Fiber Optics 1-2-3

Detailed Course Outline

Light Brigade®
FIBER OPTIC TRAINING

This four-day course has been developed with two days of classroom learning and two days of hands-on skills labs, review, and certification testing. The classroom portion is available as in person training or online via our instructor-led, remote classroom option. Each content chapter ends with a review period, which makes use of Kahoot game-based interactive quizzes to help attendees recall and retain what they have learned. After the theory portion, students will take a Light Brigade knowledge exam to gauge their mastery of the topics.

The labs provide the practical understanding and skills required to properly design, install, and maintain fiber optic networks. Students will learn how to splice, connectorize, test, and troubleshoot optical fiber networks to increase efficiency, reliability, and on-the-job safety as well as reduce cost and downtime. Following the lab sessions, those who have chosen to pursue ETA certification will then complete their ETA certification testing.

Audience: This course is applicable to anyone who is or will work with fiber optic communications systems.

Prerequisites: None. Entry level. Fiber Foundations (online) is recommended but not required.

Certifications and Credits: ETA Fiber Optic Installer (FOI) Certification
BICSI Continuing Education Credits
Light Brigade Digital Credentialing

Classroom Lecture

Communication Basics

- Basic signal communication
- Digital communications
- The binary system
- What is an optical fiber?
- Fiber coatings and color coding
- Basic units of measure in fiber optics
- Advantages of fiber optics
- Standards and codes

Fiber Optic Transmission Theory

- The electromagnetic spectrum
- Fiber optic transmitters and receivers
- The dBm and dB scales
- Attenuation and loss
- Refraction
- Reflection
- Dispersion
- Fiber tolerances
- Bandwidth

Optical Fibers

- The physical plant
- Fiber comparison
- What is a mode?
- Multimode and single-mode fiber types

Cable

- Cable designs
- Cable materials and structure
- Indoor optical cable ratings
- Ammonium Octamolybdate
- Low smoke zero halogen
- Distribution cables
- Breakout cables
- Tight buffered cable specifications
- Interlocking armor cable
- Standard cable cordage
- Indoor/outdoor cables
- Loose tube outside plant cables

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Cable (continued)

- Stranded cables
- Unitube/central tube cables
- Ribbon cables
- Ultra high density fiber cables
- Microduct cables
- Aerial fiber optic cables
- Drop cables
- Optical cable specifications
- Fiber coating and buffer color codes
- Composite and hybrid cables
- Cable components and elements
- Cable termination

Fiber Optic Connectors

- FOCIS
- IEC 61754
- Main connector components
- Typical connector roles
- What to look for in a connector
- Causes of excess loss
- SC connectors
- ST connectors
- LC connectors
- MPO connectors
- Old connector styles
- Legacy connector styles
- Emerging connectors
- Hardened fiber optic connectors
- Termination techniques

Connector Endfaces

- Endface geometry
- Fiber optic connector inspection
- Fiber optic endface inspection
- Connector inspection criteria
- Reflection issues
- Fiber optic connector polishes

Splicing

- Connectors versus splices
- Why do we need to splice?
- Splicing considerations
- Anatomy of a fusion splicer
- Splicer cleanliness
- Choosing the correct settings
- Perform regular arc tests
- Splice errors
- Strip tool cleanliness
- Fiber optic cleaving
- Fusion splicing
- Ribbon splicing
- Mechanical splicing
- Pigtail splicing
- Splice-on connectors
- Splice protection

Fiber and Cable Management

- Rack space
- Patch panels
- Splice panels
- Building entrance terminals
- Fiber distribution units
- Splice closures
- Splice trays
- Fanout and breakout kits
- Building and campus topologies
- Wall-mounted premises panels
- Fiber raceway systems
- Work area outlets
- Fiber to the building installations
- OSP fiber and cable management
- FTTx cable management products
- Fiber distribution hubs
- Fiber access terminals
- Multiport service terminals
- Fiber transition terminals
- Cabling scenarios
- Vaults and handholes
- Panel and closure considerations

