrument cover. To operate the instrument in the modulated mode, simply slide the main switch to the MOD position and the light will be square wave modulated. Note: The average power output will be 3dB less than the average power in CW mode.

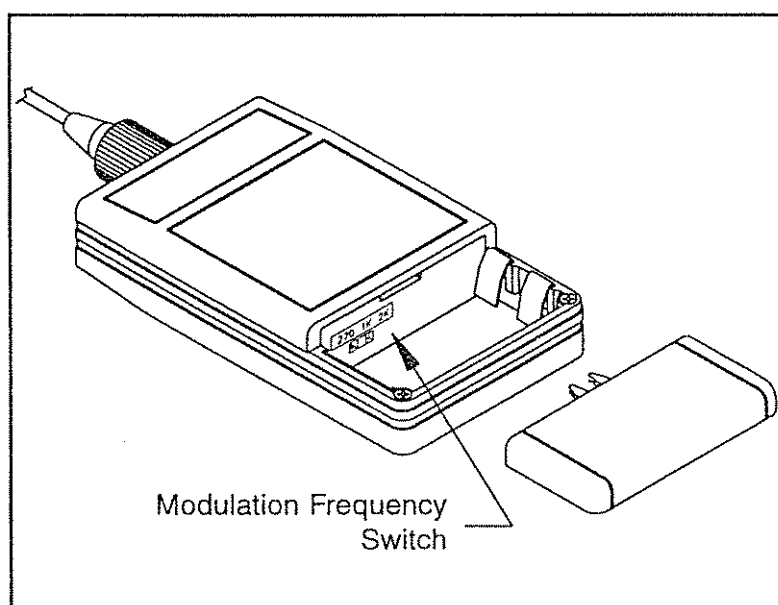


Fig. 3.2 Changing the Modulation Frequency of the TOP130/140/150/160 Sources

3.2 TOP140/150 Optical Laser Sources

- OFF/CW/MOD** This switch turns the unit off or selects continuous (CW) or modulated (MOD) "blink" (~1Hz) mode.
- ON and LOW BATTERY INDICATOR** This LED indicator is on when the unit is turned on. It will blink to indicate a low battery condition.
- FREQUENCY SELECT** This switch, located inside the battery compartment, sets the modulation frequency. (See Figure 3.2)
- OUTPUT CONNECTOR** This is the optical output connector interface. The TOP140/150/160 laser sources are equipped with the universal connector interface (UCI). See Table 1.1 for a list of available UCI adapters.

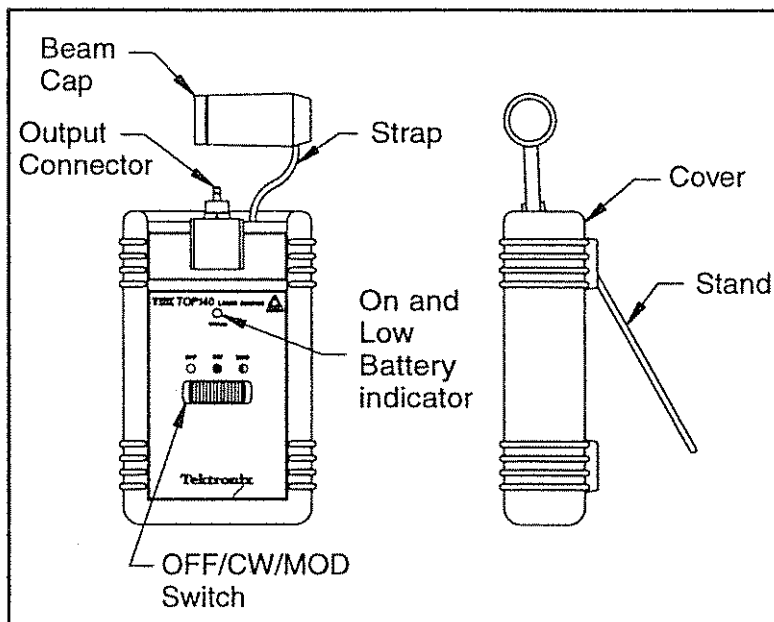


Fig 3.3 TOP140/150 Controls and Indicators

3.3 TOP160 Dual Optical Laser Source

- ON/OFF** This button turns the unit on or off. When the unit is first turned on, the 1310nm laser is automatically selected in CW mode.
- WAVELENGTH SELECT** This button allows the user to toggle between the 1310nm and 1550nm lasers. Only one source can be on at a time.
- MOD** This button toggles between CW (Continuous Wave or DC, MOD indicator is off) and MODulated modes (source output is modulated, MOD indicator is on). When the MODulation mode has been selected, the MODulation frequency is determined by the setting of the Modulation Frequency Switch (270/1000/2000Hz) accessible via the battery compartment. (See Figure 3.2)
- 1310/1550 INDICATOR** When lit, the corresponding LED indicates which laser is on. When either LED blinks continuously, this indicates a low battery condition. It is time to replace the internal batteries.

