FIP-400 FIBER INSPECTION PROBE

NETWORK TESTING—OPTICAL

Highly versatile probe to detect dirty/damaged connectors with unparalleled precision

SPEC SHEET

KEY FEATURES

Easy back-panel connector inspection

Truly rugged and lightweight solution for the field

Image-capture capability for report documentation

Ideal for all types of connectors: APC, UPC, MTP and more

Slim design for easy use in crowded patch panels

Compatible with EXFO test instruments

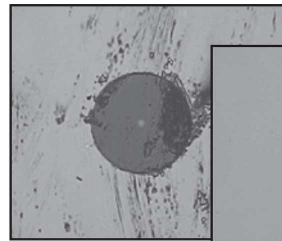
FROST & SULLIVAN
2011 BEST PRACTICES AWARD
GLOBAL PORTABLE FIBER OPTIC TEST EQUIPMENT MARKET SHARE LEADERSHIP AWARD

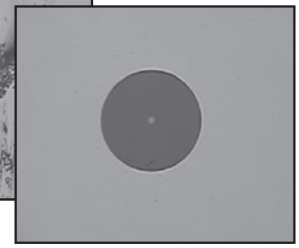
EXFO Assessing Next-Gen Networks

ZOOM IN ON CLARITY

It's a known fact: optical network problems are often caused by dirty and/or damaged connectors. Using a fiber inspection probe to ensure that connectors/adapters are clean and exempt of any defect is where accurate testing starts.

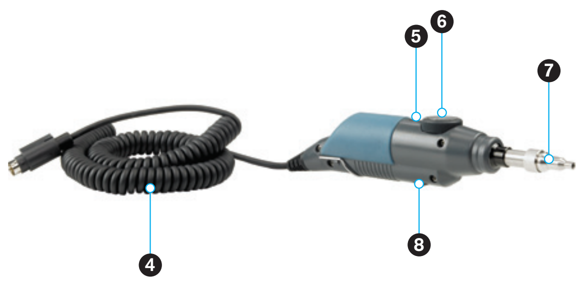
Thanks to EXFO's FIP-400 Fiber Inspection Probe, checking connectors and other fiber terminations for polish quality and cleanliness has never been easier. Benefit from the best optical resolution in the industry and see scratches and dirt particles as small as 1 µm. Also, use a USB converter to send image captures to a portable platform or a PC.


Dirty connector


Clean connector

Fiber Probe Viewer

Video Inspection Probe



1. 3.5" TFT LCD screen
2. Rechargeable Li-ion battery
3. Adjustable brightness and contrast
4. Probe connector (EXFO type)
5. Image capture button
6. Focusing device
7. Interchangeable tip
8. Magnification knob (dual model)

CONNECTORMAX ANALYSIS SOFTWARE

Automatic pass/fail analysis with multiple-platform flexibility

› Available on the portable FTB-1, FTB-200 and FTB-500 platforms

Save time and money

› Lightning-fast results in seconds through simple one-touch operation

Complete test reports for future referencing

› Stores images and results for record-keeping

Automatic pass/fail analysis in any FTB platform

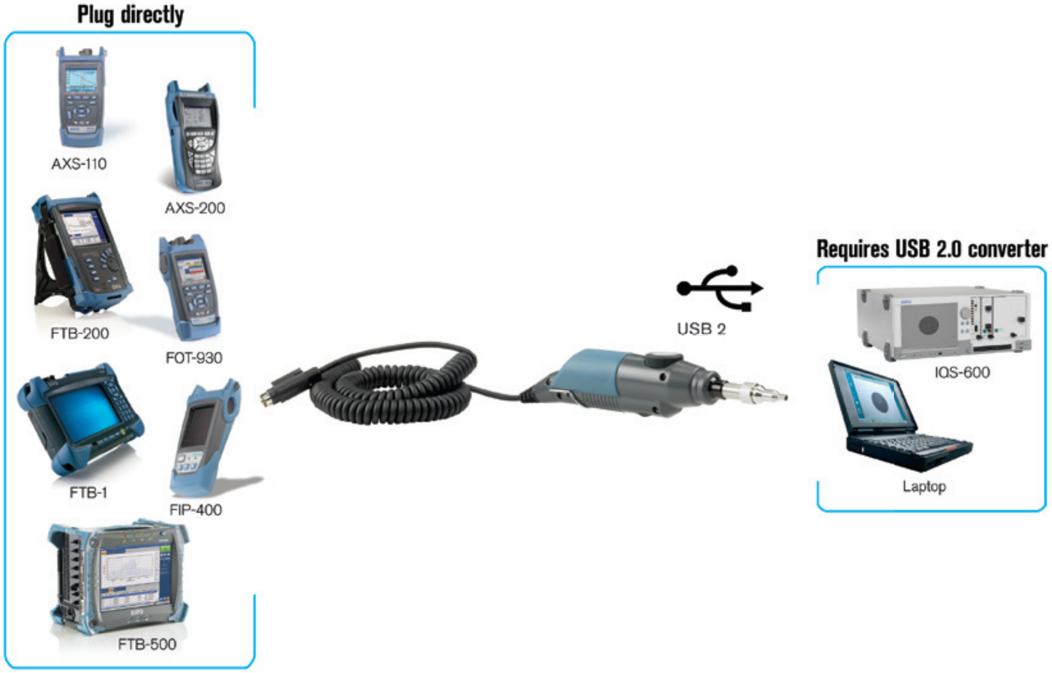
Delivering fast pass/fail assessment of connector endfaces, EXFO's ConnectorMax Analysis Software is designed to save both time and money in the field. The industry's first platform-based, automated inspection application, ConnectorMax eliminates guesswork, instead providing clear-cut connector endface analysis.

ConnectorMax enables field technicians to analyze defects and scratches and measure their impact on connector performance. Results are then compared against pre-programmed IEC/IPC standards or user-defined criteria, leading to accurate pass/fail verdicts established right on-site.

ConnectorMax therefore helps avoid two time- and money-consuming situations: undetected connector defects that force technicians to later return to the site, and unnecessary replacement of connectors whose slight defects are not enough to get a "fail" verdict.