Installation

- Cable handling
- General installation guidelines
- Standards, regulations, and codes
- Air blown fiber networks
- Topologies
- Cable trays and ducts
- Cable installation products

OSP Installation

- Underground installation methods
- Proper route planning and engineering
- Conduit and duct installation
- Microducts and multiducts
- Cable pulling
- High air speed blown
- Aerial installations
- Utility applications
- Mid-span (express) entries
- Slack storage methods
- Cable storage
- Sequential markings
- Fiber installation inspection report

Test Equipment

- Optical loss testing
- Optical time-domain reflectometers
- OTDR testing
- Key considerations for OTDRs
- Fiber identifiers
- Visual tracers
- Visual inspection
- Optical talk sets
- Optical dispersion testers
- Testing documentation

Optical Testing

- ANSI/TIA-568 testing terminology
- Test methods
- Multimode launch conditions
- Optical loss testing with a mandrel
- Mode suppressor loops
- Measurement-quality jumpers
- Referencing test methods
- Insertion loss methods
- “Not to exceed” attenuation reports
- Testing transmitter and receiver power
- OTDR deadzone
- Launch boxes and optical terminators
- OTDR signatures/traces
- Fiber roll-off
- Testing fiber optic splitters
- Index of refraction accuracy settings

Emergency Restoration

- Identify, locate, and resolve
- Effective maintenance planning
- Typical causes of failure
- Frequently encountered problems
- Restoration planning
- Emergency restoration kits
- Aerial restorations
- OSP restoration of ducted cable
- OSP restoration of direct buried cable
- Premises restorations
- Proactive versus reactive restorations
- LAN restorations
- The need for slack cable
- Post-restoration recommendations

Actives, Passives, and Loss Budgets

- Laser light sources
- Wavelength optimization
- Receivers – photo diodes
- Typical optical detector specifications
- Optical bidirectional devices
- Passive devices
- FTTH architectures
- Optical splitters
- Multiplexers and multiplexing
- Attenuators
- System budgets

Safety Best Practices

- Visual safety using fiber optic sources
- Wavelength and the eye
- Laser classifications
- Safety eyewear
- Working with optical fibers
- Personal protective equipment
- Chemicals
- Safety data sheets (SDS)
- The work area
- Installation safety practices
- Aerial safety

Wrap-up and Review

Hands-on Skills Learning

Lab Safety

- Practice safety during the labs for yourself and your fellow participants.

Review of Safety Practices

Cable Preparation for Termination

- Practice proper tool usage for cable and buffer tube preparation.
- Identify fiber optic cable and jacket types.
- Prepare a stranded cable for installation into a fiber closure/panel.
- Prepare buffer tube for a splice tray.
- Prepare a fanout kit.

Splicing and OTDRs

- Clean the test port and all connectors of an OTDR.
- Modify typical OTDR settings to obtain a clear interpretable trace.
- Recognize and interpret events depicted by an OTDR.
- Use an OTDR to test and identify events in a span.
- Use a launch box to enable identification of events close to the OTDR.
- Strip and cleave an optical fiber.
- Modify typical splicer settings to obtain a high-quality splice.
- Perform arc calibration on a fusion splicer.
- Create fusion splices on various fiber construction types.

Connectors

- Prepare and install a mechanical splice-on connector.
- Prepare and install a fuse-on connector.
- Clean a fiber connector endface.
- Use inspection scopes to view a connector endface.
- Use a light source and power meter to measure loss on a mated connector pair.
- Use a visual fault locator to identify nearby bends and breaks.
- Practice proper tool usage for connector preparation.

Optical Loss Testing

- Inspect and identify connector contamination.
- Clean connector endfaces using wet and dry cleaning methods.
- Clean connectors using commercially available fiber optic cleaning products.
- Identify damaged connectors.
- Use a light source and power meter to observe the effects of a macrobend and microbend on a fiber.
- Learn proper test reference methods.
- Create a loss budget for sample span of fiber.
- Measure optical loss for a span of fiber and compare to the calculated loss budget.
- Use a fiber identifier to detect active fibers.