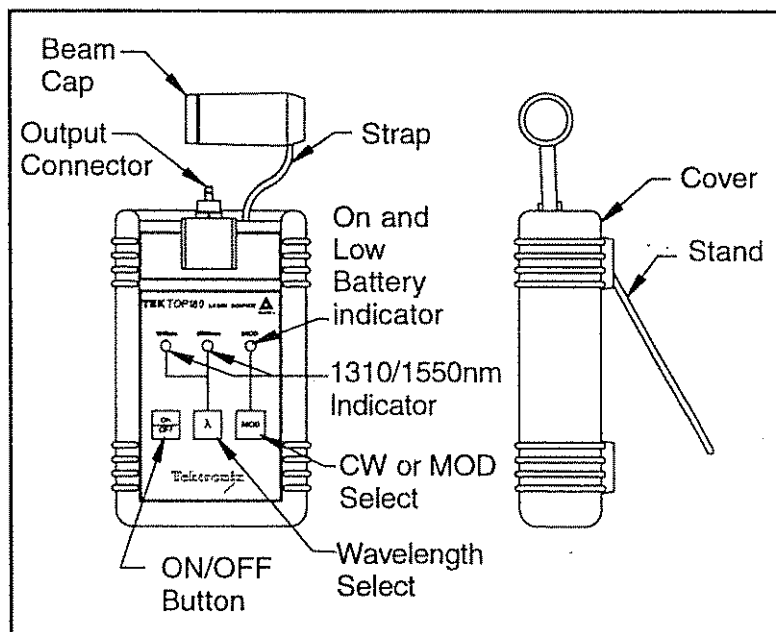


Fig 3.4 TOP160 Controls and Indicators

3.3 TOP200 Optical Power Meter

- ON/OFF** This switch turns the unit on or off.
- dBm/dB** This button controls these modes:
- Selects dBm units for absolute power measurements.
 - Toggles between absolute dBm and relative dB readouts (without changing internal reference level) when momentarily pressed
 - Selects new 0dB reference level when this button is held down for 2-3 seconds, and the little "r" annunciator appears in the lower righthand corner of the LCD display)

NOTE

The TOP200 features multiwavelength reference storage. This means that the 0dB reference settings for both TOP130 Dual 850/1300nm LED Source and TOP160 Dual 1310/1550nm Laser Source can be stored in non-volatile memory. See Section 4.3 for specific application information for using the TOP160 and TOP200 together as an efficient, dual wavelength singlemode test system. Powering on/off, changing wavelengths or toggling between dBm/dB modes does not alter these stored values **until** a new 0dB reference value for a selected wavelength is established by deliberately holding down the [dBm/dB] button as described above.

- WAVELENGTH SELECT** This button controls two modes:
- Selects proper wavelength (and internal calibration factor) corresponding to optical input 850, 1300 or 1550nm.
 - When held down at the desired wavelength, pushing the [dBm/dB] button sets the current wavelength as the new power-on default wavelength (stored in non-volatile memory).

NOTE

The TOP200 is shipped with the default/power-on wavelength set to 1300nm. This default/power-on wavelength can be changed to any other available wavelength as described above.

- CAL/OP** This switch (see Figure 3.5), located inside the battery compartment, is used when recalibrating the meter. In normal use, this should always be set to the OP position. Consult Service Manual for detailed information about calibrating the TOP200.
- INPUT CONNECTOR** This is the optical input connector. The TOP200 is equipped with the snap-on connector (SOC) interface. See Table 1.1 for a list of available SOC adapters.

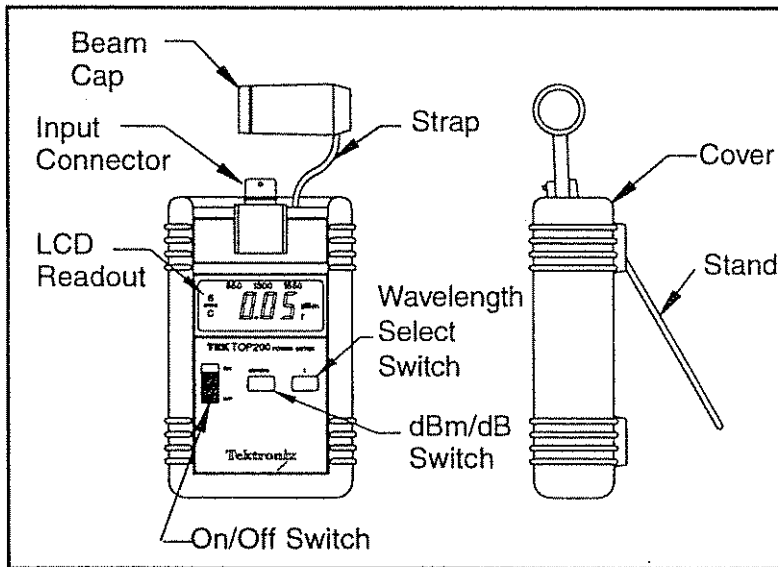


Fig 3.4 TOP200 Controls and Indicators

CAUTION

CONSULT SERVICE MANUAL BEFORE USING THIS FUNCTION. FOR NORMAL OPERATION, THIS SWITCH SHOULD ALWAYS BE SET TO THE OP POSITION.

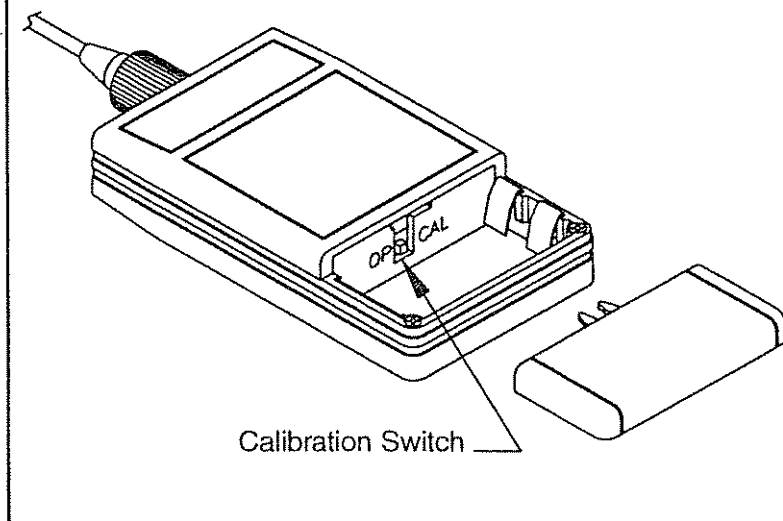


Fig 3.5 Location of the CAL/OP Switch of the TOP200 Power Meter. Switch is located behind tamper label.