THE INDUSTRY'S MOST VERSATILE PROBE

With EXFO's FIP-400, you have the choice—you can either use it with a PC, with one of our test sets or with our lightweight, handheld monitor. Choose the way that works best for you.



APPLICATIONS

Patchcord inspection

› Compatible with a wide range of connector types

› Offers great optical performance for patchcord quality assurance

› Use it as a stand-alone unit to perform field applications or with a USB adapter in a manufacturing environment

Patch panel bulkhead inspection

› Get a clear view of both sides of an interconnection

› Inspect hard-to-reach connectors without stressing adjacent fibers, thanks to the FIP-400's slim design

Single-fiber connector inspection

› Compatible with 1.25 mm and 2.5 mm angled-polished and ultra-polished connectors (APC and UPC)

Multifiber connector inspection

› Compatible with male and female ribbon connectors such as MTP multifiber APC and UPC connectors

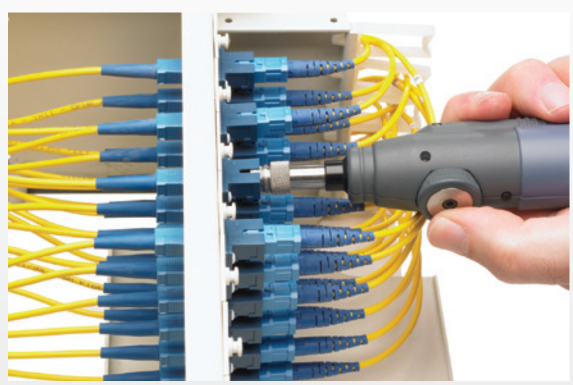
Connection inspection through ConnectorMax Analysis Software

› Delivers clear-cut pass/fail verdicts, eliminating guesswork in the field and helping you save time and money

› Lightning-fast: results in 4 seconds through simple one-touch operation

› Full test reports for future referencing

Patchcord inspection in a manufacturing environment



Patch panel bulkhead inspection

SPECIFICATIONS

Video Inspection Probe			
Size (H x W x D)	without tip cap with tip cap	38 mm x 32 mm x 170 mm (1 ½ in x 1 ¼ in x 6 11/16 in) 38 mm x 32 mm x 200 mm (1 ½ in x 1 ¼ in x 7 ¾ in)	
Weight		0.2 kg (0.44 lb)	
Resolution		Theoretical < 2 µm, detection capability < 1 µm	
Field of view		625 µm x 464 µm (low magnification) [a] 412 µm x 306 µm (high magnification)	
Light source		Blue LED	
Lighting technique		Coaxial	
Capture button [b]		Present on all models	
Connector		EXFO probe port type (8 pin mini-DIN)	
Focus control		Adjustable on the probe	
Optical magnification		Adjustable, low and high (dual model only)	
Fiber Probe Viewer			
Size (H x W x D)		50 mm x 99 mm x 190 mm (1 15/16 in x 3 7/8 in x 7 1/2 in)	
Weight [c]		0.3 kg (0.66 lb)	
LCD screen		3.5 in TFT active matrix (320 x 240 pixels)	
Power		Rechargeable Li-ion battery or AC adapter/charger	
Battery life		3 hours (continuous use)	
Charging time		4 hours	
Connector		EXFO probe port type (8 pin mini-DIN)	
USB Converter		**USB 1.1 Model**	**USB 2.0 Model**
Size (H x W x D)		20 mm x 36 mm x 90 mm (13/16 in x 1 7/16 in x 3 9/16 in)	19 mm x 36 mm x 95 mm (¾ in x 1 7/16 in x 3 ¾ in)
Connectors		EXFO probe port type (8 pin mini-DIN)/USB	
Capture button		No	Yes

GENERAL SPECIFICATIONS

Temperature	operating storage	–10 °C to 50 °C –40 °C to 70 °C
Relative humidity		0 % to 95 % non-condensing

ACCESSORIES

Optional		**Standard**
FIPT-BOX	Plastic case divided into various compartments for tips	Video inspection probe (single or dual magnification)
GP-1001	Rechargeable battery for handheld display	FC-SC tip for bulkhead
GP-10-073	Soft carrying case for inspection probe, display and accessories	U25M universal patchcord tip for 2.5 mm ferrule
		Plastic case divided into various compartments for tips

ORDERING INFORMATION

FIP-400-XX-XX

Model
FIP-400-P-SINGLE = Video inspection probe Single magnification
FIP-400-P-DUAL = Video inspection probe Dual magnification
FIP-400-D = Handheld display
FIP-400-USB1 = USB1 converter with software, compatible with FTB-400 and IQS-500
FIP-400-USB2 = USB2 converter with software for PC [e], FTB-500 d and IQS-600
FIP-400-USB

