



# SIMPLIFIBER™

## User Guide



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4/04

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# SIMPLIFIBER™

## User Guide

### ENGLISH

This guide describes how to use the SIMPLIFIBER meter and source to install, manage, and troubleshoot single-mode and multimode fiber cabling systems.

SIMPLIFIBER accurately measures power loss of single-mode and multimode fiber optic cabling.

It features automatic wavelength detection, storage of test results, and PC database support in an easy-to-use low cost design.

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# Chapter 1 - Introduction

## *The Simple Fiber Solution*

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Welcome to the family of fiber optic installation, test and diagnostic products.

SIMPLIFIBER is a high quality fiber optic cabling test tool for easy and rapid identification of failure points in a fiber network. It consists of two units: SIMPLIFIBER Meter and SIMPLIFIBER Source.

SIMPLIFIBER Meter, the optical power meter, and SIMPLIFIBER Source, the optical light source, address the challenges of installing, managing, and troubleshooting multimode and single-mode fiber cabling systems.

The SIMPLIFIBER 850/1300 Source provides a consistent dual wavelength light that allows you to quickly and accurately assess the performance of fiber optic transmission paths and equipment. It also supplies a modulated signal for use with fiber identifiers.

The SIMPLIFIBER Meter measures the power of light emerging from the fiber. By measuring optical power, SIMPLIFIBER Meter verifies the

proper installation and operations of fiber optic components, such as fiber optic hub modules, repeaters, and adapter cards.

SIMPLIFIBER also helps to identify faulty patch cables, failing splices, or bad couplers and connectors by measuring signal loss.

The SIMPLIFIBER Meter can be used with any source operating at 850, 1300, 1310, or 1550.

The SIMPLIFIBER 850/1300, 1310, or 1550 Source can be used with any power meter.

A hinged cover protects the units connector(s). It also allows the units to be propped up during use.

### *The SIMPLIFIBER Kit*

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The SIMPLIFIBER kit contains the SIMPLIFIBER Meter and SIMPLIFIBER 850/1300 Source units. The kit includes the optical cleaning supplies that are needed to keep fiber connectors and adapters free from contamination.

The SIMPLIFIBER kit contains:

- SIMPLIFIBER Meter
  - SIMPLIFIBER 850/1300 Source
  - ST or SC connector adapter
  - A soft carrying case
  - Four AA alkaline batteries (two for each unit)
-

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- Fiber cleaning supplies
  - LinkWare™ Software
  - A communication cable to connect to the PC
  - Registration Card and User Guide

## *The SIMPLIFIBER Accessory Kits*

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The SIMPLIFIBER Meter allows you to use different light sources.

SIMPLIFIBER 1310 Source and SIMPLIFIBER 1550 Source, additional sources for the verification of single-mode fiber at 1310nm and 1550 nm, are sold separately.

SIMPLIFIBER 1310 Source and SIMPLIFIBER 1550 Source are active laser sources that work with SIMPLIFIBER Meter to verify optical cable transmission quality.

SIMPLIFIBER Meter will recognize all SIMPLIFIBER Sources and automatically set the appropriate


## SIMPLIFIBER Meter


DB-9 serial connector allows attachment of a serial cable for interface with PC-based software (LinkWare).


SIMPLIFIBER threaded optical receiver port. Accepts different connector adapters.



 Powers SIMPLIFIBER ON or OFF.

 SHFT in conjunction with other keys executes extended functions. REF sets the Reference.

 λ increases the wavelength from 850nm to 1300nm to 1310nm to 1550nm. SHFT + dBm switches the mode between dBm and dB.

 SAVE saves test results. SHFT + DEL deletes results.

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## SIMPLIFIBER 850/1300 Source

850 nm ST or SC  
connector port

1300 nm ST or SC  
connector port



Powers SIMPLIFIBER Source ON or OFF.



AUTO senses the wavelength currently used by SIMPLIFIBER.



MOD allows you to toggle between continuous and modulated lightsource




λ turns on the 850nm or 1300nm output when cable is moved from one port to the other.