3.5 TOP300 Visual Fault Finder

OFF/CW/MOD This switch turns the unit off or selects continuous (CW) or modulated (MOD) "blink" (~1Hz) mode.

ON and LOW BATTERY INDICATOR This LED indicator is on when the unit is turned on. It will blink to indicate a low battery condition.

OUTPUT CONNECTOR This is the optical output connector. The TOP300 is equipped with the universal connector interface (UCI). See Table 1.1 for list of available UCI adapters.

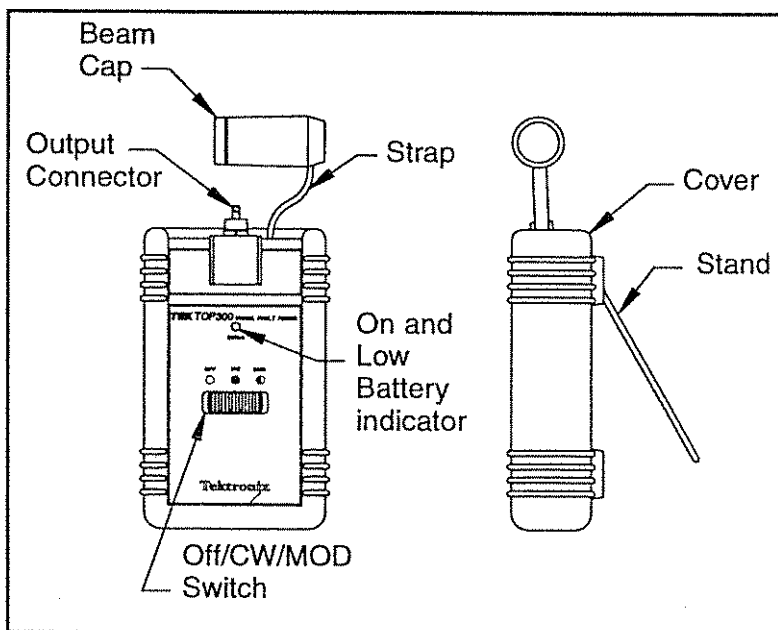


Fig 3.6 TOP300 Controls and Indicators

Section 4 Applications

Fiber optic insertion-loss tests require a stable source and an accurate power meter. The Telecommunications Industries Association (TIA, Washington, D.C.) has developed a comprehensive library of industry approved fiber optic test procedures (FOTPs) and system level optical fiber systems-test procedures (OFSTPs). For a detailed description of various loss measurement methods, consult:

- FOTP-34** INTERCONNECTION DEVICE INSERTION LOSS TEST
- FOTP-171** ATTENUATION BY SUBSTITUTION MEASUREMENT - FOR SHORT LENGTH MULTIMODE GRADED INDEX AND SINGLE-MODE OPTICAL FIBER ASSEMBLIES
- OFSTP-2** OPTICAL POWER LOSS MEASUREMENTS OF INSTALLED MULTIMODE FIBER CABLE PLANT
- OFSTP-7** OPTICAL POWER LOSS MEASUREMENTS OF INSTALLED SINGLE-MODE FIBER CABLE PLANT

These and other FOTPs/OFSTPs can be ordered through Global Engineering Documents (Englewood, CO, USA, Tel: 303/792-2181, Fax: 303/397-7935, credit card orders accepted).

The Tektronix TOP series fiber optic sources serve as precision light sources to provide accurate loss measurements for any fiber optic installation. Except for very special applications, it is recommended the proper source be selected as follows:

Table 4.1 Source Selection Guide

Wavelength	Fiber Type/Size	Use this TEKTRONIX Source Model
635nm (Red Laser)	SM or MM (Visual Troubleshooting)	TOP300
850nm	Multimode 62.5/125	TOP130
1300nm	Multimode 62.5/125	TOP130
1310nm	Singlemode	TOP140
1310/1550	Singlemode	TOP160
1550nm	Singlemode or Dispersion Shifted	TOP150

4.1 Connector Insertion Loss

To measure the insertion loss of a connector (re: FOTP 34, Method A), follow the procedure described below:

- A) Connect the TOP source to the TOP power meter using a suitable reference cable, with a length of about 6-10 feet (2-3 meters) per Figure 4.1

