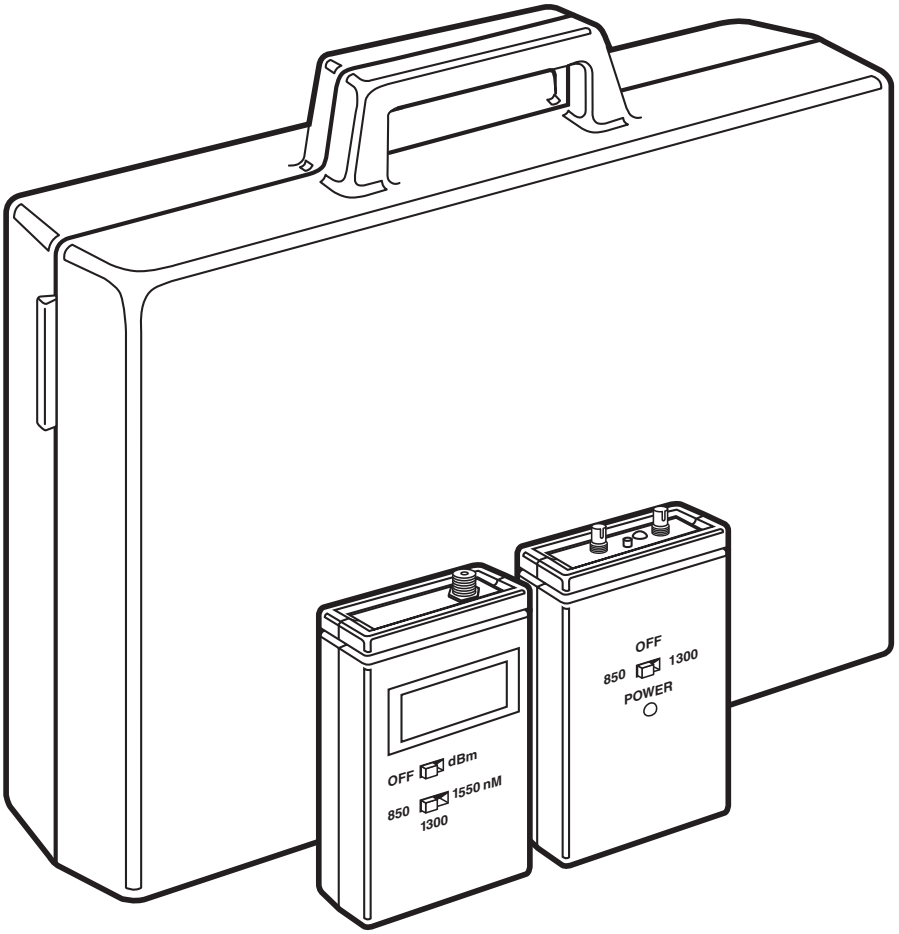
1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746

BLACK BOX®
NETWORK SERVICES

APRIL 1999
FT820A-R2

Fiber Optic Test Kit



CUSTOMER SUPPORT INFORMATION
Order **toll-free** in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
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NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El parato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS USED IN THIS MANUAL

Any trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

CONTENTS

1. Specifications

1.1 Mini Fiberoptic Power Meter

Resolution—0.1 dB

Accuracy—0.2 dB (NIST traceable)

Range— +3 to -55 dBm

Operating Temperature—32 to 122 °F (0 to 50 °C)

Power—9-V battery (120-hour life)

Size—4.3"H x 2.7"W x 1.3"D (11 x 7 x 3.3 cm)

Weight—6 oz. (170 g)

1.2 Mini Light Source

Power—9-V alkaline battery (8-hour life), AC adapter jack provided

Size—4.3"H x 2.7"W x 1.3"D (11 x 7 x 3.3 cm)

Weight—6 oz. (170 g)

2. Introduction

2.1 What's Included in the Package

The Fiber Optic Test Kit is a complete solution for fiberoptic installation, testing, and troubleshooting. It includes the following:

- Mini fiberoptic power meter, germanium, 850/1350/1550 dBm
- Mini light source, 850/1300 nm, LED, ST
- Accessory pack:

- Fiber Tracer
- ST adapter
- Texwipe alco pads
- Trim tool
- Carrying case
- Optical-loss calculator
- 9-V battery
- Plastic bags
- Accessory pouch

3. Operation

3.1 Meter

3.1.1 Off/dBm Selection

The meter has an Off/dBm selection switch located on the front panel of the instrument. When the switch is in the dBm position, the meter is on and ready for operation.