Example: FIP-400-P-SINGLE-FIPT-400-LX5-APC

Extra Adapter Tips [d]
00 = Without extra FIP-400 tip
FIPT-400-LC-K
FIPT-400-25A-K
FIPT-400-ADAPTER = Adapter tip
FIPT-400-D4 = D4 tip for bulkhead adapter
FIPT-400-E2000 = E-2000 tip for bulkhead adapter
FIPT-400-E2000-APC = E2000 APC tip for bulkhead adapter
FIPT-400-FC-SC-A6 = FC and SC angled tip for bulkhead (60 degree)
FIPT-400-FC-SC-APC = FC APC angled tip for bulkhead adapter
FIPT-400-LC = LC tip for bulkhead adapter
FIPT-400-LC-A6 = LC angled tip for bulkhead adapter (60 degree)
FIPT-400-LC-APC = LC/APC tip for bulkhead adapter
FIPT-400-LEMO = LEMO tip for bulkhead adapter
FIPT-400-LX5-APC = LX.5/APC tip for bulkhead adapter
FIPT-400-MTP2 = MTP2 tip for bulkhead adapter (extended, reversible)
FIPT-400-MTP2-K = MTP, APC and UPC tips for bulkhead adapter (extended, reversible)
FIPT-400-MTPA-TIP = MTPA replaceable nozzle for MTP2 (extended, reversible)
FIPT-400-MTPA2 = MTP/APC tip for bulkhead adapter (extended, reversible)
FIPT-400-MTP2-TIP = MTP2 replaceable nozzle for MTP2 (extended, reversible)
FIPT-400-MU = MU tip for bulkhead adapter
FIPT-400-MU-L = MU tip for bulkhead adapter (extended)
FIPT-400-ODC-S = ODC Socket (male) tip
FIPT-400-ODC-U = ODC Universal Guide tip
FIPT-400-ODC-2PIN-P = ODC 2 Pin Plug (female) Guide tip
FIPT-400-ODC-4PIN-P = ODC 4 Pin Plug (female) Guide tip
FIPT-400-ODC-2PIN-P-K = ODC 2 Pin Plug (female) Guide & Universal tip
FIPT-400-ODC-4PIN-P-K = ODC 4 Pin Plug (female) Guide & Universal tip
FIPT-400-ODC-2&4PIN-P-K = ODC 2 & 4 Pin Plug (female) Guides & Universal tip
FIPT-400-SC-APC = SC APC tip for bulkhead adapter
FIPT-400-OTAP-APC = OptiTap™ bulkhead adapter
FIPT-400-OTIP-MT-APC = MT/APC type OptiTip™ for male and female connectors
FIPT400-OTIP-MT-APC/M = Male adapter tube for FIPT-400-OTIP-MT-APC tip
FIPT-400-SC-L = SC tip for bulkhead adapter (extended)
FIPT-400-ST = ST tip for bulkhead adapter
FIPT-400-U12M = Universal patchcord tip for 1.25 mm ferrule
FIPT-400-U12MA = Universal patchcord tip for 1.25mm APC ferrule
FIPT-400-U20M2 = Universal patchcord tip for 2.0 mm ferrule (P4, LEMO)
FIPT-400-U25MA = Universal patchcord tip for 2.5 mm APC ferrule

Notes

a. Dual model only
b. Works with USB 2.0 adapter, FOT-930 and FTB-200
c. Without battery
d. FTB-500 minimum Toolbox software requirement: 6.28 or higher
e. May require USB1 or USB2 depending on user's PC

EXFO Corporate Headquarters > 400 Godin Avenue, Quebec City (Quebec) G1M 2K2 CANADA | Tel.: +1 418 683-0211 | Fax: +1 418 683-2170 | info@EXFO.com

Toll-free: +1 800 663-3936 (USA and Canada) | www.EXFO.com

EXFO America	3400 Waterview Parkway, Suite 100	Richardson, TX 75080 USA	Tel.: +1 972 761-9271	Fax: +1 972 761-9067
EXFO Asia	100 Beach Road, #22-01/03 Shaw Tower	SINGAPORE 189702	Tel.: +65 6333 8241	Fax: +65 6333 8242
EXFO China	36 North, 3rd Ring Road East, Dongcheng District Room 1207, Tower C, Global Trade Center	Beijing 100013 P. R. CHINA	Tel.: + 86 10 5825 7755	Fax: +86 10 5825 7722
EXFO Europe	Omega Enterprise Park, Electron Way	Chandlers Ford, Hampshire S053 4SE ENGLAND	Tel.: +44 23 8024 6810	Fax: +44 23 8024 6801
EXFO Finland	Elektroniikkatie 2	FI-90590 Oulu, FINLAND	Tel.: +358 (0)403 010 300	Fax: +358 (0)8 564 5203
EXFO Service Assurance	270 Billerica Road	Chelmsford, MA 01824 USA	Tel.: +1 978 367-5600	Fax: +1 978 367-5700

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Assessing Next-Gen Networks

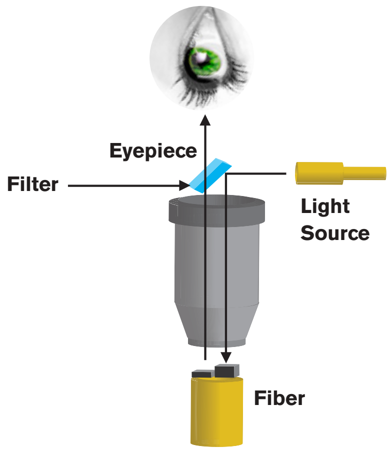
FIBER INSPECTION PROBES VS. FIBER-OPTIC MICROSCOPES

Varis Hicks, Product Specialist, Optical Business Unit

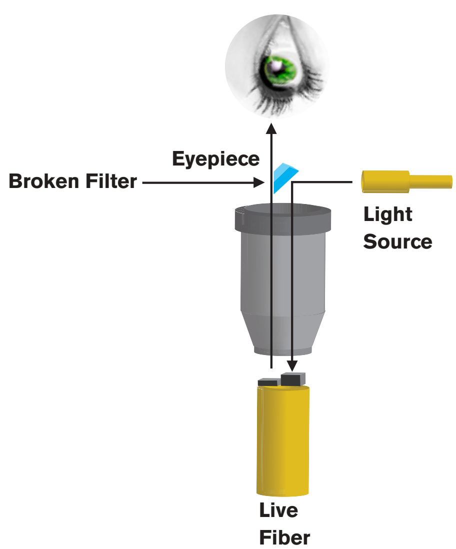
The fiber-optic marketplace has come to widely accept the benefits and necessity of connector cleaning. However, this has lead to some confusion over which connector inspection tool is best: fiber inspection probes (FIP) or fiber-optic microscopes (FOMS). Although both instruments are used to inspect connectors, there are important differences between them.

1. Eye Safety

Fiber-optic microscopes rely on an internal filter to protect the eye from an accidental live fiber inspection.



However, if the fiber-optic microscope filter is missing, damaged or malfunctioning, there is a risk of eye damage in an accidental live fiber inspection.

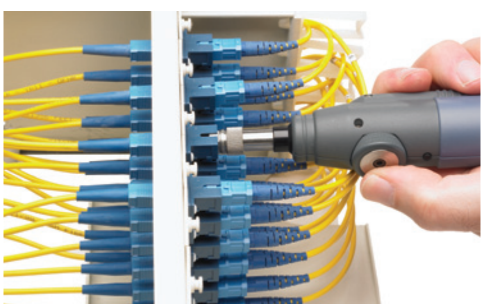


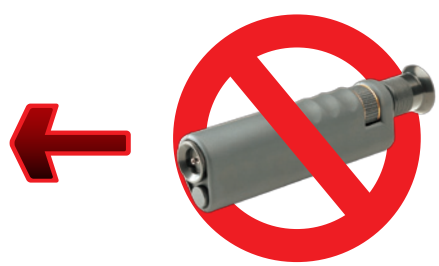
When using an FIP, there is absolutely no risk of eye damage since you view the image on a video display instead of directly.