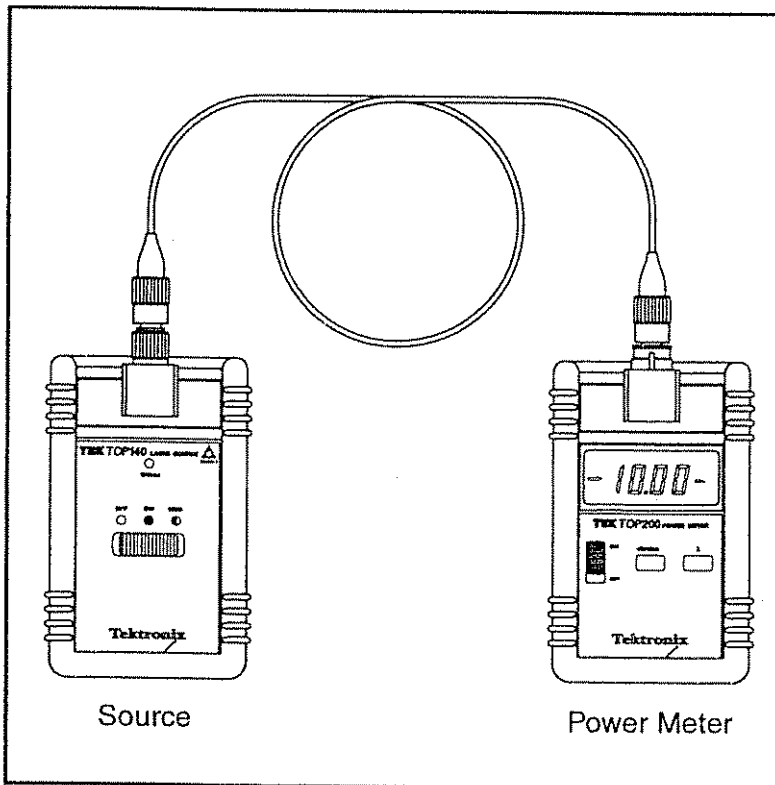


Fig 4.1 Initial Setup

- B) Switch the source to continuous (CW) light output and the power meter to the appropriate wavelength (using button) and dBm units. Note the dBm output of the reference cable should be within acceptable limits.

- C) To store this reference level, press the [dBm/dB] button (for about 2-3 seconds until the little "r" annunciator appears on the LCD display) and the display reads 0.00dB. See Figure 4.2

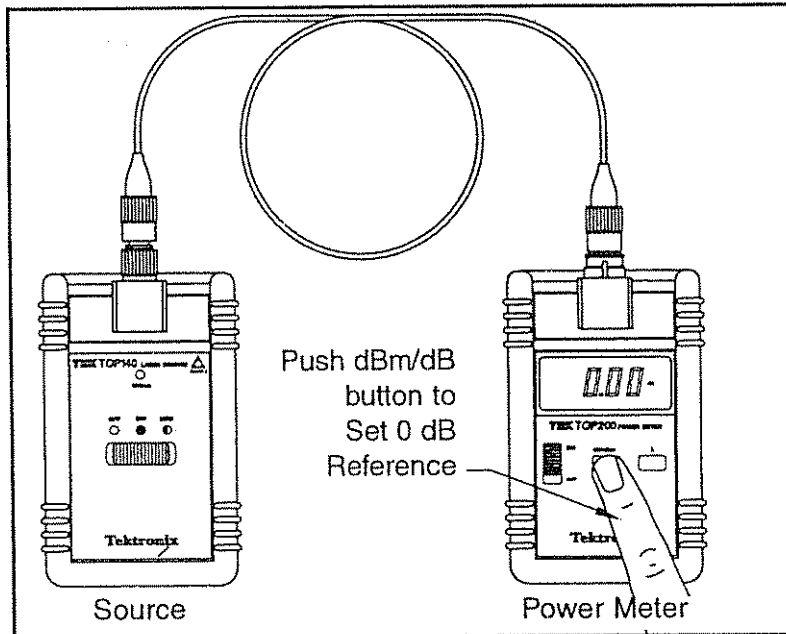


Fig 4.2 Establishing a Reference Measurement

- D) Disconnect the cable end from the power meter and insert the cable to be tested using a mating adapter. The power meter now reads the connector/cable loss in dB. The example of Figure 4.3 displays a connector loss of 0.15dB.

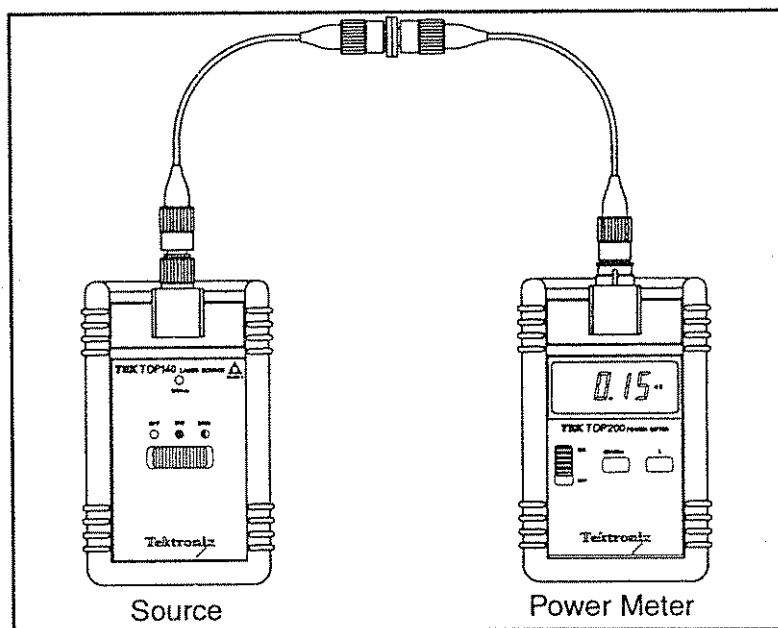


Fig 4.3 Measuring the Insertion Loss of a Connector/Cable

4.2 Link Loss Testing

Now assume that we want to measure the attenuation of a SM or MM link which is so long that we cannot access both ends from a single location. To measure the loss of a fiber optic link (re:OFSTP-2 or OFSTP-7, Method A), follow the procedure described below:

- A) If a complete test set (source and power meter) is available at each end, it is advisable to test the output power of the TOP series sources and the condition of the test jumpers. Connect the local source and power meter together with a test jumper per Figure 4.4. The source should be set to continuous (CW) output mode and the power meter set to the correct wavelength and dBm display units. Note the P_1 and P_2 dBm readings. For example, a TOP140 laser source should read between -9.5 and -10.5dBm on the power meter.

