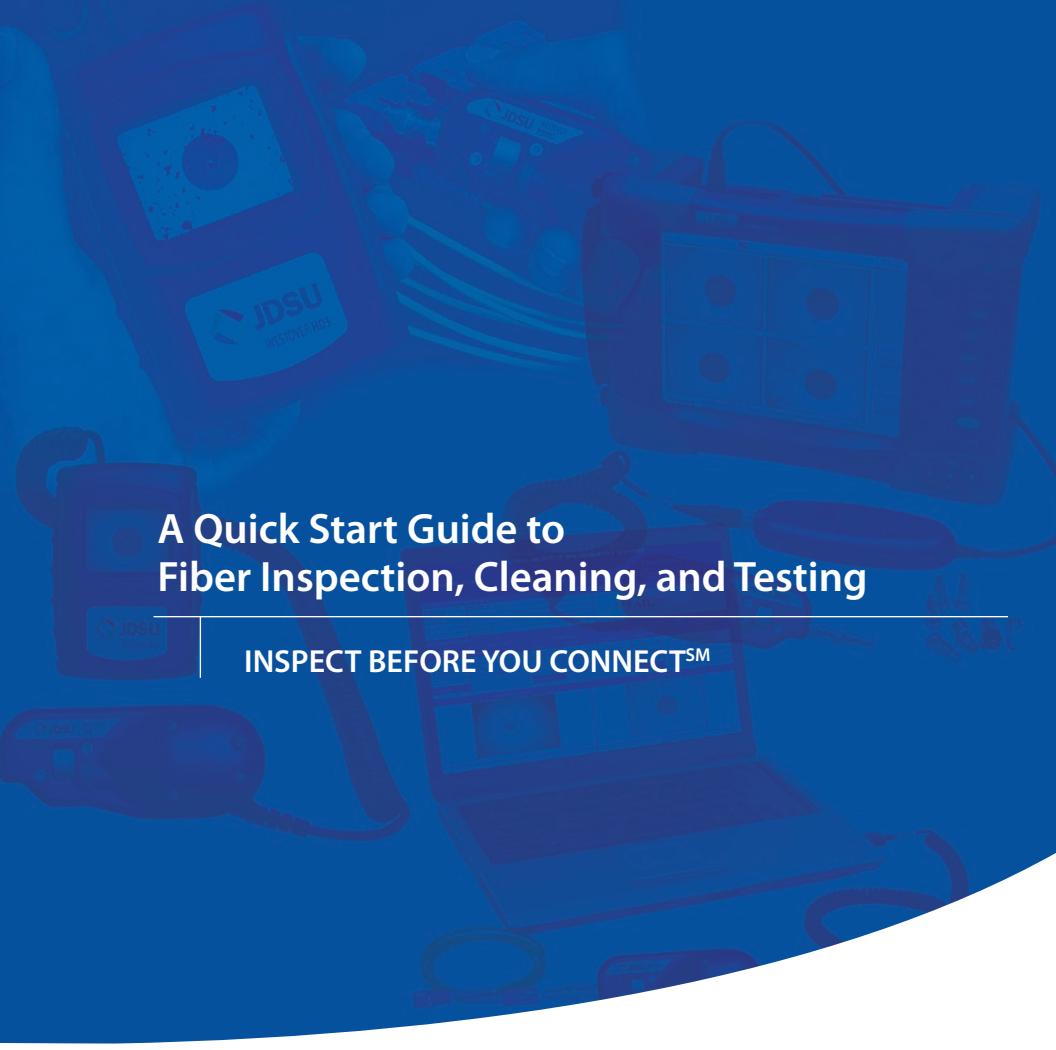

A Quick Start Guide to Fiber Inspection, Cleaning, and Testing

INSPECT BEFORE YOU CONNECT℠

JDSU

NOTICE

Every effort was made to ensure that the information in this document was accurate at the time of printing. However, information is subject to change without notice, and JDSU reserves the right to provide an addendum to this document with information not available at the time that this document was created.

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TESTED EQUIPMENT

All pre-qualification tests were performed internally at JDSU, while all final tests were performed externally at an independent, accredited laboratory. This external testing guarantees the unerring objectivity and authoritative compliance of all test results. JDSU's Commerce and Government Entities (CAGE) code under the North Atlantic Treaty Organization (NATO) is 0L8C3.

FCC INFORMATION

Electronic test equipment is exempt from Part 15 compliance (FCC) in the United States.