3.1.2 Calibration Wavelength Selection

The meter has a second front-panel switch that is used to select the calibration wavelength. Moving the switch will select one of the calibration wavelengths. The calibration wavelengths are shown next to the switch position on the front panel to prevent confusion.

3.1.3 Battery Condition/Replacement

The meter is powered by a 9-V battery, NEDA 1604 or equivalent. Internal circuitry monitors the battery voltage and provides a visible warning on the display when the battery needs replacement. The battery should be replaced as soon as possible after this warning since the meter accuracy will suffer if the battery voltage drops too low. The battery is in the compartment located on the rear of the unit. Take care when replacing the battery to prevent damage to the battery leads.

3.1.4 Calibration

The meter has been calibrated to NIST traceable standards at the wavelengths shown on the front-panel label next to the calibration selection switch. Calibration is not needed more than once a year. Calibration must be done by a NIST traceable calibration laboratory. Contact technical support for instructions.

3.2 Fiberoptic Source

The mini light source included in your package operates at 850 and 1300 nm using an LED.

3.2.1 Using the Power Switch

The Source has only two positions on the power switch: ON/OFF.

3.2.2 Wavelength Selection

All sources with multiple-wavelength outputs have a wavelength-selection switch. Choose the wavelength needed by following the front-panel indicators.

3.2.3 Source Output Power

A small trimpot is located on the right side of the instrument near the AC adapter input that allows setting the source power to a given value. Attach a launch cable to the source output, connect it to a power meter and set the power level with a small screwdriver. Setting the source to a known value will allow easier testing of loss, since the calculations of loss will be simpler. We recommend setting LED sources to -30 dBm.

3.2.4 Adapting to Various Fiberoptic Connectors

If you need to test cables with connector styles different from your fiberoptic light source—for example, an LED source with ST connectors to cables with SMA connectors—use a hybrid launch cable with an ST connector on the end to be connected to the source and an SMA connector on the end that mates to the cables being tested.

The Source is powered by a single 9-V battery, NEDA 1204 or equivalent. Internal circuitry monitors the battery voltage and lights an LED on the front panel. When the LED no longer lights, the battery needs to be replaced. The battery should be replaced as soon as possible after this warning, because the source accuracy will suffer if the battery drops too low.

The battery is in the compartment located at the rear of the unit. Take care when replacing the battery to prevent damage to the battery leads.

3.3 Fiber Tracer

Use the Fiber Tracer to check the continuity of cables and trace out cable connections. The Fiber Tracer can go as far as 2.5 miles (4 km).

3.3.1 Assembly

Remove the flashlight from the plastic packaging, attach the carrying strap to the light, and insert the battery. Push the circular end of the Tracer adapter onto the end of the flashlight. It's ready to use.

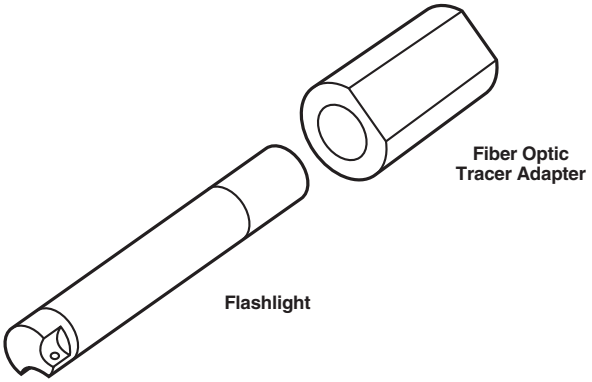

Figure 3-1. Tracer Assembly.