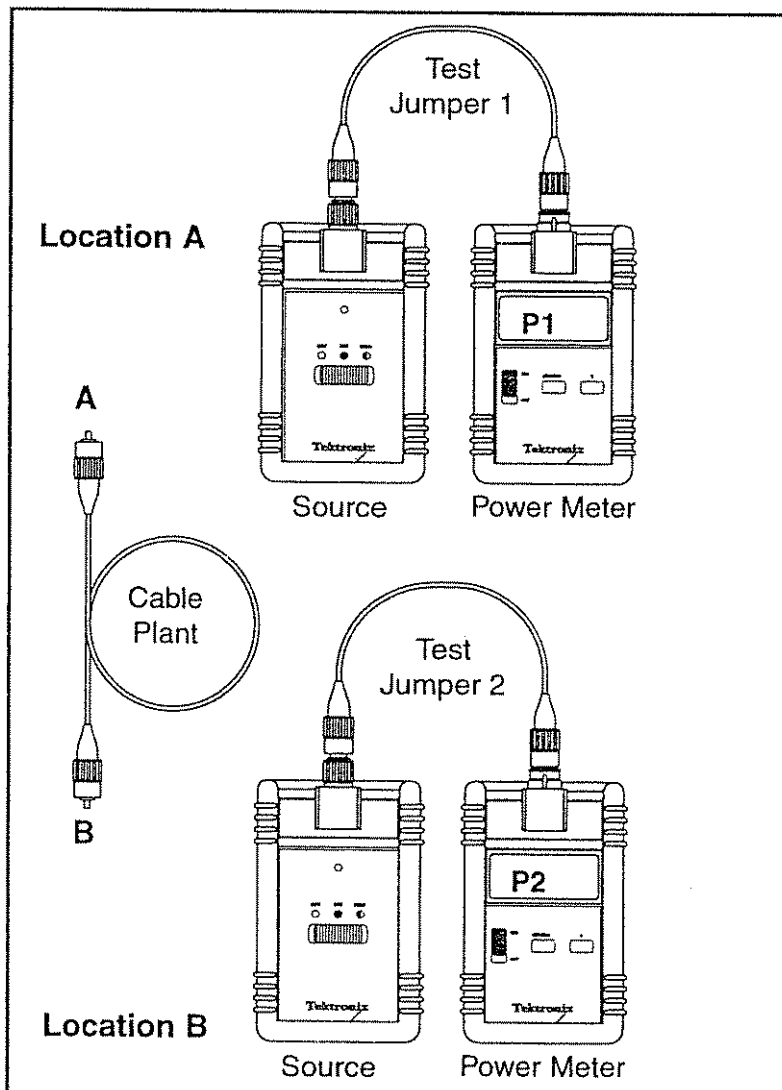


Fig 4.4 Checking the Local Test Set(s)

B) Connect the TOP laser source and power meter to their respective patch panel ports using the test jumpers per Figure 4.5.

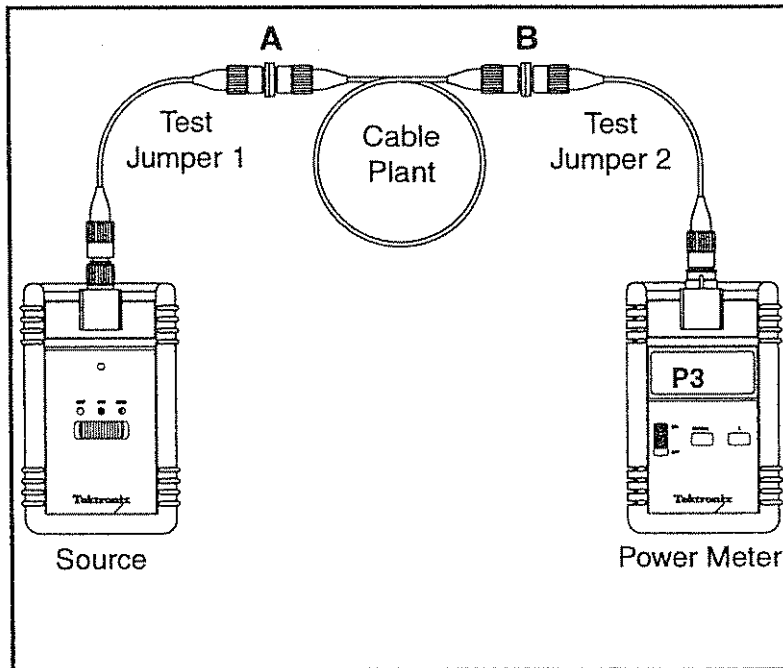


Fig 4.5 Forward Link Connection

C) Using the formula below, take the dBm power reading of the power meter (P3) and the nominal source output value shown in Table 4.2 corresponding to the TOP source model. For example, if the power meter reads -18dBm then (for a TOP140 or TOP150 laser source) the FORWARD link loss [-10 - (-18)] is calculated to be 8dB.