EUROPEAN UNION

Electronic test equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment. This unit has been tested and found to comply with the limits for a Class A digital device.

INDEPENDENT LABORATORY TESTING

This unit has undergone extensive testing according to the European Union Directive and Standards.

PROCESS PROCEDURES

The fiber inspection, cleaning and testing procedures documented in this manual are recommendations made by JDSU. Please reference your company's process documents for standard tools and methods for your specific application.

CONTENTS

INTRODUCTION TO FIBER INSPECTION

INSPECT BEFORE YOU CONNECT℠

CONTAMINATION IS THE #1 SOURCE OF TROUBLESHOOTING in optical networks. A single particle mated into the core of a fiber can cause significant back reflection, insertion loss, and equipment damage. Visual inspection is the only way to determine if fiber connectors are truly clean before mating them.

The JDSU video fiber inspection probe and handheld display system is used to quickly and easily inspect connector end faces, which ultimately minimizes signal loss and optimizes test conditions. WESTOVER FBP series video probes, available in digital or analog and single- or dual-magnification (200/400X), are high-performance handheld microscopes designed for inspecting both "female" (bulkhead) and "male" (patch cord) connectors, as well as other optical devices. The probe microscope can also be combined with a USB converter module to inspect connectors via compatible test platforms and PC/laptop. This versatile system offers a wide range of configurable solutions that can meet the demands of any application.

JDSU's precision, stainless-steel fiber inspection tips and adapters are carefully engineered to produce consistent and accurate inspection. These inspection tips are interchangeable and designed with a unique optics architecture, that enables the probe to interface with every connector and application in your network.

SIMPLE SOLUTION

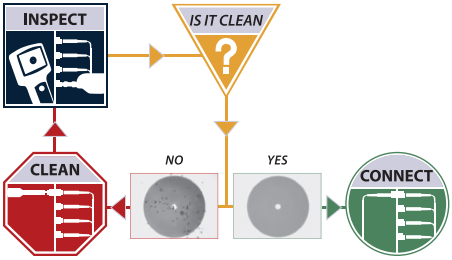
By implementing a **SIMPLE *yet* IMPORTANT** process of proactively inspecting and cleaning before mating, you can prevent poor signal performance and equipment damage.

PROACTIVE INSPECTION

By **PROACTIVELY INSPECTING** your fiber optic connectors, you will...

- **Reduce Network Downtime**
- **Reduce Troubleshooting**
- **Optimize Signal Performance**
- **Prevent Network Damage**

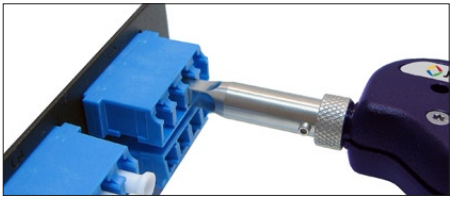
INSPECT BEFORE YOU CONNECT℠

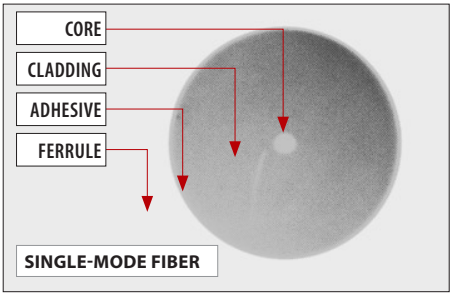


INSPECT

BULKHEAD

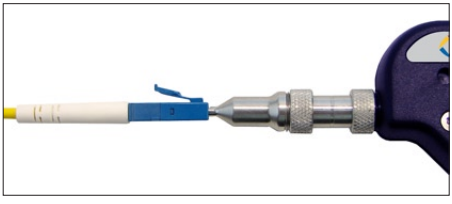
1. Select the appropriate bulkhead inspection tip that corresponds to the connector type and install on microscope.
2. Insert the scope into the bulkhead to inspect.
3. Determine whether **CLEAN** or **DIRTY**.
   - **IF CLEAN,** DO NOT TOUCH IT and **CONNECT.**
   - **IF DIRTY,** and cleaning is required, **CLEAN.**





PATCH CORD

1. Select the appropriate patch cord inspection tip that corresponds to the connector type and install on microscope.
2. Attach the patch cord connector to the microscope.
3. Determine whether **CLEAN** or **DIRTY**.
   - **IF CLEAN,** DO NOT TOUCH IT and **CONNECT.**
   - **IF DIRTY,** and cleaning is required, **CLEAN.**



IS IT CLEAN?