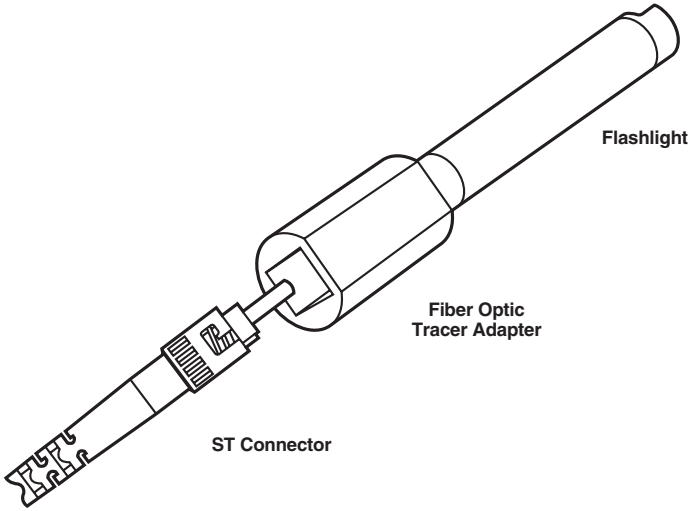

Figure 3-2. Tracer Use.

3.3.2 Power On/Off

To power on the Tracer, unscrew the connector adapter until the unit powers on. The light will be visible through the adapter, indicating that the unit is on. Screw it back in to turn the unit off.

3.3.3 Replacing the Battery and Bulb

The Fiber Tracer uses one AAA battery. To replace the battery, unscrew the base (opposite the connector adapter) and remove the battery. Replace with a fresh

battery. Alkaline batteries are preferred for longer life.

A spare bulb is included in the base of the Tracer. Unscrew the base, gently pull the spring out, and tip the base over to allow the spare bulb to fall out. Replace the base. Completely unscrew the connector adapter and the bulb will be visible. Pull it straight out and replace with the spare bulb. Screw the connector adapter back on and the unit is ready to use.

3.3.4 Connecting Cables to the Fiber Tracer

To connect a cable to the Fiber Tracer, insert the ST connector fully into the receptacle in the connector adapter (it's nylon, so it will not damage the connector).

3.3.5 Tracing Fibers

To trace fibers using the Fiber Tracer, connect the fiber to the output connector of the unit. The white light output will be visible to the eye at the other end of the fiber. This allows finding particular fibers in multifiber cables easily for proper connections during installation. With the low power output of the Fiber Tracer, there is no danger to the eye.

3.3.6 Continuity Testing

To test for continuity, attach the fiber to the Fiber Tracer. If light is visible at the far end, the fiber is not damaged.

3.3.7 Finding Splices and Splice Optimization

Optical splices, especially the mechanical type, will often be visible when light from the Tracer is being transmitted through the fiber. If the splice is close to the connector, such as when a pigtail is spliced to a cable, there is enough light to allow optimizing the splice. Adjust the positioning and/or rotation of the splices until the light from the splice is minimized, indicating maximum transmission or minimum loss.

3.4 Using the Optical Loss Calculator

The Optical Loss Calculator can be used to calculate loss or convert dBm into microwatts.

3.4.1 Calculating Loss

Set the transmitted power by rotating the disks until the source output from the launch cable measured by the meter shows at the pointer in the window on the top disk.

Find the received power (measured at the meter after the cable under test has been connected to the launch cable and meter) on the outer scale of the top disk.

Read the loss of the cable on the outer scale of the calculator.

3.4.2 Converting dBm to µW and µW to dBm

Rotate the top disk until the pointer in the window points to the power you want to convert. Read the converted value from the opposite side of the window.

