

Hands-On

# Fiber Optic - ISP/LANs

Inside Plant/Local Area Cable Networks



## Course Description

This Hands-On 3-day course is designed to provide technicians with a practical understanding of fiber optic theory and fiber applications in Local Area Network, Security and Closed Circuit TV systems. This course provides the knowledge and skills to help students design, install, terminate, test, troubleshoot and maintain cables in an intra-building and inter-building environment.

### Certification(s)

ETA FOI (Fiber Optic Installer) Certification can be administered during this course, and will add an additional day with applicable charges, upon request.



## Students Will Learn

- Discuss the history of fiber optics & evolution of fiber.
- Discuss fiber types and manufacturing methods.
- Discuss fiber optic theory and waveguide functions.
- Describe the causes of attenuation, optical reflection and refraction.
- Understand Optical Dispersion and Pulse Spreading Issues.
- List the three basic elements of fiber optic systems and discuss their uses.
- Describe various cables types and proper installation methods.
- Describe Safe Optical and Physical Work Practices.
- Understand the design of various Indoor Network Topologies.
- Discuss LAN specifications and standards.
- Recognize challenges for the Designer and Installer.
- Demonstrate safe hand tool use.
- Perform cable and fiber preparation techniques.
- Perform ST & SC style connector assemblies.
- Demonstrate connectorized Jumper and Cable Assembly skills.
- Recognize other types of connectors currently available.
- Perform optical loss testing on jumpers and cable assemblies.
- Perform Visual Fault Locator techniques.
- Demonstrate troubleshooting techniques.
- Understand OTDR basic operation and testing methods.
- And More

## Target Audience

Contractors, union craftsman, electricians, technicians, installers, splicers, LAN managers/administrators, end-users, engineers, MIS managers, facilities managers, architects and developers, systems engineers, telecom managers and anyone involved in repairing, installing, maintaining, designing, evaluating, or provisioning Cable, Fiber Optic Cables and Optical Networks.

## Prerequisites

A basic understanding of various telecommunications systems is highly recommended. We offer these topics in several of our courses, please visit [www.BTStraining.com](http://www.BTStraining.com) for additional course descriptions.

## Course Outline

### MODULE: 1 FIBER OPTIC GENERAL STUDIES

#### I. INTRODUCTION

- Common Industry Terminology
- History of Fiber Optics
- Advantages/Disadvantages of Fiber Optics
- Basics of a Fiber Optic Communications System
- Fiber Types and Manufacturing Processes (VIDEO)
- Typical Transmission Rates for Voice, Video & Data Applications
- System Topologies
- Fiber Optic Standards

## **II. THEORY TOPICS**

- Theory of Light
- Electromagnetic Spectrum
- Total Internal Reflection (Singlemode)
- Refraction (Multimode)
- Index of Refraction (Refractive Index)
- Light Sources (LEDs & LASERS)
- Wave Division Multiplexing (WDM)
- Optical Switching Fundamentals

## **III. FIBER TOPICS**

- Optical Fiber Types
- Typical Fiber Specifications
- Multimode Optical Fibers
- Singlemode Optical Fibers
- Dispersion Characteristics
- Modal Dispersion
- Chromatic Dispersion

## **IV. FIBER CABLE TYPES**

- Outside Plant
- Inside Plant
- Loose tube Gel Filled (OSP)
- Tight Buffered Distribution (ISP)
- Tight Buffered Breakout (ISP)
- Jumper Cables and Hybrids styles
- Reverse Oscillation Locator (OSP)
- Fiber Color Code

## **MODULE: 2 FIBER OPTIC SAFETY ISSUES**

### **V. SAFETY FIRST**

- LASER Safety and Warning labels
- Types of LASERS
- LASER Output Power Levels
- Eye Safety Precautions
- Safe Glass Disposal Practices

Food and Drinks Not Safe  
Proper Person Cleanliness  
Safe Work Surroundings  
Confined Spaces Issues

## **MODULE: 3 FIBER OPTIC CABLE INSTALLATION**

### **VI. PROPER PLANNING**

Project Considerations  
Cable Pre-testing  
Cable Reels Identification and Handling  
Proper Cable Pulling Techniques  
Outdoor Cable Design Characteristics  
Direct Bury Cable Installation  
Directional Boring Methods  
Buried Cable Depths  
Man Holes and Vaults  
Cable Pulling Specifications  
Tensile Strength and Bend Radius  
Avoiding Installation Obstacles  
Grounding and Bonding Fiber Cables  
Identifying Cable Types  
Work Area Protection Issues

## **MODULE: 4 FIBER OPTIC TESTING**

### **VII. BASIC TESTING INFORMATION**

The dB Scale and Units of Loss  
OTDR Functions for Testing  
OTDR Testing for Splices, Distances and Back Reflection  
OTDR Trace Guidelines  
The Dead Zone  
Trace Events and Interpretation  
Testing at Various Wavelengths  
System Loss Parameters  
Calculating System Loss  
Total System OTDR Testing  
Optical Loss Test Sets (OLTS)  
Referencing the Test Set First  
Measuring Cable System Loss  
Documenting Test results

## Hands-On Labs:

### Safety Meeting

#### 1 Cable Preparation Tools and Techniques

##### A. Show the correct and safe usage of cable preparation tools

- Cable Knife
- Kevlar shears/snips
- Tube Ring Tool
- T strippers

##### B. Tight Buffer Cables - Preparations for termination of jumpers and system cables

- Measure and then Ring the cable jacket accordingly
- Remove the out jacket to expose fibers and inner materials
- Cut the Kevlar, nylon tape and any strength members
- If necessary, ground the cable using recommended cable manufactures procedures.

##### C. Breakout & Fan Out Kits

- Determine the type of kit if necessary
- Prepare and clean the cable to match
- Install fibers to kit
- Label as necessary

##### D. Connector Assembly

- Determine connector type to be installed
- Slide the connector boot onto each fiber
- Remove the fiber coating with proper stripping tools
- Clean the exposed fiber with alcohol pad
- Apply epoxy to fiber and connector body
- Insert fiber through connector & ferrule and let epoxy cure
- Cleave fiber from ferrule end with hand scribe tool
- Perform hand polishing techniques until fiber is flush with ferrule
- Inspect polished fiber end with connector view scope
- Determine polish quality for acceptance

#### 2 Testing Equipment and Methods

##### E. Optical Loss Testing

- Reference the Light Source and Power Meter
- Perform End to End and Link Loss Measurements
- Measuring your equipments transmit power
- Measuring your equipments receive power
- Coupling Errors

Optic Attenuators  
Documentation

#### F. OTDR Testing

Operating an OTDR  
Setup the OTDR for Testing  
OTDR Test Functions:

- a) Acceptance Testing (Reel)
- b) Span Loss and Distance Testing
- c) Connector loss testing
- d) Back Reflection Testing
- e) Using the OTDR for Troubleshooting and Restoration

#### G. Troubleshooting a Local Area Network

Power Meters  
Visual Fault Finders  
Fiber Identifiers  
OTDRs

## Delivery Method

Instructor led with numerous Hands-On labs and exercises.

## Equipment Requirements

**(This apply's to our hands-on courses only)**

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

## Course Length

3 Days