TFS-FS1™
Optical Leakage Detector

Operation Manual

think ahead.

TRILITHIC

Trilithic Company Profile

Trilithic is a privately held manufacturer founded in 1986 as an engineering and assembly company that built and designed customer-directed products for telecommunications, military, and industrial customers. From its modest beginnings as a two-man engineering team, Trilithic grew over the years and broadened its offerings of RF and microwave components by adding broadband solutions to its product line. This was accomplished with the acquisition of components manufacturer Cir-Q-Tel and instruments manufacturer Texscan.

Today, Trilithic is an industry leader providing telecommunications solutions for major broadband, RF, and microwave markets around the world. As an ISO 9000:2001 certified company with over 40 years of collective expertise in engineering and custom assembly, Trilithic is dedicated to providing quality products, services, and communications solutions that exceed customer expectations.

Trilithic is comprised of five major divisions:

- **Broadband Instruments and Systems**
  Offers test, analysis, and quality management solutions for the major cable television systems worldwide.
- **Telecom Solutions**
  Offers affordable, easy-to-use instruments for testing and measurement of Telecom networks.
- **RF Microwave Components**
  Provides components and custom subsystems for companies specializing in cellular, military, and other wireless applications.
- **Emergency Alert Systems**
  Leading supplier of government-mandated emergency alert systems used by broadcast TV, cable TV, IPTV, DBS, and radio stations.
- **XFTP**
  Offers a specialty line of field technical products for cable operators and technicians, as well as a line of products for installing electronics in the home of the future.

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Chapter 1

General Information

Helpful Website

The following website contains general information which may be of interest to you:

http://www.trilithic.com

Trilithic's website contains product specifications and information, tips, release information, marketing information, Frequently Asked Questions (FAQs), bulletins and other technical information. You can also check this website for product updates.

Where to Get Technical Support

Trilithic technical support is available Monday through Friday from 8:00 AM to 5:00 PM EST. Callers in North America can dial 317-895-3600 or 800-344-2412 (toll free). International callers should dial 317-895-3600 or fax questions to 317-895-3613. You can also e-mail technical support at *techsupport@trilithic.com*.

For quicker support response when calling or sending e-mail, please provide the following information:

- Your name and your company name.
- The technical point of contact (name, phone number, e-mail).
- Product name, model number, and serial number.
- A detailed description of the problem you are having, including any error or information messages.

How this Manual is Organized

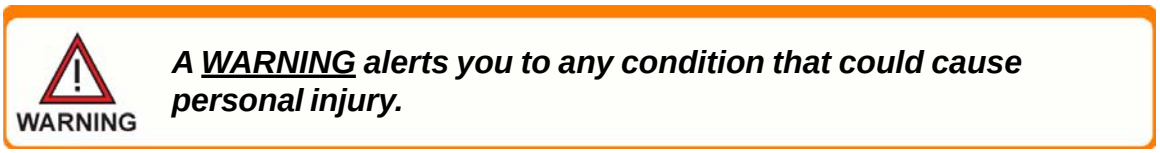
This manual is divided into the following chapters:

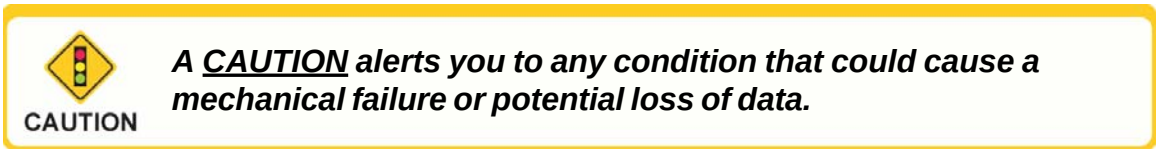
- Chapter 1, “General Information” provides Trilithic contact information and describes how this operation manual is structured.
- Chapter 2, “Introduction” describes the purpose and list the features of the TFS-FS1™ Optical Leakage Detector.
- Chapter 3, “Operation” describes how to setup, test, and operate the TFS-FS1™ Optical Leakage Detector.
- Chapter 4, “Appendix” describes the troubleshooting procedures and lists the technical specifications of the TFS-FS1™ Optical Leakage Detector.