$$\text{FORWARD LOSS (dB)} = P_1 - P_3$$

TEKTRONIX Source Model	Wavelength Fiber Type/Size	Calibrated Output Source Value (dBm)
TOP130	850nm MM 62.5/125	-13dBm +1dB
TOP130	1300nm MM 62.5/125	-20dBm +1dB
TOP140	1310nm Singlemode	-10dBm +0.5dB
TOP150	1550nm Singlemode	-10dBm +0.5dB
TOP160	1310/1550nm Singlemode	-7dBm +0.5dB

Table 4.2 Source Output Guide

D) It is advisable to measure losses in both directions.
Reverse the source and power meter connections
(see Figure 4.6). Calculate the reverse loss using the
formula below:

$$\text{REVERSE LOSS (dB)} = P_2 - P_4$$

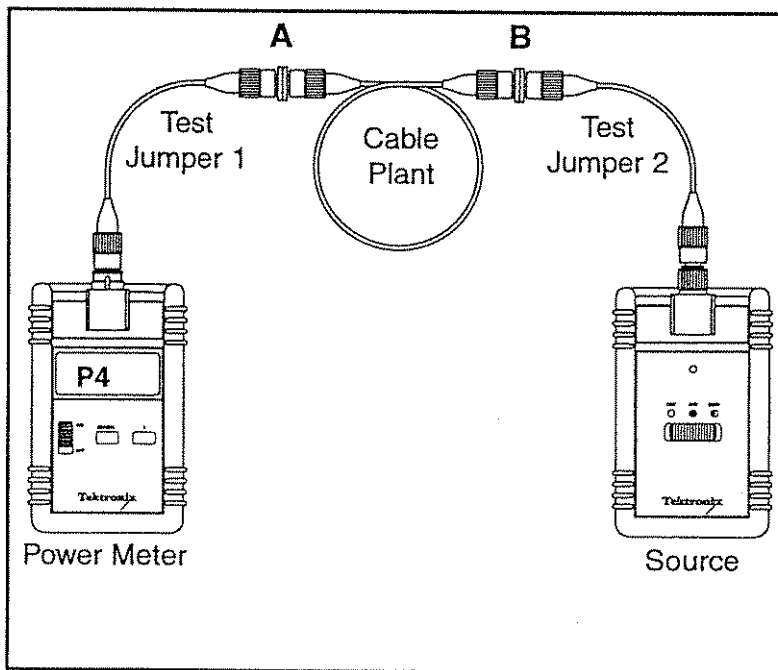


Fig 4.6 Reverse Link Connection

E) Report both forward and reverse loss values.

4.3 Visually Locating a Break Within a Fiber

The TOP300 injects visible light into a fiber. The visible light escapes the fiber wherever the continuity is interrupted. A break will always generate a highly visible output. If the fiber is only under stress a smaller effect may be produced. In general however, if you see any light escaping the fiber you can be sure that there is a problem which must be repaired.

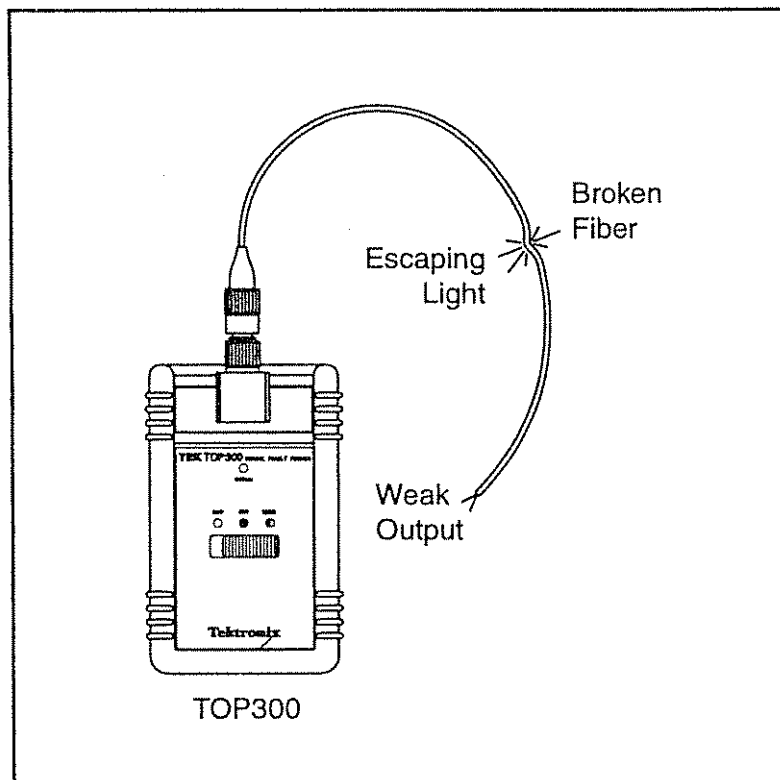


Fig 4.7 Locating a Fiber Break

The light in jacketed fiber is heavily attenuated; sometimes it is necessary to darken the room to see better where the light is escaping the fiber.

CAUTION

TO AVOID ANY POTENTIAL INJURY TO THE EYE
DO NOT LOOK CLOSER THAN 30CM
FROM THE OUTPUT PORT

4.4 Visually Locating a Defective Connector

Fiber breakage often occurs close to a connector or within a connector. Verifying such a fault with confidence is not always easy. Here are some helpful hints on how such problems can be pinpointed exactly. If you inject light into a fiber but can see neither the light coming out at the far end nor is there any visible light loss along the fiber, then a break at exactly the launch end is the likely cause. To verify this do the following:

Reverse the setup and launch from the far end. Most likely you will now see more light escaping at the broken end.