## SIMPLIFIBER 1310 Source

1310 nm ST or SC  
connector port



 Powers SIMPLIFIBER Source ON or OFF.

 AUTO senses the wavelength currently used by SIMPLIFIBER.

 MOD allows you to toggle between continuous and modulated lightsource

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## SIMPLIFIBER 1550 Source

1550 nm ST or SC  
connector port



Powers SIMPLIFIBER Source ON or OFF.



AUTO senses the wavelength currently used by SIMPLIFIBER.



MOD allows you to toggle between continuous and modulated lightsource

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## *SIMPLIFIBER Meter*

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The SIMPLIFIBER Meter interface consists of an LCD display and a keypad.

### Using the Keypad

Use the SIMPLIFIBER Meter keypad to select the functions necessary to test and troubleshoot fiber optic cabling. Each key performs at least two functions. When multiple keys are required to activate a function, press and hold each key in the order shown below.



When turned on, SIMPLIFIBER Meter will flash the LCD power up test and then resume the test mode that was last executed. To conserve battery life SIMPLIFIBER Meter will turn off automatically when no signal is detected and no key has been used for 60 minutes.



Press this button to shift to the upper key functions (dB/m and DEL). When activated the word SHFT is displayed.

Press and hold this button to set the Reference.

Press this button until SHFT is displayed, press it again to display the reference value.





Press this button to change the wavelength ( $\lambda$ ). The sequence is: 850nm, 1300nm,


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1310nm, and 1550nm. Use this function only when connecting to a lightsource other than SIMPLIFIBER Source. When using SIMPLIFIBER 850/1300, 1310, or 1550 Sources in AUTO mode, the wavelength will be detected automatically.

 +  Use these buttons to change the mode between Power Meter (dBm) and Loss Meter (dB).

 Press this button to display the next available position where a test can be saved.

Press and hold this button to SAVE test results.

Press  and then press and hold  to DELETE the last saved test result.




Press  and then press  to VIEW the last saved test result.

## Reading the Display

The display is operational when all LCD icons appear as shown below.



If no icons appear when the unit is in operation, check the batteries for correct installation or install new batteries.

- $\lambda$  **850 nm**    Measure at 850nm wavelength
- $\lambda$  **1300 nm**    Measure at 1300nm wavelength
- $\lambda$  **1310 nm**    Measure at 1310nm wavelength
- $\lambda$  **1550 nm**    Measure at 1550nm wavelength
- ALIGN**        Align units, set Reference
-     Low Battery power
-     Error occurred
- OK**            Successful operation
-     Negative value
- dB**            Loss measurement value displayed
- dBm**          Power measurement value displayed
- REF**          Current reference value being stored

 Result or Error message

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## *SIMPLIFIBER Source*

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The SIMPLIFIBER Source is an active and intelligent light source that works with SIMPLIFIBER Meter to verify optical cable transmission quality.

The SIMPLIFIBER 850/1300 is an LED light source.

The SIMPLIFIBER 1310 and 1550 Sources are laser light sources.

### **WARNING:**

When using SIMPLIFIBER 1310 or 1550 Source, visible and/or invisible laser radiation could be present.

Avoid direct exposure to the beam.

## Using the Keypad



When turned on the SIMPLIFIBER Source will light the LED of the last active transmission mode.



Press AUTO and SIMPLIFIBER Meter will automatically sense the current SIMPLIFIBER Source wavelength. When using SIMPLIFIBER Meter and SIMPLIFIBER Source, AUTO mode should always be selected, so that SIMPLIFIBER Meter can automatically determine the  $\lambda$  of

the transmitted light.



The transmitted light can be operated continuously or modulated. When measuring power, use the continuous light source. When identifying fiber cables with an identifier, use the 2kHz modulated mode.

Press MOD to toggle between continuous and modulated lightsource. When Continuous Wave is selected, the LED will show a steady light; when 2kHz (modulated) is selected, the LED will blink.

Use this feature with all third party power meters.



(SIMPLIFIBER 850/1300 Source) Press λ (Lambda) to manually switch the wavelength between 850 nm and 1300 nm. Connect the launch cable to the appropriate port.