2. Connector/Patch Panel Bulkhead Inspection

Since the ferrule (male) of the connector to be inspected is inserted at one end of the instrument and the user must look in at the other end, fiber-optic microscopes are not designed for inspecting connector bulkheads (female) located in a patch panel.

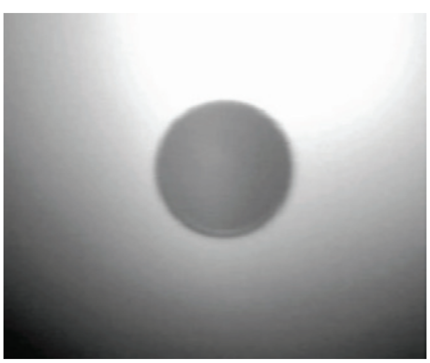
Typical patch panel bulkhead inspection



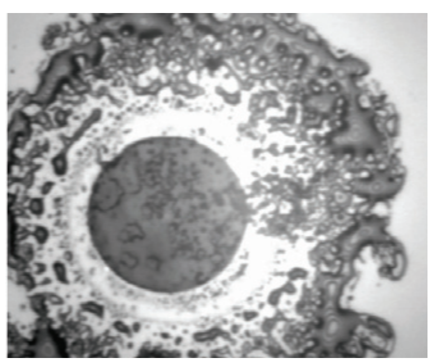


3. Cross Contamination

Cross contamination can occur when a clean connector is inserted in a dirty connector bulkhead. The mating of both connectors tends to move debris and dirt to the center of the connector where it can interfere with the optical transmission and cause extensive damage.

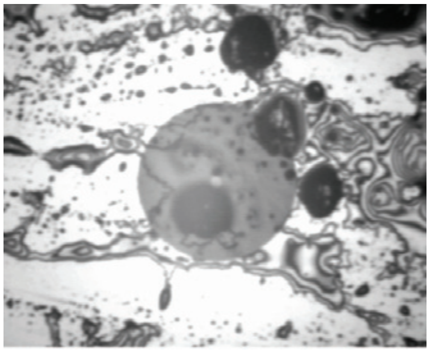


Clean connector

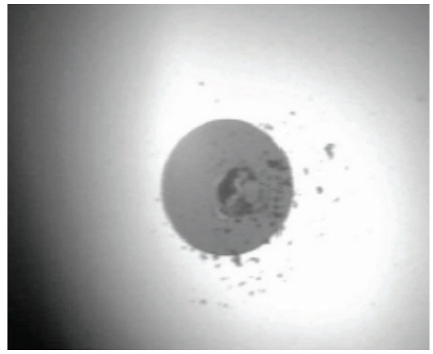


Cross contaminated connector

For instance, let's consider a cross-contaminated connector is plugged into a powered-up erbium-doped fiber amplifier (EDFA). The output power of an EDFA is around +25 dBm. At this power level, any debris or dirt is burned, permanently damaging the connector and, more importantly, the EDFA, which costs around US$10,000.



Contaminated connector



Permanently damaged EDFA connector

4. Inspection Applications

Many connector inspection applications require interfacing with the FIP. Here are some examples:

1. Manufacturing or lab environments where the FIP is connected to a test station or test platform.
2. Manufacturing, lab or field applications where the FIP is connected to a computer.
3. Field applications where the FIP is connected to a test instrument.
4. Generation of a fiber "birth certificate" where the fiber-link connector images are stored for report generation and future reference.

All of these applications make the FIP very versatile. None of these applications can be addressed using a fiber-optic microscope.

5. Cost

Initially, FIPs are more expensive than fiber-optic microscopes. However, looking at the risks and potential costs of using a microscope, investing in an FIP is well justified. Here are a few situations that can result in costly expenses if not equipped with the right tool:

- Network outages can be extremely costly to business in terms of lost revenue and productivity. The table below shows, for different companies, the annual revenue, the revenue lost due to network downtime and the estimated per-hour cost of this downtime. As these numbers date back to 2003, costs have most likely gone up since.

Annual Downtime Cost: Productivity vs. Revenue

Case Study	Annual Revenue	Lost Revenue	Cost/Hour
Energy	$6.75 billion	$4.3 million	$1,624
High Tech	$1.3 billion	$10.2 million	$4,167
Health Care	$44 billion	$74.6 million	$96,632
Travel	$850 million	$2.4 million	$38,710
Finance (US)	$4 billion	$10.6 million	$28,342
Finance (EU)	$1.2 billion	$379,000	$1,573

Source: “The Cost of Enterprise Downtime 2003” study by Infonetics Research

- A possible lawsuit by microscope users due to accidental eye damage
- Damaging expensive optical equipment such as EDFAs
- Network downtime due to cross-contaminated connectors
- Lost of productivity associated with using an FOMS since it is an incomplete inspection solution (not designed for connector bulkhead inspection)

6. Summary Table

	Fiber Inspection Probe (FIP)	Microscope (FOMS)
Eye safety	Indirect viewing of image; no risk of eye damage.	Direct viewing of image; relies on an internal filter for eye protection. High risk of eye damage, if the internal filter is missing or malfunctioning.
Connector and patch panel bulkhead inspection	Wide variety of adapters to inspect connector ferrules (male) and patch panel bulkhead connectors (female).	Cannot be used to inspect connectors and patch panel bulkheads (female) because of its design (insertion of connector ferrule (male).
Cross contamination	Since both connector ferrules and bulkheads can be inspected, cross contamination is eliminated.	Cross contamination is a serious problem; inserting a clean connector into a dirty bulkhead will contaminate the clean connector.
PC, platform and test instrument connectivity	Most probes can be connected to computers, test platforms or test instruments; images can be stored to generate reports and be used for future reference.	Cannot be connected to a computer, test platform or test instrument; images cannot be stored.
Cost	Higher initial cost, but lower long-term cost.	Lower cost, but higher risks and limited versatility.