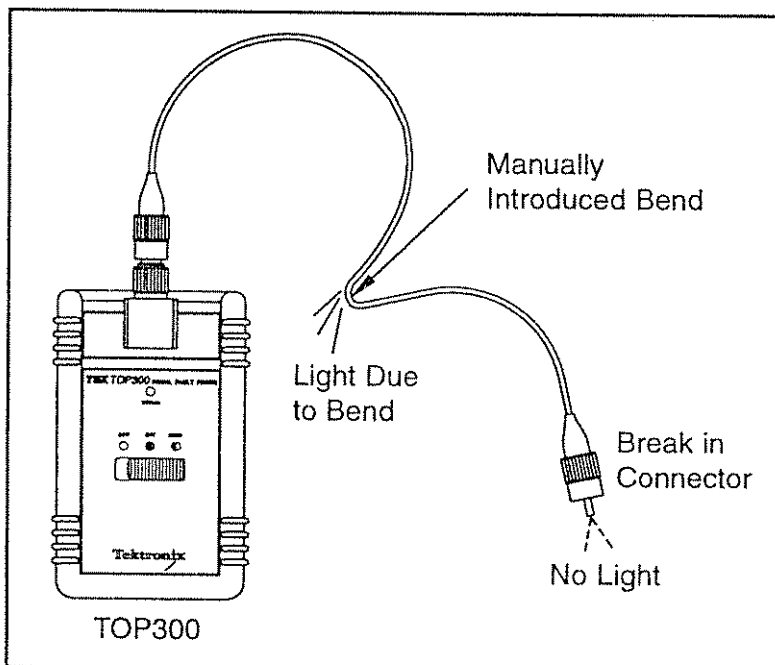


Fig 4.8 Locating a Defective Connector

If the connector does not show any anomaly then start introducing microbends with your finger until you can see the light escaping. Keep introducing microbends while moving to the far end of the fiber until you no longer can see light escaping. If the light is visible just before the connector then you can be sure that the far end connector is broken. Look at the near end of the connector, if excessive light is visible, this is a sure sign of a problem within the connector interface.

4.5 Visually Identifying Breaks within Ferrules and Polishing Problems

The TOP300 can also be used to pinpoint problems caused by bad connectors.

Ceramic ferrules are translucent and if there is a fiber break within the ferrule or right after the ferrule, then the ferrule itself will glow, indicating a broken or damaged fiber. If the connector "glows" then it is definitely a bad connector.

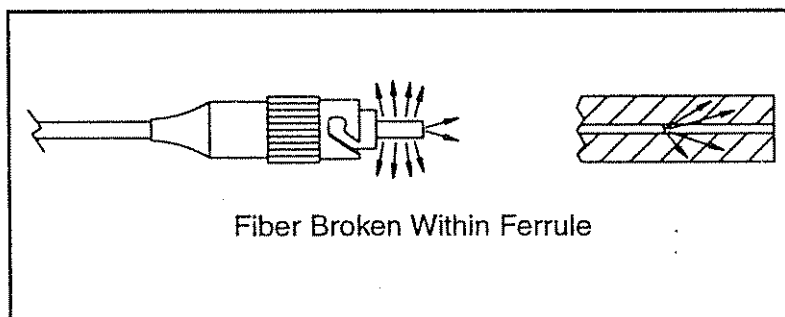


Fig 4.9 Locating Fiber Break in a Ferrule

Similarly, if the endface polish of the fiber is not good then light is being reflected and this light will be visible through the ceramic ferrule.

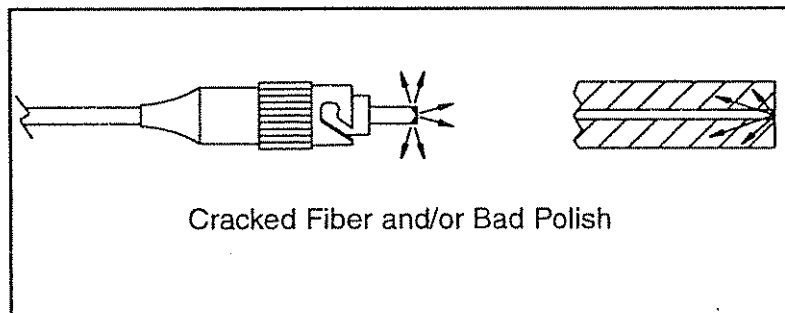


Fig 4.10 Identifying a Bad Polish

4.6 Dual Wavelength Singlemode Loss Measurements with the TOP160/TOP200

The TOP160 Dual Laser Source is used to measure the attenuation of a singlemode fiber link. Dual wavelength testing at both 1310nm and 1550nm may be required under the following conditions:

- 1) Telephony systems now operating in the 1310nm window are likely to be upgraded for operation at 1550nm in the future. Consequently, it is important to validate the newly installed link at both 1310nm and 1550nm now to be sure that all specifications are met and can be met in the future. Unless measured and verified at time of installation, unexpected fiber attenuation and excess bend losses might render the link useless for later commissioning at 1550nm. While fiber attenuation decreases at longer wavelengths, microbend and macrobend losses increase at higher wavelengths (1550nm vs 1310nm).
- 2) The telecommunication system is operating in both the 1310nm and 1550nm windows. Therefore, dual wavelength acceptance testing is required to be performed at this time.