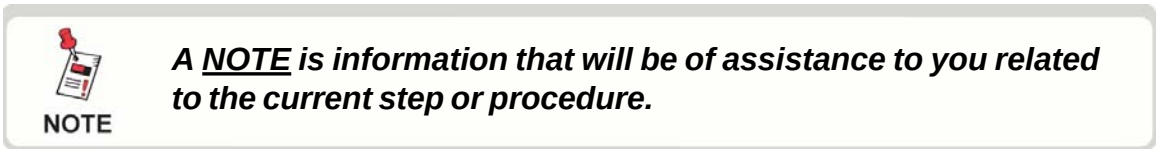
Conventions Used in this Manual

This manual has several standard conventions for presenting information.

- Connections, menus, menu options, and user-entered text and commands appear in **bold**.
- Section names, web and e-mail addresses appear in *italics*.







Precautions

Do not look into the output ports when the source is turned on. Although the unit is designed to emit only eye safe infrared radiation, Trilithic recommends a safety first approach when working with fiber optics. Keep in mind that infrared light is invisible to the naked eye.

When working with any fiber optic test equipment or in an area with active fiber optic links, be aware there can be infrared optic energy present.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Cover all the unused ports when not in use. This is not only to protect the eyes but to protect the optical outputs from damage or contamination.

The TFS-FS1™ Optical Leakage Detector is a precision instrument. Clean all connectors before engagement to the source. Any contamination on the fiber endface will degrade or damage the output port optics. Use alcohol preps or swabs which are dust and lint free to clean the optics.

When cleaning the output ports or using the bare fiber adapters, be careful not to scratch or otherwise contaminate the port optics. They are highly polished glass and can be damaged.

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Chapter 2
Introduction

This chapter:

- Describes the TFS-FS1™ Optical Leakage Detector's purpose
- Lists the TFS-FS1™ Optical Leakage Detector's features

Purpose

When troubleshooting fiber optic systems, it is often necessary to identify fibers or places where light is being lost from a fiber. Optical test sets and OTDRs are useful in finding the amount of loss or general loss locations, but to actually pinpoint a fault, a visible laser source has traditionally been the instrument of choice.

Visible laser sources inject red light into a fiber. Any red light that is visible indicates the fiber being tested has loss points or breaks. The problems with visible lasers however are that they have a range of only a few miles, do not work with more opaque buffer colors (black, blue, green, etc.), and are not visible in well lit areas.

The TFS-FS1™ Optical Leakage Detector probe solves these problems. This pistol type device looks for an infrared tracer signal which can travel up to 300 km, penetrate most 250 and 900 µm buffers regardless of the color, and is detectable in bright light conditions.

Features

- Identify Fibers up to 300 Kilometers with Proper Light Source
- Long Distance and Local Applications
- Optimize Mechanical Splices and Connectors
- Find Breaks in Dark Buffered Fiber
- Locate Signals through Bulkheads / Dust Caps
- Audio / Visual Leak Indication
- Pinpoint faults to Within Inches

Supplied Equipment

The TFS-FS1™ Optical Leakage Detector includes the following components:

- **TFS-FS1™ Optical Leakage Detector** - The core of the TFS-FS1™ unit, containing optical detection, laser, and power circuitry.
- **Wide Bandwidth IR Filter** - Detect wavelengths from 1280 to 1620 nm. Designed to locate energy leaks in fiber optic systems due to splice loss, connector loss, breakage, or bending and to identify fibers over long distances.
- **Alkaline Battery** - One (1) 9 VDC Alkaline Battery.
- **Operation Manual** - Full Operation Manual on CD.