DIRT IS EVERYWHERE, and a typical dust particle (2–15µ in diameter) can significantly affect signal performance and cause permanent damage to the fiber end face. Most field test failures can be attributed to dirty connectors, and most connectors are not inspected until the problem is detected, AFTER permanent damage has already occurred.

ZONES & ACCEPTANCE CRITERIA

ZONES are a series of concentric circles that identify areas of interest on the connector end face. The innermost zones are more sensitive to contamination than the outer zones.

ACCEPTANCE CRITERIA are a series of failure thresholds that define contamination limits for each zone.

GRADING PROCESS

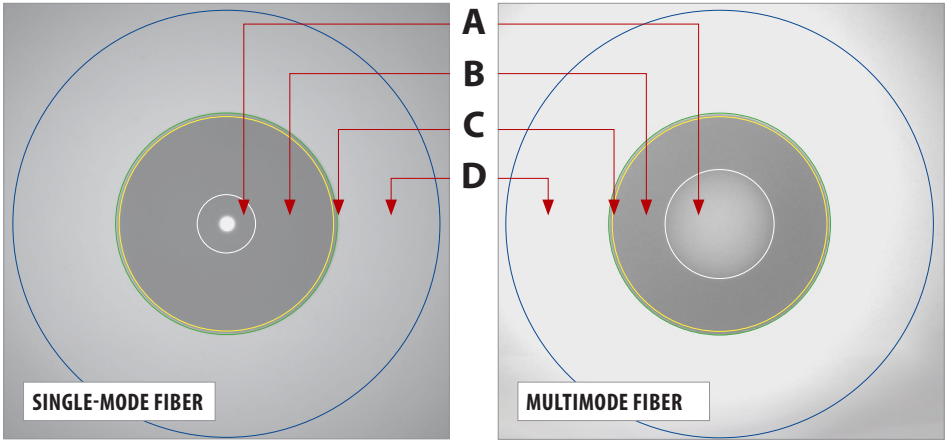
1. Count/measure the particles/contamination that are on the fiber surface.
2. Estimate or use a grading overlay to **GRADE** the fiber by determining the number and size of each particle that are present in each of the 4 fiber zones.

NOTE: In most cases, there are **no limits** to the number/size of contamination present on **ZONE C** (Adhesive/Epoxy).*

- **IF ACCEPTABLE,** DO NOT TOUCH IT and **CONNECT.**
- **IF NOT ACCEPTABLE, CLEAN.**

A. CORE ZONE
B. CLADDING ZONE
C. ADHESIVE / EPOXY ZONE*
D. CONTACT / FERRULE ZONE

ZONES OVERLAYS



ACCEPTANCE CRITERIA

The tables below list the **ACCEPTANCE CRITERIA** standardized by the **International Electrotechnical Commission (IEC)** for single-mode and multimode connectors as documented in *IEC 61300-3-35 Ed. 1.0*.

SINGLE-MODE CONNECTORS

ZONE NAME (Diameter)	**SCRATCHES**	**DEFECTS**
A. CORE Zone (0–25µm)	none	none
B. CLADDING Zone (25–120µm)	no limit <= 3µm none > 3µm	no limit < 2µm 5 from 2–5µm none > 5µm
C. ADHESIVE Zone (120–130µm)	no limit	no limit
D. CONTACT Zone (130–250µm)	no limit	none => 10µm

MULTIMODE CONNECTORS

ZONE NAME (Diameter)	**SCRATCHES**	**DEFECTS**
A. CORE Zone (0–65µm)	no limit <= 5µm 0 > 5µm	4 <= 5µm none > 5µm
B. CLADDING Zone (65–120µm)	no limit <= 5µm 0 > 5µm	no limit < 2µm 5 from 2–5µm none > 5µm
C. ADHESIVE Zone (120–130µm)	no limit	no limit
D. CONTACT Zone (130–250µm)	no limit	none => 10µm

CLEAN: BULKHEAD

IBC™ CLEANER

1. Select the appropriate cleaning tool for the connector type.

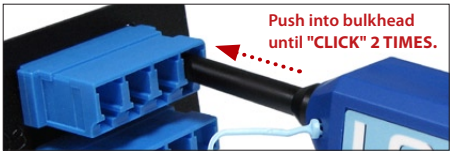
2. Pull off the **GUIDE CAP**.