The following test procedure complies with TIA/EIA-526-7 (OFSTP-7, Method A), Attenuation of Installed Singlemode Fiber Link.

- A) Connect the TOP160 Dual Source to the TOP200 Optical Power Meter via a suitable REFERENCE cable (minimum 3m long). Turn on both instruments and set wavelength to 1310nm, and 1300 respectively. Expected reading on TOP200 is -6.25dBm to -7.75dBm.

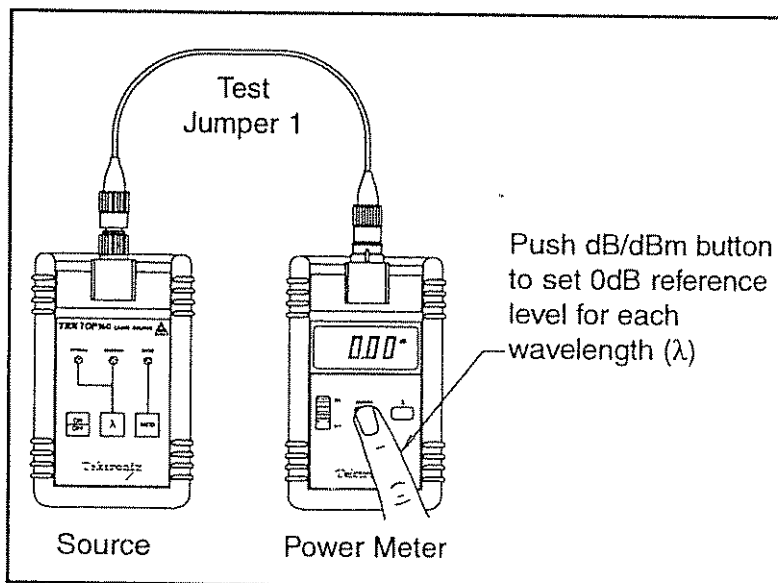


Fig 4.11 Dual Wavelength Initial Setup

- B) Press the [dBm/dB] button of the TOP200 until the small "r" annunciator appears and the display reads 0.00dB.
- C) Set both TOP160 and TOP200 to 1550nm. Expected reading on TOP160 is -6.25dBm to -7.75dBm.
- D) Press the [dBm/dB] button of the TOP200 until the small "r" annunciator appears and the display reads 0.00dB.
- E) Connect both TOP160 and TOP200 to opposite ends of the link under test. Use suitable REFERENCE cable for connecting either instrument to the patch panel.
- F) With the TOP160 set to 1310nm and the TOP200 set to 1300nm, record the dB reading from TOP200 OPM. This is the link loss at 1310nm.
- G) With both the TOP160 and TOP200 set to 1550nm, record the dB reading from the TOP200 OPM. This is the link loss at 1550nm. Go to the next fiber and repeat from Step A.

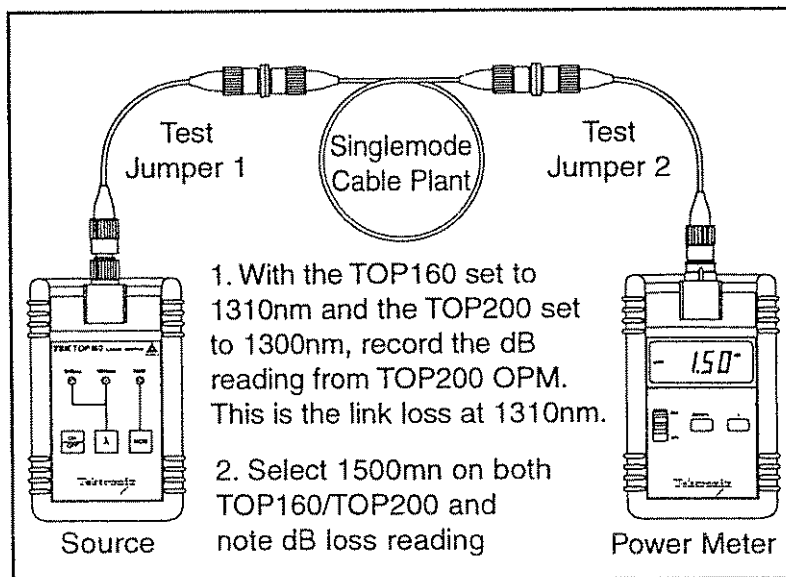


Fig 4.12 Measuring the Insertion Loss of a Connector/Cable

Section 5

Factory Service and Calibration

5.1 Introduction

This section contains information regarding obtaining factory service and calibration for the TOP series of handheld optical products. The user should not attempt any maintenance or service of these instruments and/or accessories beyond the procedures given in this instruction manual. Any problems which cannot be resolved using the guidelines listed there should be referred to Tektronix factory service personnel. Contact Tektronix, Inc. or your Tektronix representative for assistance.

The Tektronix TOP series optical instruments contain no user-serviceable parts. They are delivered in a permanently sealed condition.

5.2 Obtaining Service

To obtain information concerning factory service, contact Tektronix, Inc., or your Tektronix representative. Please have the following information available:

1. Instrument model number
2. Instrument serial number
3. Description of the problem

5.3 Recommended Calibration Interval

It is recommended that the TOP series instruments be recertified/recalibrated every 12 months. This provides the basis for an effective quality assurance/standards program. This service is available for Tektronix products at a nominal charge.

NOTES