7. Conclusion

Dirty/damaged connectors are the no. 1 cause of link deployment problems. Their inspection should therefore be given the full attention it requires. In this context, when we add up the above-mentioned benefits, it is clear to see that although they require a higher initial investment, FIPs constitute a safer, more flexible and more complete connector inspection choice for ensuring smooth link deployment and, ultimately, optimal network performance.

EXFO Corporate Headquarters > 400 Godin Avenue, Quebec City (Quebec) G1M 2K2 CANADA | Tel.: +1 418 683-0211 | Fax: +1 418 683-2170 | info@EXFO.com
Toll-free: +1 800 663-3936 (USA and Canada) | www.EXFO.com

EXFO America	3701 Plano Parkway, Suite 160	Plano, TX 75075 USA	Tel.: +1 800 663-3936	Fax: +1 972 836-0164
EXFO Asia	151 Chin Swee Road, #03-29 Manhattan House	SINGAPORE 169876	Tel.: +65 6333 8241	Fax: +65 6333 8242
EXFO China	Beijing New Century Hotel Office Tower, Room 1754-1755 No. 6 Southern Capital Gym Road	Beijing 100044 P. R. CHINA	Tel.: +86 (10) 6849 2738	Fax: +86 (10) 6849 2662
EXFO Europe	Omega Enterprise Park, Electron Way	Chandlers Ford, Hampshire S053 4SE ENGLAND	Tel.: +44 2380 246810	Fax: +44 2380 246801
EXFO Service Assurance	285 Mill Road	Chelmsford, MA 01824 USA	Tel.: +1 978 367-5600	Fax: +1 978 367-5700

EXPERTISE REACHING OUT

APPNOTE228.1AN

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Connector Inspection Guide

Assessing
Next-Gen Networks

Connector Inspection Guide

CONNECTOR INSPECTION AND MAINTENANCE

One of the first tasks to perform when designing fiber-optic networks is to evaluate the acceptable budget loss in order to create a product that will meet application requirements. To adequately characterize the budget loss, the following key parameters are generally considered:

› Transmitter: launch power, temperature and aging

› Fiber connections: connectors and splices

› Cable: fiber loss and temperature effects

› Receiver: detector sensitivity

› Others: safety margin and repairs

When one of the above-listed variables fails to meet specifications, the performance of the network can be greatly affected or worse, the degradation can lead to network failure. Unfortunately, not all the variables can be controlled with ease during the deployment of the network or the maintenance stage; however, there is one component—the connector—that is too often overlooked, sometimes overused (test jumpers) but that can be controlled using the proper procedure.

The Inspection Phase

Connectors are key components that interconnect the entire network elements, which is why maintaining them in good condition is essential to ensure that all the equipment operates to their maximum performance—to avoid catastrophic network failure. Since connectors are susceptible to damage what is not immediately obvious to the naked eye—the inspection phase is vital.

COMPONENTS

When proceeding with the inspection of connectors, there are two main components to inspect: the connector itself and the ferrule.

The Connector

One of the advantages with connectors is that when connector failure occurs, it can be rapidly dealt with since its main cause is often traced to the endface (also called the "ferrule") or the mechanical section of the connector. Connector failure is most frequently the result of a dirty or damaged endface. Figure 1 illustrates the parts of a SC-type fiber-optic connector.

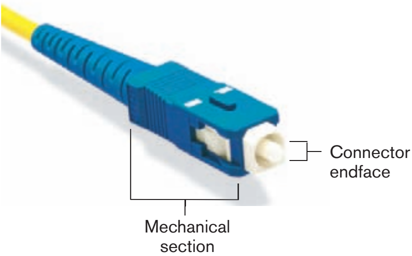

Figure 1. Fiber-optic connector: SC type

Connector Inspection Guide

The Ferrule

In the connector, the ferrule holds the fiber and provides the alignment positioning. The ferrule is the part of the connector that connects the cable either to another cable, a transmitter or a receiver. Made of either glass, plastic, metal or ceramic, the ferrule is composed of three principal zones (see Figure 2a): (1) Zone A, which is defined as the core of the fiber where the light travels; (2) Zone B, called the "cladding", is the outer optical material surrounding the core that reflects the light into the core and (3) the buffer coating protects the fiber from damage and moisture as it surrounds the cladding and is normally made of plastic.

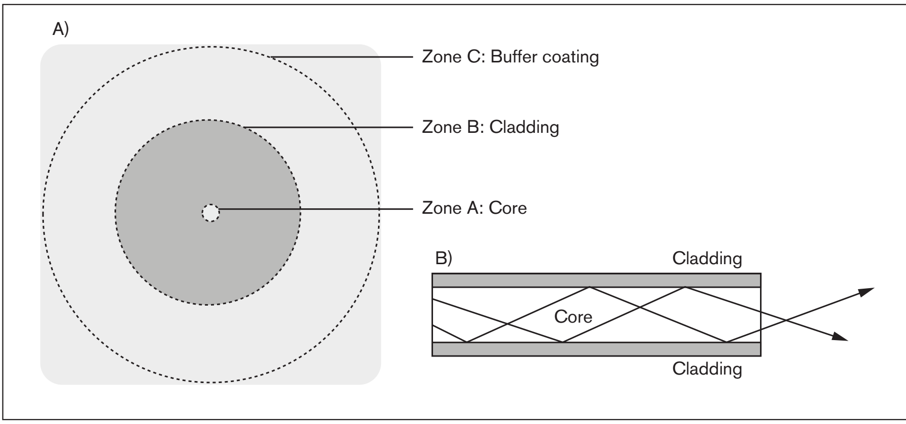

Figure 2. A) Zones defining the ferrule
B) How light is guided through an optical multimode fiber

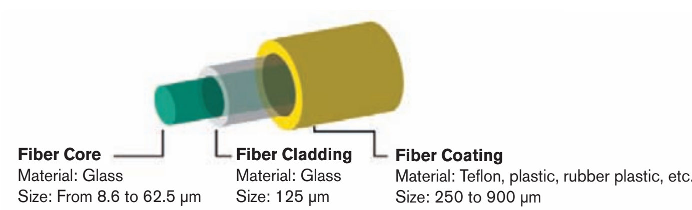

Figure 3. Layered view of a fiber cable

Connector Inspection Guide

INSPECTING CONNECTORS

Since the core and cladding are the two main sections of the ferrule, it is critical that they be maintained in good condition to minimize the loss that occurs when two ferrules are mated together. In order to properly carry out connector maintenance, the connector endface must first be visually inspected. As shown in Table 1, the core diameter of a singlemode fiber is less than 10 microns, which means that without the proper inspection tool, it is impossible to tell if the ferrule is clean, making it essential to have the right tools.