Optional Configurations

TFS-TSA Aerial Lens and Scope

The TFS-TSA™ Aerial Lens and Scope Kit is designed to work with the TFS-FS1™ Optical Leakage Detector to identify aerial fiber breaks from the ground. The complete kit includes the aerial lens with built-in narrow band IR filter (1550 nm) and red-dot scope.

Narrow Band IR Filters

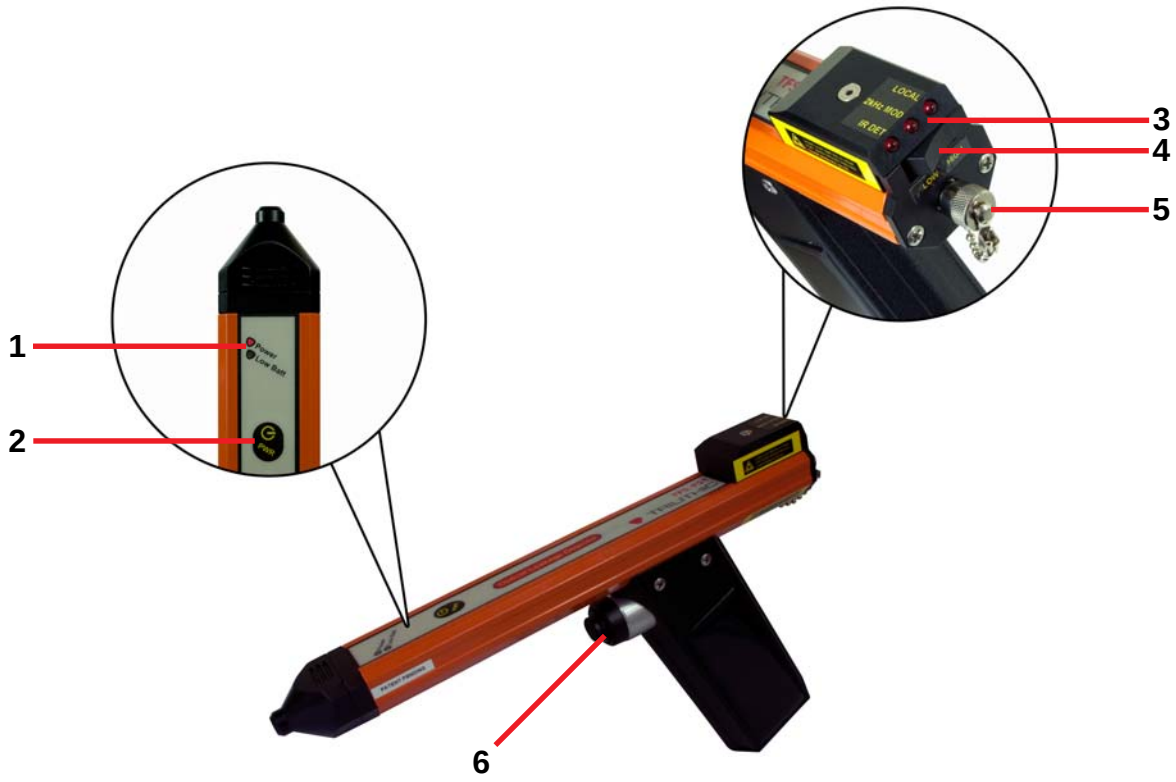
These optional IR filters are designed to work with the TFS-FS1™ Optical Leakage Detector to locate energy leaks in fiberoptic systems due to splice loss, connector loss, breakage, or bending and to identify fibers over long distances.

- **TFS-F1310™ Filter Kit** - Narrow Band IR Filter (1310 nm)
- **TFS-F1490™ Filter Kit** - Narrow Band IR Filter (1490 nm)
- **TFS-F1550™ Filter Kit** - Narrow Band IR Filter (1550 nm)

Controls

The TFS-FS1™ Optical Leakage Detector includes the following controls:

1. **Status Indicators** - Indicates the power and battery status.
2. **PWR (Power Button)** - Turns the unit on and off. The local emitter and detection circuit are off until the trigger is pressed.
3. **Modulation Detect Indicators** - These indicators illuminate when the trigger is pressed and the local or remote light sources are being detected.
4. **Power Level Switch** - This switch controls the power of the local optical tracer source output.
5. **Internal Laser Source** - This is a local optical tracer source output.
6. **Trigger** - The TFS-FS1™ Optical Leakage Detector begins sensing light when the trigger is pressed. The trigger also activates the internal laser source.