DRY CLEAN

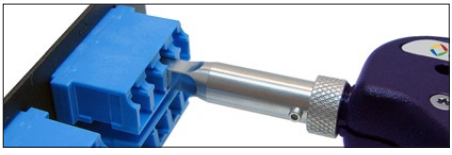
REPEAT STEPS 3, 4, AND 5 IF NECESSARY

3. Insert the cleaning tool into the bulkhead adapter and **PUSH THE TOOL INTO THE BULKHEAD UNTIL "CLICK" 2 TIMES.**

NOTE: *For hard-to-reach places, push the* ***NOZZLE EXTENDER LOCK*** *and pull the* ***NOZZLE*** *out.*



4. **INSPECT**



5. Determine whether **CLEAN or DIRTY**.

- **IF CLEAN,** DO NOT TOUCH IT and **CONNECT.**
- **IF DIRTY,** either repeat **DRY** cleaning ***OR*** go to **WET→DRY** cleaning.

WET → DRY CLEAN

6. Apply fiber optic cleaning solution onto a clean fiber wipe.

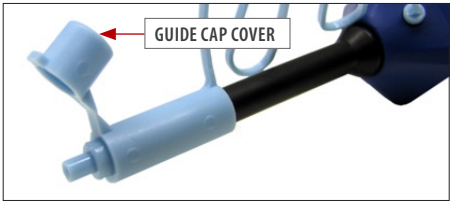
7. Dab the cleaning tool onto the wet area of the wipe to moisten the cleaning tip, then **GO TO STEP 3.**

CLEAN: PATCH CORD

IBC™ CLEANER

1. Select the appropriate cleaning tool for the connector type.

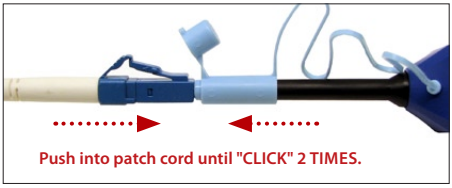
2. Pull off the **GUIDE CAP COVER**.



DRY CLEAN

REPEAT STEPS 3, 4, AND 5 IF NECESSARY

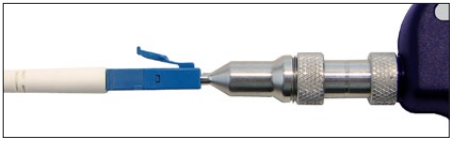
3. Attach the cleaning tool to the connector and **PUSH THE TOOL INTO THE PATCH CORD UNTIL "CLICK" 2 TIMES.**



4. **INSPECT**

5. Determine whether **CLEAN or DIRTY**.

- **IF CLEAN,** DO NOT TOUCH IT and **CONNECT**.
- **IF DIRTY,** either repeat **DRY** cleaning ***OR*** proceed to **WET→DRY** cleaning.



WET → DRY CLEAN

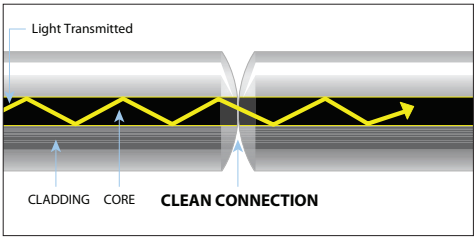
6. Apply fiber optic cleaning solution onto a clean fiber wipe.

7. Wipe the end of the fiber connector on the wet area of the wipe, then **GO TO STEP 3.**

GOOD FIBER CONNECTION

There are **3 BASIC PRINCIPLES** that are critical to achieving an efficient fiber optic connection:

1. **PERFECT CORE ALIGNMENT**
2. **PHYSICAL CONTACT**
3. **PRISTINE CONNECTOR INTERFACE**



Today's connector design and production techniques have eliminated most of the challenges to achieving **CORE ALIGNMENT** and **PHYSICAL CONTACT.**

What remains challenging is maintaining a **PRISTINE END FACE.** As a result, **CONTAMINATION IS THE #1 SOURCE OF TROUBLESHOOTING** in optical networks.

FIBER CONNECTIONS

Optical connections are made for one of two reasons:

1. **COMPLETING A SYSTEM LIGHT PATH (Tx to Rx)**

   Connectors are used extensively throughout optical networks. They give us the ability to reconfigure the network and provision services. If contamination is present in the light path, system performance will be degraded.

   Always **INSPECT,** and if necessary, **CLEAN** the optical port and optical cable for contamination before connecting.