Fiber Type	Core Diameter (µm/inches)	Cladding Diameter (µm/inches)
Singlemode	9/0.000000394	125/0.000354
Multimode	50/0.001969 or 62.5/0.002461	125/0.000354

Table 1. Singlemode and multimode core and cladding diameters

Inspection Tool	Main Characteristics
Video fiber inspection probes	› Image display on an external video screen, PC or a test instrument (see Figure 3) › Eye protection from direct contact with a live signal › Image-capture capability for report documentation › Ease of use in crowded patch panels › Ideal to inspect patchcord, patch panel, multifiber connector (e.g., MTP) › Different degrees of magnification available (100x/200x/400x) › Adapter tips for all connector types available
Optical microscope	› Laser safety filter* to protect eyes from direct contact with a live fiber › Two different types of microscopes needed–depending on the types of connector to inspect–one to inspect patchcords and a different one to inspect connectors in bulkhead-patch panels

* It is highly recommended to never use a direct magnifying device (optical microscope) to inspect live fiber.

Table 2. Inspection tools

Figure 4. Video inspection probe

Connector Inspection Guide

INSPECTING FERRULES

When inspecting a connector ferrule, two types of problems can be encountered: a damaged endface or a dirty endface.

Damaged Endfaces

Physical damage to the connector endface are, in general, permanent and will, in most cases, require a connector replacement—unless the damage is not detrimental to the endface. In order to determine whether the damage is detrimental or not, a good rule of thumb is to discard or replace any connector that has scratches near or across the fiber core (see Figure 5a), since these scratches can generate high loss and affect the connector performance. For physical damage, including chipped cladding (see Figure 5b), worn connectors and/or excessive epoxy residue on the cladding, the connector must be replaced.

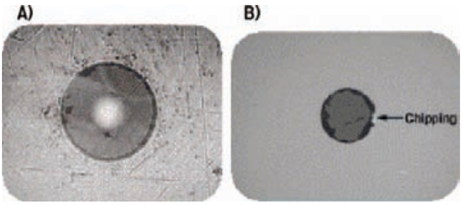

Figure 5. A) Scratch in the core region
B) Chipping on the cladding

Dirty Endfaces

In an ideal world, free of contaminants, connector endfaces would always be clean and would not require in-depth maintenance; however, this is not the present reality, and many fiber-optic connector contaminants exist. For example, a 1 µm dust particle on a singlemode core can block up to 1 % (0.05 dB loss) of the light—imagine what a 9 µm dust particle can do. Another important reason for keeping endfaces free of contaminants is the effect of high-power components on the connector endface. Some of today's telecommunication components can produce signals with a power level up to +30 dBm (1 W), which can have catastrophic results when used with a dirty or damaged connector endface (e.g., fiber fuse).

Dust, isopropyl alcohol, oil from hands, mineral oils, index matching gel, epoxy resin, oil-based black ink and gypsum are among the contaminants that can affect a connector endface. Some of these contaminants are single soil or they may come in complex soil combinations. Note that each contaminant appears differently, but regardless of its appearance, the most critical areas to inspect are the core and cladding regions—as contamination in these regions can greatly affect the quality of the signal. Figure 7 illustrates the endface of different connectors that has been inspected with a video inspection probe.

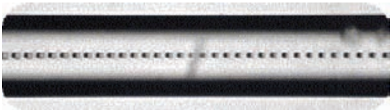

Figure 6. Effect of a fiber fuse on a fiber core

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Good practice for avoiding connector endface damage or contamination is to always keep a protective cap on the unused connector—thereby stressing the importance of storing unused protective caps in a sealed container to prevent contamination. When inserting the protective cap on a ferrule, do not insert it all the way since small dirt particles can accumulate at the bottom of the cap and if the bottom of a contaminated cap comes into contact with the connector endface, it can contaminate the connector endface. Note that outgassing from the manufacturing process of the dust cap can leave a residue of the mold release agent or materials in the cap. Therefore, the presence of a dust cap does not guarantee cleanliness; it is a protective device to prevent damage. Another interesting fact about test jumper and connectors, which you take right out of the sealed bag from the supplier, is that they are not always clean before sealing of the bag and therefore will be dirty. Fortunately, using the proper cleaning tools and cleaning procedures can effectively clean a soiled connector.

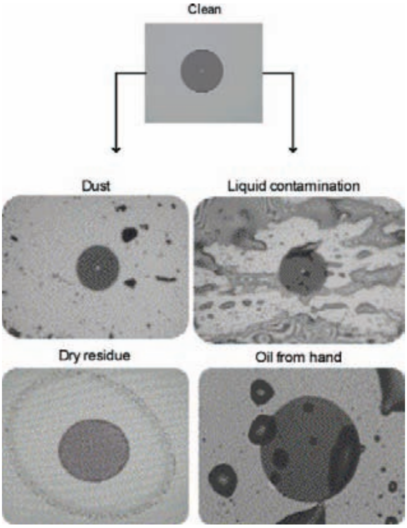

Figure 7: Clean connector endface vs. endfaces contaminated with different materials

The Cleaning Phase

A reliable network begins with connector care and cleaning. Through the years, many devices and procedures have been used. In the past, the way a connector was cleaned did not affect performance, but nowadays with fiber-optic network demands increasing to meet consumer expectations of services, the way the connector is cleaned is vital. Therefore, before connecting a connector, it is essential to make sure that it is clean and exempt of defects. To ensure connector cleanliness, the connector must first be inspected with either a fiber-optic microscope or a video inspection probe and cleaned if necessary.

Note: Always inspect a connector before cleaning—inspection may reveal that the connector does not need to be cleaned.