Battery Replacement

The TFS-FS1™ Optical Leakage Detectors use a standard 9 V alkaline battery. The battery will need to be installed before first use.

Bottom View

9 VDC Battery Compartment

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Chapter 3
Operation

This chapter:

- Provides information on the TFS-FS1™ Optical Leakage Detector's general use, testing, and operation.

Overview

The TFS-FS1™ Optical Leakage Detector probes are designed to sense in three ways.

- **Raw IR Light Detection** - The front **IR DET** indicator illuminates when any IR light hits the sensor at the tip of the probe. This includes communications traffic, strong room light, or sun light.
- **2 kHz Remote Tracer Source Light Detection** - The **2 kHz MOD** indicator illuminates only when the probe is sensing a 2 kHz modulated signal from the Trilithic TFS-290 Series Optical Tracer Source. Light can also be detected from any 2 kHz light source operating between the wavelengths of approximately 1000-1700 nm. 1550 nm is recommended.
- **LOCAL Tracer Source Light Detection** - The **LOCAL** indicator illuminates only when the probe is sensing light from its own internal laser source at the rear of the unit. This is the most sensitive mode of operation.

Raw IR Light Detection

> ***When working with any fiber optic test equipment or in an area with active fiber optic links, be aware there can be infrared optic energy present.***
>
> WARNING

General Purpose

To detect IR light including traffic, tracer signals, or CW light. This allows identification of light at uncovered ports or to locate some severe bends or breaks in lightly colored fibers.

Probe Setup

1. Place a cap on the internal laser source port.
2. Depress the **PWR** button.
3. Squeeze the trigger to test.
4. Slowly (approximately 4-6 inches per second) scan the probe tip over the areas of interest.

What to Expect

When IR light is encountered, the **IR DET** indicator at the top-front portion of the probe will illuminate. Be aware that this indicator will see bright room and sun light as well.

2 kHz Remote Tracer Source Light Detection

> **WARNING** ***When working with any fiber optic test equipment or in an area with active fiber optic links, be aware there can be infrared optic energy present.***

General purpose

To examine ports, fibers, splices or connectors for the presence of a 2 kHz IR tracer light. This allows identification of light at uncovered ports up to 300 km away or to locate severe bends and breaks in most 250 or 900 µm buffered fibers.

Probe Setup

1. Remotely connect a 2 kHz modulated, 1550 nm source to the fiber under test.
2. Place a cap on the internal laser source port.
3. Depress the **PWR** button.
4. Squeeze the trigger to test.
5. Slowly (approximately 4-6 inches per second) scan the probe tip over ports or areas of interest.

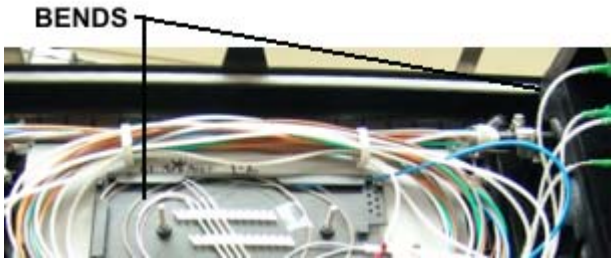
What to expect

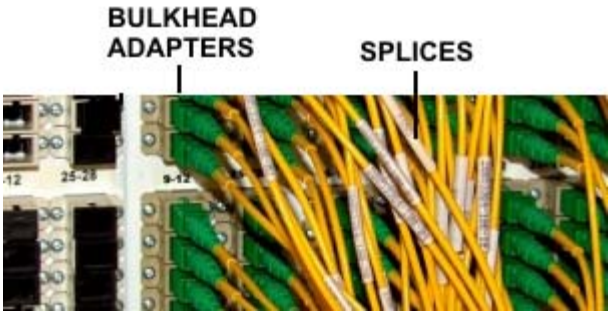
When 2 kHz light is encountered, the **2 kHz MOD** indicator at the rear of the probe will illuminate and a tone will be heard. This indicator will not detect most room light or traffic.