2. **CONNECTING A TEST DEVICE TO PART OF THE SYSTEM**

   Test devices are frequently connected and disconnected to elements of the network. Often, test leads are systematically connected to each port in a network element in sequence. This duty cycle makes test leads especially prone to contamination and damage. If a test lead is contaminated, it can quickly spread that contamination through a large portion of the network.

   Always **INSPECT,** and if necessary, **CLEAN** the network port and test lead for contamination before connecting.

TEST

JDSU power meters are pocket-sized optical devices used for quick, easy, and convenient field measurement of optical power and attenuation in fiber networks. They can be used on their own for simple output tests, or with a light source for insertion loss measurements.

JDSU optical light sources are designed for dual-wavelength measurement in various single-mode or multimode applications alongside JDSU power meters.

LASER RADIATION
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS
CLASS 1M LASER PRODUCT

CAUTION!

This radiation can cause irreparable damage to the retina if you do not exercise caution.

OPTICAL POWER METER (OLP)

- 1.25mm Universal Push-Pull (UPP) or 2.5mm UPP Port for All Optical Connectors
- LCD - Displays Optical Power, dBm/dB & Wavelength
- 3-Button Keypad Operation
- Dust & Shock Protection
- 2 "AA" Batteries or NiCd/ NiMH Cells

OPTICAL LIGHT SOURCE (OLS)

- Single-mode or Multimode Ports
- LCD - Displays Wavelengths & Type of Modulation
- 3-Button Keypad Operation
- Dust & Shock Protection
- 2 "AA" Batteries or NiCd/ NiMH Cells

- **SHORT KEY PRESS**
  Switches between absolute and relative power level display
- **LONG KEY PRESS**
  Stores a reference power level

- Sets the calibrated wavelength; four (five) possible wavelengths. Additionally from series F on: Activates auto wavelength detection.

- **SHORT KEY PRESS**
  Brief operating mode
- **LONG KEY PRESS**
  Permanent operating mode

TEST: POWER MEASUREMENT

ABSOLUTE & RELATIVE POWER

Optical power meters can be used to take two types of measurements: **ABSOLUTE POWER** and **RELATIVE POWER.**

The **ABSOLUTE POWER LEVEL** *(system power measurement)* is the amount of optical power present in the system, measured in **dBm.** The source of this power is the transmitter or transceiver sending information through the system. This test is often performed to determine if the signal has enough power to operate the receiver or transceiver at the end of the link.

The **RELATIVE POWER LEVEL** *(attenuation measurement)* is the amount of power lost *(attenuated)* by the optical link being tested, measured in **dB.** The source of this power is typically a handheld optical light source. This test is often performed to determine if the optical link is constructed properly, either as a qualification test or when troubleshooting the network.

SYSTEM POWER MEASUREMENT

1. Select the connector you are testing and disconnect from the system.

2. **INSPECT** *if necessary* → **CLEAN** both ends of the **TEST LEAD** fiber.

3. Connect the **TEST LEAD** connector to the power meter **(OLP)** and to the system.

4. Press 

to turn the OLP **ON.**

5. Press 

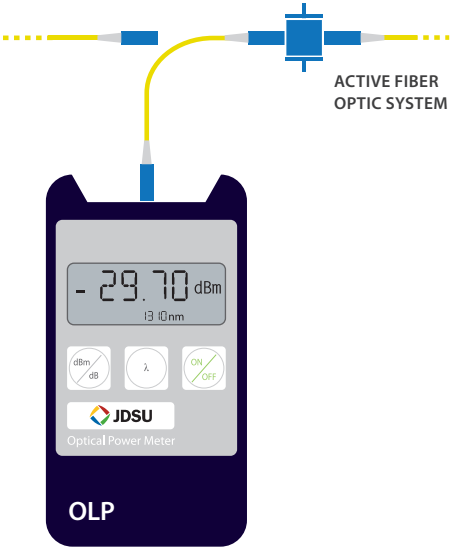
to select wavelength.

6. Press 

to select **"dBm."**

7. The optical power measurement is displayed on the **OLP.**

8. **INSPECT** *if necessary* → **CLEAN** the disconnected end and **CONNECT.**



TEST: REFERENCE MEASUREMENT

ATTENUATION MEASUREMENT

Acquiring **ATTENUATION MEASUREMENTS** *(optical link loss)* on optical components or fiber optic links *(e.g., fiber connectors, cable assemblies, installed fiber optic links)* is done by measuring the relative power level (dB) at the far end of the link or device under test.