There exist various approaches for cleaning connectors, but for the purpose of this document, the three cleaning procedures that are the most commonly used in the industry will be discussed: dry cleaning, wet cleaning and hybrid combination cleaning.

Advantages	Disadvantages
› Convenience of readily available tools › Fast and easy	› Can possibly create electrostatic charges › Not effective in removing all contaminant types › Possible cost consideration

Table 3. Advantages and disadvantages of using the dry cleaning method

There are different types of dry cleaning tools on the market that are made of various materials and that come in a variety of shapes, depending on the type of connector to clean. Table 4 below lists the most popular and affordable tools used in the dry cleaning method:

Dry Cleaning	Application	Image
Lint-free swabs	Bulkhead, receptacles and patchcord endfaces	
Lint-free wipes	Pigtails and patchcord endfaces	
Compressed gas dusters	Pigtails and patchcord endfaces	
Specialized lint-free wipes	Pigtails and patchcord endfaces	
Cartridge (ReelCleaner/CLETOP)	Pigtails and patchcord endfaces	
Specialized cleaner	Bulkhead, receptacles and patchcord endfaces	

Table 4. Dry cleaning tools

THE WET CLEANING METHOD

One of the main active elements of the wet cleaning method is the solvent used and selecting the right one, along with an effective and reliable drying is essential for effective wet cleaning. The main purpose of using the wet cleaning method is to raise dust and contaminants from the connector's endface, which avoids scratching the connector. The most widely-known solvent in the industry is the 99.9 % isopropyl alcohol (IPA), which is effective for removing a large majority of the contaminants; yet some of them—such as matching gel and most lubricants—are quite resistant and can leave soil residue.

Advantages	Disadvantages
› Can dissolve complex soils and contaminants › Eliminates the accumulation of electrostatic charge on the ferrule	› Can leave residue on the ferrule when too much solvent is used and not properly dried › Solvent choice can be confusing with issues of performance and EH&S

Table 5. Advantages and disadvantages of using the wet cleaning method

Table 6 below shows the various tools available for the wet cleaning method:

Dry Cleaning	Application	Image
Pen style container	Connector endface cleaning	
Pre-saturated wipes IPA wipers	Connector endface cleaning	
Precision solvents	Connector endface cleaning in combination with an integrated drying procedure	

Table 6: Wet cleaning tools

THE HYBRID CLEANING METHOD

Hybrid cleaning (also called “combination cleaning”) is a mix of wet and dry cleaning methods. The first step in hybrid cleaning is to clean the connector endface by using a solvent and then to dry any remaining residue with either a wipe or a swab, depending on the type of connector being cleaned.

Advantages	Disadvantages
› Cleans all soil types › Reduces potential of static field soil accumulation › Automatically dries moisture and solvent used in the cleaning process › Captures soil in wiping material as an integrated aspect of cleaning procedure › Not expensive	› Requires multiple products and re-training of existing procedures

Table 7. Advantages and disadvantages of using the hybrid cleaning method

Cleaning the connector endface using the hybrid technique:

1. Pull a wipe from the specialized wipe container (SWC).

2. Spray a small amount of specialized solvent on the wipe.

3. Place the endface in the wet portion of the wipe. For a standard polished endface (UPC), hold the endface at 90° perpendicular to the SWC platen. Tilt the container or endface to find the angle on the angled polish connector (APC).

4. In a smooth linear motion, trace the endface lightly over the platen from the wet section to the dry area without picking up the connector. Do not press too hard and do not perform the cleaning procedure over the same area. It is recommended to repeat this step three times.

5. Using a video inspection probe or other inspection device, inspect the connector endface to make sure there is no solvent residue or remaining contamination.

Figure 8. Cleaning procedure

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CONCLUSION

There are a number of reasons to be excited about by what is going on technologically in the optical telecommunication world. With the advent of 40 Gbit/s transmission and even faster in the near future, numerous challenges will be faced. However, it should never be overlooked that what may seem as a trivial task—ensuring that connectors are clean before connecting—may represent one of the most difficult challenges in the field. In light of this, it is important that connectors receive proper maintenance and that the cleaning procedures are respected to avoid network failure.

Appendix 1—Cleaning Procedure

Figure 9 below, illustrates the step-by-step inspection/cleaning procedure that should be rigorously followed before a fiber is connected to another optical component—using this simple procedure can avoid costly network downtime.

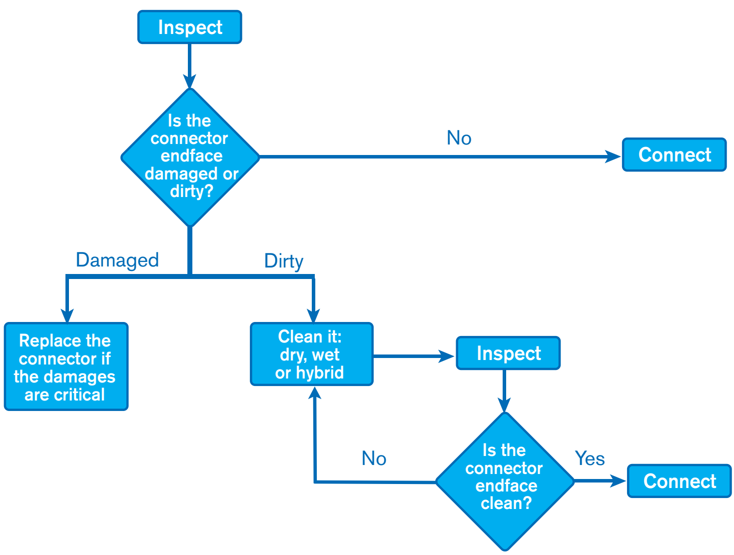

Figure 9. Connector inspection and cleaning procedure

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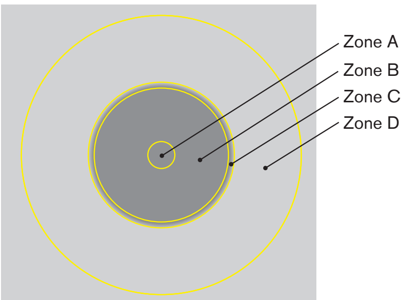
Appendix 2 — IEC 61300-3-35 and IPC 8497-1 Standards