Where to Look for 2 kHz Tracer Tones

When using a 2 kHz tracer tone to locate a strand of fiber, it is generally preferable to have a high power light source operating at 1550 nm. As opposed to 1310 nm sources, 1550 nm light will not only travel a greater distance in good fiber but will be more easily detectable at discontinuity points such as bends, connections, and splices.

Tracer tones may be detected at the downstream side of any discontinuity or at the end of a strand. Depending upon the source used and characteristics of the fiber, it is possible to find light leaking from bends, fusion splices, through connector bulkhead adapters, and through plastic end caps.





LOCAL Tracer Source Light Detection

> **WARNING** ***When working with any fiber optic test equipment or in an area with active fiber optic links, be aware there can be infrared optic energy present.***

General purpose

To examine ports, fibers, splices or connectors for the presence of locally generated tracer light (from laser at rear of probe). This allows detection of light leaks at the ends of a fiber cable.

Probe Setup

1. Connect a patch cord between the leakage detector's internal laser source and the fiber to be tested.
2. Depress the **PWR** button.
3. Squeeze the trigger to test.
4. Slowly (approximately 4-6 inches per second) scan the probe tip over ports or areas of interest.

What to Expect

When local tracer IR light is encountered, the **LOCAL** indicator at the rear of the probe will illuminate and a variable tone will be heard. The pitch of this tone will be higher in frequency as more leakage is encountered. This mode is up to 10x more sensitive than 2 kHz remote source mode. Breaks in nearly all 250 µm and 900 µm fibers can be detected.

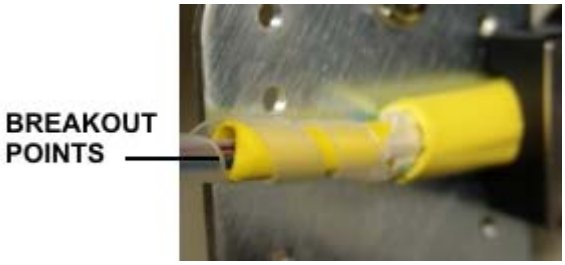
Where to Look for Light Leakage

Fiber Bends

Scan the routing areas where the fiber is bent tightly or where the fiber rests against another object. Scan over any visible kink or aberration.

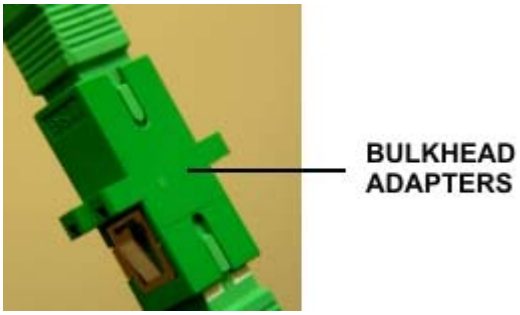
Breakout Points

A common problem area is the breakout points. Scan regions where the fiber exits in the cable sheath. Fibers may be broken or cut here. The damage may be retracted into the sheath.



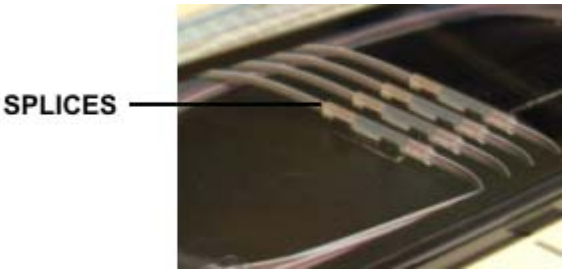
Bulkhead Adapters

Poorly mated connectors, dirty or cracked end faces, and side stresses can cause light loss at bulkhead adapters. Scan near the connector boots or directly at the bulkhead.