3.5 Launch Cable Calibration Before Loss Measurements (Single- or Double-Ended)

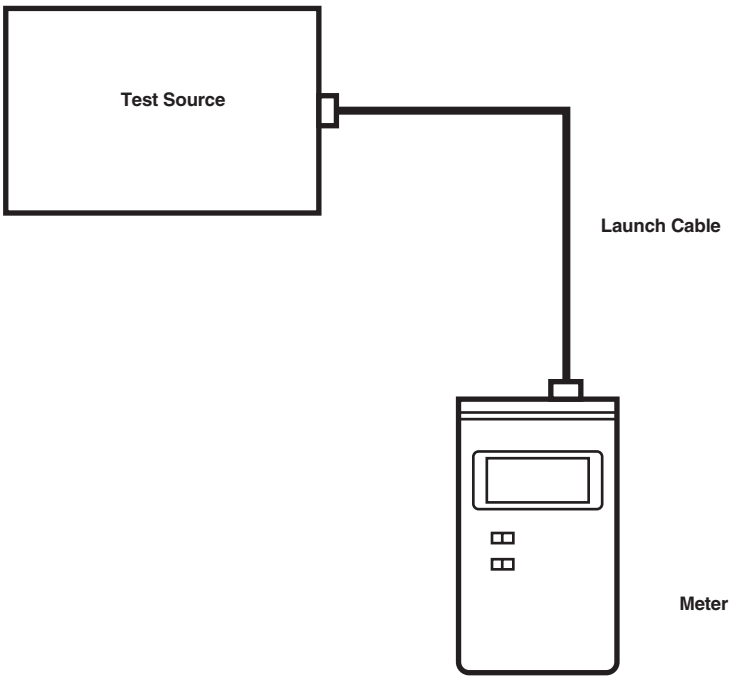

Figure 3-3. Test Setup.

Launch Power Calibration

1. Attach 1-meter launch cable to the fiberoptic source.
2. Select the source output port.
3. Connect the meter to the launch cable.
4. Adjust the power of the source until the meter reads -30 dBm for LED or -10 dBm for laser. This technique ensures that the reference level is known.
5. Write down the launch power values at each wavelength for later reference, in case the lauch cable changes or the source is changed.
6. The launch power calibration data is automatically stored for you, simplifying testing.

NOTE

We recommend that you test your launch cable using the single-ended method to make sure it is in good condition; otherwise, loss measurements may be in error.

3.6 Single Cable Testing (One-Way Loss)

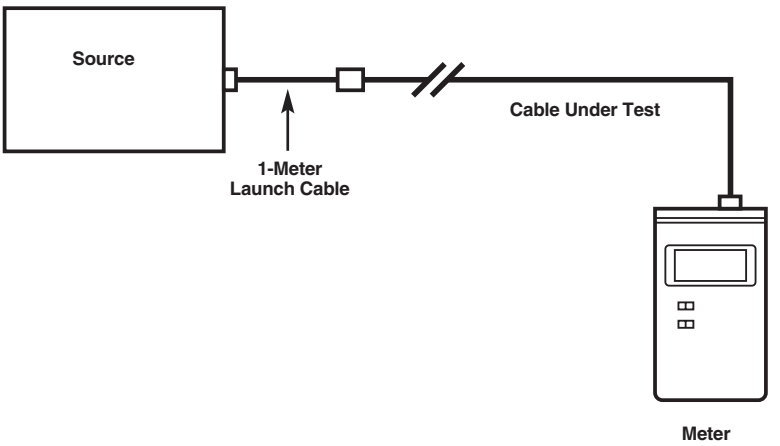

Figure 3-4. Single cable testing: one-way loss.

Test Procedure per FOTP-171

Launch Power Calibration

1. Attach 1-meter launch cable to the fiberoptic source.
2. Select the source output port.
3. Connect the meter to the launch cable.
4. Adjust the power of the source until the meter reads -30 dBm for LED. This technique ensures the reference level is known.

NOTE

We recommend that you test your launch cable using the single-ended method to make sure it is in good condition; otherwise, loss measurements may be in error.

Cable Testing

1. Connect the cable to be tested to the launch cable using splice bushing and meter.
2. Calculate optical loss in dB using the Optical Loss Calculator. The reading will be the optical loss of the cable, including the first connector.

Options

1. Repeat the test for both wavelengths if required by system specifications.
2. Use a known-good receive cable to test the connector on the launch cable.
3. Reverse the cable under test to test each connector separately.

Calculating Loss

Optical loss (dB)=Reference value (dBm) - Reading of cable under test (dBm)

Expected Measurement Results

Approximately 0.5 dB per connector plus a cable loss of 1 dB/km @ 1300 nm and 3 dB/km at 850 nm.

3.7 Single Cable Testing (Dual-Ended Test)

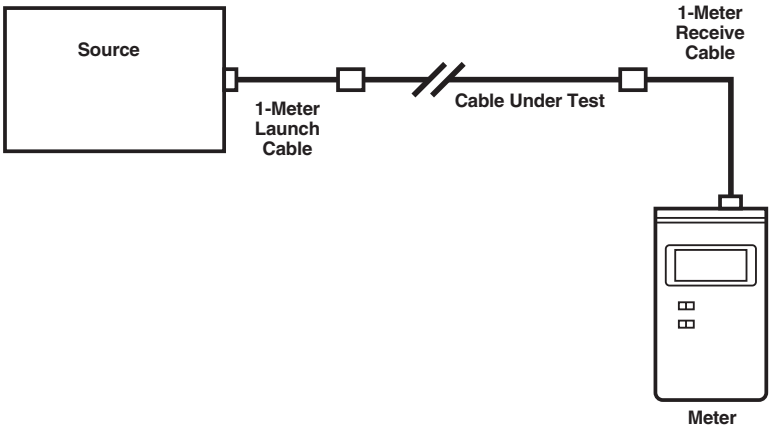

Figure 3-5. Single cable testing: dual-ended test.