TO MEASURE ATTENUATION, you must:

1. **GET A REFERENCE MEASUREMENT** *(page 13)*
2. **GET ATTENUATION MEASUREMENT** *(page 14)*

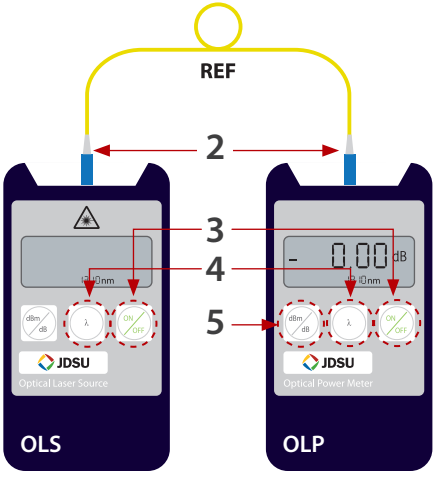
NOTE: *Loss testing of **SINGLE-MODE** fiber links is specified in ANSI/TIA/EIA-526-7 and ISO/IEC-TR-14763-3. Loss testing of **MULTIMODE** fiber links is specified in ANSI/TIA/EIA-526-14A and ISO/IEC-TR-14763-3.*

1. REFERENCE MEASUREMENT

1. **INSPECT** *if necessary* **CLEAN** both ends of the **REFERENCE** fiber.
2. Connect the optical laser source **(OLS)** to the power meter **(OLP)** using the **REFERENCE** fiber.
3. Press ON/OFF to turn both devices **ON.**
4. Press λ to select wavelength.
5. Press and hold dBm/dB until the screen until a reference level of **0.00 dB** is displayed.

NOTE: **REF** *flashes briefly to indicate that the reference level was saved.*

NOTE: **DO NOT** *disconnect the* **REFERENCE** *fiber from the* **OLS.**



2. ATTENUATION MEASUREMENT

1. Disconnect the **REFERENCE** fiber from the **OLP** side.

NOTE: **DO NOT** *disconnect the* **REFERENCE** *fiber from the* **OLS.**

2. **INSPECT** *if necessary* → **CLEAN** the **REFERENCE** fiber and the system port.

3. Connect the **REFERENCE** fiber to the system port.

4. **INSPECT** *if necessary* → **CLEAN** the fiber at the far end of the optical link.

5. Connect the **OLP** at the far end of the optical link.

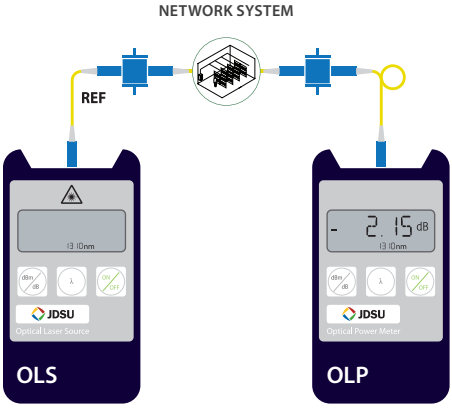
6. Press 

to turn both devices **ON.**

7. Press 

to select wavelength.

8. The attenuation *(insertion loss)* of the optical link is displayed on the **OLP.**



LCD INDICATORS	
REF	Reference level transfer
BAT	Batteries discharged
LO	Too low for power level range
HI	Too high for power level range
dBm	Absolute power level unit
dB	Relative power level unit
PERM	Permanent operating mode

APPENDIX: JDSU VIDEO PROBE MICROSCOPES

DIGITAL VIDEO PROBE

JDSU's **WESTOVER P5000** digital probe microscope connects directly to PC/laptops via a USB 2.0 connection, and operates with **FIBERCHEK2™**, an advanced software that determines the acceptability of optical fiber end faces through advanced automated inspection and analysis.

USB 2.0 connection to PC/laptop

ANALOG VIDEO PROBE

JDSU's **WESTOVER FBP and FBE** analog probe microscopes connect directly to **WESTOVER HD DISPLAYS** *(HD1, HD2 or HD3)* or to a PC/laptop or JDSU test platform *(T-BERD/MTS or FST)* via a **USB ANALOG TO DIGITAL CONVERTER**.

with HD Series displays

with USB converter module

ZP-PKG-0453
REV 3

JDSU

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