## LED Indicators

SIMPLIFIBER 850/1300 Source has 5 red LED indicators. The following describes the LED activity:

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LED Name	Description
850nm	transmitting at 850nm wavelength
1300nm	transmitting at 1300nm wavelength
AUTO	SIMPLIFIBER Meter is auto-sensing the wavelength of SIMPLIFIBER Source
CW/2kHz	Steady for continuous light source; flashing for modulated light source
Low Batt	Time to replace AA batteries

SIMPLIFIBER 1310 Source has 4 red LED indicators. The following describes the LED activity:

LED Name	Description
1310nm	transmitting at 1310nm wavelength
AUTO	SIMPLIFIBER Meter is auto-sensing the wavelength of SIMPLIFIBER Source
CW/2kHz	Steady for continuous light source; flashing for modulated light source
Low Batt	Time to replace AA batteries

SIMPLIFIBER 1550 Source has 4 red LED indicators. The following describes the LED activity:

LED Name	Description
1550nm	transmitting at 1550nm wavelength
AUTO	SIMPLIFIBER Meter is auto-sensing the wavelength of SIMPLIFIBER Source
CW/2kHz	Steady for continuous light source; flashing for modulated light source
Low Batt	Time to replace AA batteries

## Calibration

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The SIMPLIFIBER Meter should be calibrated annually at the factory. Contact Fluke Networks for information.

## Technical Support

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### Note

*Always use the appropriate optical cleaning supplies to clean all connectors and couplers before testing.*

The Fluke Networks Knowledge Base answers common questions about Fluke Networks products and provides articles on cable testing techniques and technology.

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To access the Knowledge Base, log on to [www.flukenetworks.com](http://www.flukenetworks.com); then click **knowledge base** at the top of the page.

For additional support, contact Fluke Networks.

## Contacting Fluke Networks

### Note

*Before contacting Fluke Networks, please have your product version number available. See “Product Versions” on page 20.*



[www.flukenetworks.com](http://www.flukenetworks.com)



[support@flukenetworks.com](mailto:support@flukenetworks.com)



+1-425-446-4519



- Australia: 61 (2) 8850-3333 or 61 (3) 9329 0244
- Beijing: 86 (10) 6512-3435
- Brazil: 11 3044 1277
- Canada: 1-800-363-5853
- Europe: +44-(0)1923 281 300
- Hong Kong: 852 2721-3228
- Japan: 03-3434-0510
- Korea: 82 2 539-6311
- Singapore: 65-6799-5566
- Taiwan: (886) 2-227-83199
- USA: 1-800-283-5853

Visit our website for a complete list of phone numbers.

## Product Versions

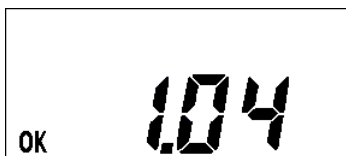
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To display the Product Version, turn SIMPLIFIBER Meter off.

Hold the  key down while pressing the  key.

Release both keys.

The Product Version will be displayed as shown below.



**WARNING: DURING OPERATION, TESTING, OR MAINTENANCE OF A FIBER OPTIC SYSTEM, NEVER LOOK INTO AN ACTIVE FIBER OPTIC CABLE. INFRARED RADIATION MAY BE PRESENT AND PERMANENT EYE DAMAGE CAN RESULT.**

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## Chapter 2 - Measuring Loss

Loss is the signal degradation in a fiber optic cable. SIMPLIFIBER 850/1300 Source injects a signal into the fiber cable and SIMPLIFIBER Meter measures the received signal at 850nm or 1300nm.

This chapter describes three loss test methods that vary in the way the launch cables are connected during referencing.

### Note

*You should use mandrels when measuring loss in multimode fiber optic cabling. See Appendix C on page 43.*

### The Reference Value

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Accurate repeatable measurements of optical power and signal loss are fundamental for the installation and maintenance of fiber optic cabling.

To make an accurate measurement, you need to know the loss of your attached launch cable and the power being transmitted.