Launch Power Calibration

1. Attach 1-meter launch cable to the fiberoptic source.
2. Select the source output port.
3. Connect the meter to the launch cable.
4. Adjust the power of the source until the meter reads -30 dBm.

NOTE

We recommend that you test your receive cable using the single-ended method to make sure it is in good condition; otherwise, loss measurements may be in error.

Cable Testing

1. Connect the cable to be tested to the launch cable using splice bushing.
2. Connect the receive cable from the meter to the cable under test with splice bushing.
3. Calculate the optical loss in dB. Reading will be the optical loss of the cable, including both connectors.

OPTIONS

Repeat the test for both wavelengths if required by system specifications.

CALCULATING LOSS

Optical loss (dB)=Reference value (dBm) - Reading of cable under test (dBm).

EXPECTED MEASUREMENT RESULTS

Approximately 0.5 dB per connector plus a cable loss of 1 dB/km at 1300 nm and 3 dB/km at 850 nm.

3.8 Duplex Cable Loss Test

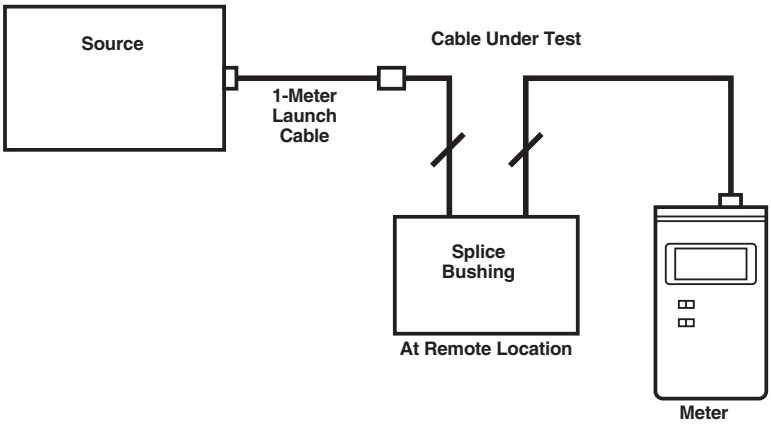

Figure 3-6. Duplex cable loss test.

TEST PROCEDURE: LAUNCH POWER CALIBRATION

1. Attach 1-meter launch cable to the fiberoptic source.
2. Select the source output port.
3. Connect the meter to the launch cable.
4. Adjust the power of the source until the meter reads -30 dBm. This technique ensures that the reference level is known.

Cable Testing

1. At the far end of the duplex cable to be tested, connect both connectors together using a splice bushing.
2. Remove the meter from the launch cable.
3. Using the splice bushing, attach the transmit end of the cable under test to the end of the launch cable.
4. Attach the meter to the receive end of the cable under test.
5. Calculate the optical loss in dB. This will be the “loopback loss” of the cable, equal to twice the cable one-way loss.
6. Test each cable separately to find the high-loss components.
7. Repeat the test for both wavelengths if required by system specifications.

Calculating Loss

Optical Loss (dB)=Reference value (dBm) - Reading of cable under test (dBm)

Expected Measurement Results

Approximately 0.5 dB per connector and a cable loss of 1 dB/km @ 1300 nm and 3 dB/km at 850 nm.