CONNECTOR ENDFACE CRITERIA ARE DEFINED INTO DIFFERENT ZONES



Zones	Singlemode (µm)	Multimode (µm)
A: Core	0-25	0-65
B: Cladding	25-120	65-120
C: Adhesive	120-130	120-130
D: Contact	130-250	130-250

Appendix 3 — IEC 61300-3-35 and IPC 8497-1 Standards

EACH ZONE HAVE A DIFFERENT TOLERANCE

Here's an example for PC polished connectors, singlemode fiber, return loss ≥45 dB

Zones	Scratches	Defects
A: core (0 µm to 25 µm)	None	None
B: cladding (25 µm to 120 µm)	No limit ≤3 µm None >3 µm	No limit <2 µm Five from 2 µm to 5 µm None >5 µm
C: adhesive (120 µm to 130 µm)	No limit	No limit
D: contact (130 µm to 250 µm)	No limit	None ≥10 µm

IEC 61300-3-35 STANDARD:

› Singlemode, UPC connector, return loss of 45 dB: single and multiple fibers
› Singlemode, UPC connector, return loss of 26 dB: single and multiple fibers
› Multimode, UPC connector: single and multiple fibers
› Singlemode, angled connector: single and multiple fibers

IPC 8497-1 STANDARDS:

› Singlemode, new UPC connector: single and multiple fibers
› Singlemode, field UPC connector: single and multiple fibers
› Multimode, UPC connector: single and multiple fibers

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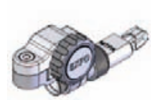
Appendix 4—Tips

Model	Description	Tip
FIPT-400-Adapter	Adapter tip (to attach any Westover probe tip to EXFO's probe)	
FIPT-400-D4	D4 tip for bulkhead adapter	
FIPT-400-E2000	E-2000 tip for bulkhead adapter	
FIPT-400-E2000-APC	E2000 APC tip for bulkhead adapters	
FIPT-400-FC-SC	FC and SC tip for bulkhead adapter	
FIPT-400-FC-SC-APC	FC and SC APC tip for bulkhead adapter	
FIPT-400-LEMO	Lemo bulkhead adapter	
FIPT-400-LC	LC tip for bulkhead adapters	
FIPT-400-LC-A6	LC angled tip for bulkhead adapters (60°)	
FIPT-400-LC-APC	LC/APC tip for bulkhead adapter	

Model	Description	Tip
FIPT-400-LX5-APC	LX.5/APC tip for bulkhead adapter	
FIPT-400-MTP2	MTP tip for bulkhead adapter (extended, reversible)	
FIPT-400-MTP2-TIP	MTP tip for bulkhead adapter (extended, reversible)	
FIPT-400-MTPA2	MTP/APC tip for bulkhead adapter (extended, reversible)	
FIPT-400-MTPA-TIP	MTPA tip for bulkhead adapter (extended)	
FIPT-400-MTP2-K	MTP, APC and UPC tip for bulkhead adapter (extended, reversible)	
FIPT-400-MU	MU tip for bulkhead adapters	
FIPT-400-MU-L	Extended MU tip for PC bulkhead adapter	
FIPT-400-OTAP-APC	OptiTap™ bulkhead adapter	
FIPT-400-OTIP-MT-APC	MT/APC type OptiTip™ multifiber adapter for male and female connectors; comes into a kit compatible with male and female cable ends	

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Model	Description	Tip
FIPT-400-OTIP-MT-APC/M	Male adapter tube for FIPT-400-OTIP-MT-APC tip	
FIPT-400-FC-SC-A6	FC and SC angled tip for bulkhead adapters, 60 degree	
FIPT-400-SC-L	Extended SC tip for PC bulkhead adapter	
FIPT-400-ST	ST tip for bulkhead adapter	
FIPT-400-U12M	Universal patchcord tip for 1.25 mm ferrules	
FIPT-400-U12MA	Universal patchcord tip for 1.25 mm APC ferrules	
FIPT-400-U20M2	Universal patchcord tip for 2.0 mm ferrules (D4, Lemo)	
FIPT-400-U25M	Universal patchcord tip for 2.5 mm ferrules	
FIPT-400-U25MA	Universal patchcord tip for 2.5 mm APC ferrules	
FIPT-400-SMA	SMA tips for bulkhead connector	

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Model	Description	Tip
FIPT-400-SMAM	SMA tip for male connector	
FIPT-400-LX.5	LX.5 PC tip for bulkhead connector	
FIPT-400-U16M	Universal 1.6 PC tip for male connector	
FIPT-400-MTRJ	MTRJ tip for MTRJ bulkhead	
FIPT-400-SC-APC-L	SC angled, extended tip for bulkhead connector	
FIPT-400-AD-P5	Adapter tip (allows the user to attach EXFO's FIP-400 probe tips to the old Westover probe)	

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EXFO Corporate Headquarters > 400 Godin Avenue, Quebec City (Quebec) G1M 2K2 CANADA | Tel.: +1 418 683-0211 | Fax: +1 418 683-2170 | info@EXFO.com

Toll-free: +1 800 663-3936 (USA and Canada) | www.EXFO.com

EXFO America	3701 Plano Parkway, Suite 160	Plano, TX 75075 USA	Tel.: +1 800 663-3936	Fax: +1 972 836-0164
EXFO Asia	151 Chin Swee Road, #03-29 Manhattan House	SINGAPORE 169876	Tel.: +65 6333 8241	Fax: +65 6333 8242
EXFO China	36 North, 3rd Ring Road East, Dongcheng District Room 1207, Tower C, Global Trade Center	Beijing 100013 P. R. CHINA	Tel.: + 86 10 5825 7755	Fax: +86 10 5825 7722
EXFO Europe	Omega Enterprise Park, Electron Way	Chandlers Ford, Hampshire S053 4SE ENGLAND	Tel.: +44 2380 246810	Fax: +44 2380 246801
EXFO NetHawk	Elektroniikkatie 2	FI-90590 Oulu, FINLAND	Tel.: +358 (0)403 010 300	Fax: +358 (0)8 564 5203
EXFO Service Assurance	270 Billerica Road	Chelmsford, MA 01824 USA	Tel.: +1 978 367-5600	Fax: +1 978 367-5700