Splices

Scan over mechanical or fusion splices to detect leakage light. All splices will leak some light but a failure can be detected from 6-36 inches away from the splice.



Chapter 4
Appendix

Troubleshooting

Leakage Detector Does Not Operate

- Battery is installed incorrectly. Check the battery orientation and make sure it is properly seated.
- Battery is drained. Replace the battery and try again.
- Power control on the top of the unit is not depressed (the trigger does not turn the unit on).

Leakage Detector Not Indicating Raw Infrared Light (Traffic/IR Det) Properly

- Average signal strength is not greater than -40 dBm.
- Trigger is not being pressed while testing.
- Wavelength is not between 1280 and 1620 nm for wideband head.
- Wavelength is not within 20 nm of narrow band head wavelength.
- Too much ambient IR light (always on).

Leakage Detector Not Detecting 2 kHz Modulation

- Source is not modulating at 2 kHz +/-50 Hz @ 50% duty cycle.
- Average signal strength is not greater than -77 dBm.
- Trigger is not being pressed while testing.
- Wavelength is not between 1280 and 1620 nm for wideband head.
- Wavelength is not within 20 nm of narrow band head wavelength.

Leakage Detector Not Detecting Local Tracer Signal

- Bad launch cord connection (make sure FC connector tab is seated properly).
- Bad launch cord or connector.
- Average signal strength from fault is not greater than -87 dBm.
- Trigger is not being pressed while testing.
- Power Level Switch at rear of unit may need to be set to HIGH.
- Extreme ambient light interference may be present.

Leakage Detector Spuriously Detecting Local Tracer Signal

- Gain switch at rear of unit may need to be set to LOW.
- Bad launch cord. A fractured or leaking launch cord will emit detectable light.
- Uncapped rear port. If the rear port is not capped when not in use, tracer light will reflectively illuminate an entire area and give false indications.
- The probe can also detect reflections from fiber faults. If a severe enough leak occurs, its glow can reflect from the sides of enclosures and illuminate adjacent structures.

Specifications

Optical

Emitter	Laser
Port Style	ST, FC, SC, others available
Fiber Size (MAX)	100/140
Wavelength	1550 nm
Power	< -1 dBm
Modulation	500 Hz
Stability	0.2 dB/8hr typical
Bandwidth	5 nm

General

Operating Temperature	0°C to +50°C
Storage Temperature	-10°C to +60°C
Humidity	10% to 90%, non-condensing
Power	1 x 9 VDC Alkaline Battery
Battery Life	8 hours typical

Warranty Information

Trilithic, Inc. warrants that each part of this product will be free from defects in materials and workmanship, under normal use, operating conditions and service for a period of one (1) year from date of delivery. Trilithic, Inc.'s obligation under this Warranty shall be limited, at Trilithic, Inc.'s sole option, to replacing the product, or to replacing or repairing any defective part, F.O.B. Indianapolis, Indiana; provided that the Buyer shall give Trilithic, Inc. written notice.

Batteries are not included or covered by this Warranty.

The remedy set forth herein shall be the only remedy available to the Buyer under this Warranty and in no event shall Trilithic, Inc. be liable for incidental or consequential damages for any alleged breach of this Warranty. This Warranty shall not apply to any part of the product which, without fault of Trilithic, Inc., has been subject to alteration, failure caused by a part not supplied by Trilithic, Inc., accident, fire or other casualty, negligence or misuse, or to any cause whatsoever other than as a result of a defect.

Except for the warranty and exclusions set forth above, and the warranties, if any, available to the Buyer from those who supply Trilithic, Inc., there are no warranties, expressed or implied (including without limitation, any implied warranties of merchantability of fitness), with respect to the condition of the product or its suitability for any use intended for it by the Buyer or by the purchaser from the Buyer.

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