3.9 Measuring Transmitter Power Coupled into Fiber or Receiver Power

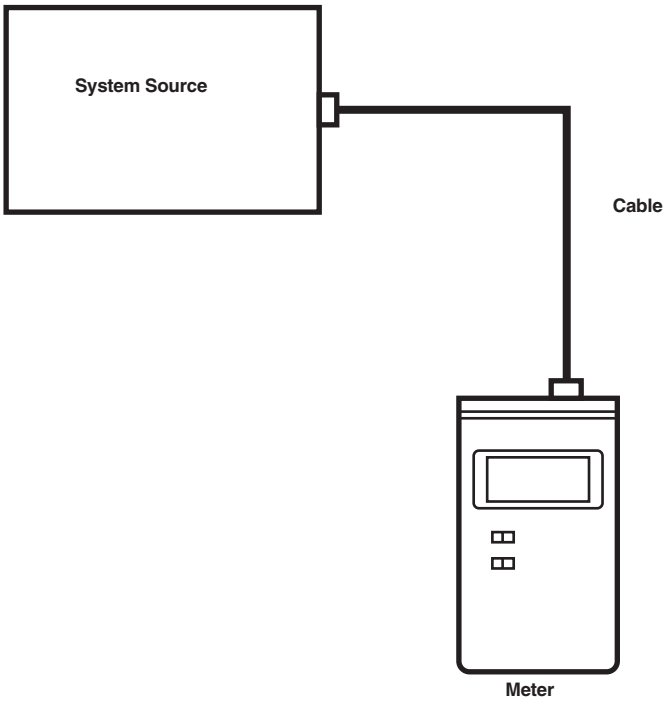

Figure 3-7. Measuring transmitter power coupled into fiber or receiver power.

TEST PROCEDURE: TRANSMITTER COUPLED POWER

1. Attach a 1-meter test cable, used as launch cable in cable tests, to the system transmitter.
2. Connect the meter to the other end of the test cable.
3. Check to see if the calibration wavelength set on the meter corresponds to the source wavelength.
4. Run system diagnostics to turn the transmitter on.
5. Read the optical power coupled into fiber on the meter display.

6. Refer to the system manual to determine the minimum acceptable coupled power.

TEST PROCEDURE: RECEIVER POWER

1. Disconnect the system cable from the receiver.
2. Connect the meter to the end of the system cable.
3. Check to see if the calibration wavelength set on the meter corresponds to the source wavelength.
4. Run system diagnostics to turn the transmitter on.
5. Read the optical power coupled into the fiber on the meter display.
6. Refer to the system manual to determine minimum acceptable receiver power.

TESTING HINTS

Follow the test procedures carefully. Our method for launch power may be different from procedures you have used before. We set the launch power "reference" level at specific power levels so if you replace a launch cable or source, you can reset to the same power level at a remote site. If you use whatever power level the source puts out when you start and set your zero only by the reference function on the meter, you can lose the reference power by hitting the reference button on the meter by accident or changing the launch cable. Then you have to bring the source and meter back together to set the reference, which is very difficult if they are miles apart. Our method allows you to return to the proper power level at any time.

Make certain your launch and receive cables are good. Before going out to a job site, test all your cables in the office to make absolutely certain they are good cables.

Clean your connectors regularly and inspect with a microscope for scratches and cracks.

4. Troubleshooting

- Symptom: Meter has no display—doesn't turn on.
- Possible Cause: Battery discharged.
- Check and Fix: Turn off, replace battery, or connect a 110-VAC adapter.

- Symptom: Source has no output; indicators do not light up.
- Possible Cause: Battery discharged.
- Check and Fix: Turn off, replace battery, or connect a 110-VAC adapter.

- Symptom: Power reads low while setting launch reference for loss testing.
- Possible Cause: Launch cable bad.
- Check and Fix: Use Fiber Tracer or visual light source to test launch cable.

- Symptom: Power reads low while setting launch reference for loss testing.
- Possible Cause: Source battery power low.
- Check and Fix: Check battery condition, power set control, modular adapter (try another).

- Symptom: All cables tested have high loss.
- Possible Cause: Launch and/or receive cable bad.
- Check and Fix: Test launch and receive cables with known good cable to see if its connectors are good, replace if necessary.

- Symptom: All cables tested have high loss.
- Possible Cause: Splice bushing connecting launch or receive cables to cable under test is worn out.
- Check and Fix: Replace with new splice bushing, preferably with ceramic or metal alignment sleeve.

- Symptom: Cable has different losses in each direction tested in single ended method.
- Possible Cause: Bad connector has higher loss when coupled to launch cable; meter has large area detector with 100% coupling.
- Repolish or replace connector with high loss.