The reference value must be stored before a loss measurement can be calculated. SIMPLIFIBER

requires the reference value to compensate for the signal loss in the launch cable. This value is then automatically subtracted from the actual measured value to determine cable plant loss.

### *Note*

*The launch cable used to set the reference value should be the same type as the cables to be tested: 50/125, 62.5/125, or single-mode.*

## IMPORTANT

All connectors and fiber end faces should be cleaned prior to testing.

## *The Reference Methods*

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There are three recognized methods for reference determination. Reference diagrams will show how to establish a reference for each method.

It is very important that the connections are not disturbed after the reference value is established. To assure that the effects of the connectors and launch cables are “zeroed out”, follow the instructions closely.

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## Note


*When a connector is removed and then reattached, it is unlikely to go back into the exact same position. As a result, measurements will change slightly when connections are made or broken.*

## Method A

For Method A two launch cables are used to set the reference.

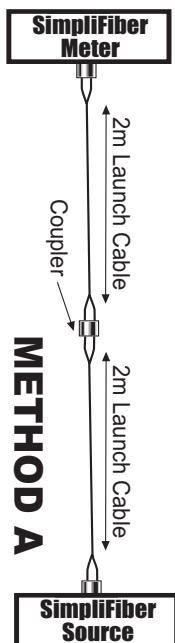
Method A cancels the effects of the launch cables and one coupler for all subsequent measurements.

1. Connect a Launch Cable to SIMPLIFIBER Meter.
2. Connect a Launch Cable to SIMPLIFIBER Source.
3. Use a coupler to connect the two fiber ends.
4. Power on SIMPLIFIBER Source

and press . To choose the appropriate wavelength, 850 or 1300 depending on where the fiber is connected, press




5. Power on SIMPLIFIBER Meter. The unit will auto-sense the




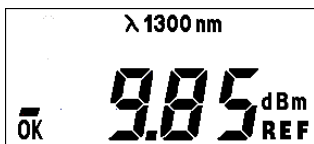
appropriate wavelength.

### Note

*When using a light source other than*

*SIMPLIFIBER Source, press the  to select the appropriate wavelength. Both units must be set to the same wavelength.*

6. Press, hold and release the  button to set and save the new reference value. The reference value will be displayed.




7. Disconnect the coupler without disturbing the fiber connections to the units.

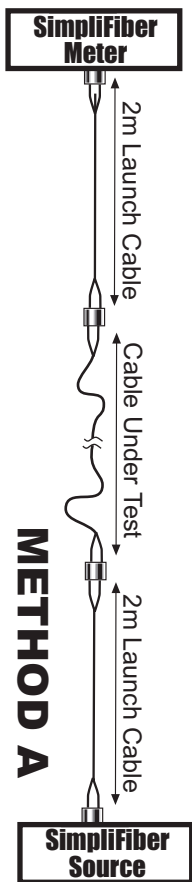
## Measuring Loss using Method A

When Method A was used to set the reference, proceed as follows:

1. Do not disconnect the launch cables from the SIMPLIFIBER units.
  2. Disconnect one launch cable from the coupler.
  3. Connect the fiber to be measured between the launch cables. An extra coupler is needed.
  4. SIMPLIFIBER Meter will report the loss in dB.
-

5. Press and hold  to save the test result.

When using Method A, the effects of both launch cables and one coupler are removed.




## Method B

This method is commonly recommended by ISO 11801 and ANSI/EIA/TIA 568A.

For Method B, one launch cable is used to set the reference.

The launch cable will be canceled out for all subsequent measurements.

1. Connect one end of a Launch Cable to SIMPLIFIBER Meter.
2. Connect the other end of the same Launch Cable to SIMPLIFIBER Source.
3. Power on SIMPLIFIBER

Source and press . To choose the appropriate wavelength, 850 or 1300,


press .


4. Power on SIMPLIFIBER Meter. The unit will auto-sense the appropriate wavelength.



### Note

*When using a light source other than*

*SIMPLIFIBER Source, press the  to select the appropriate wavelength. Both units must be set to the same wavelength.*

5. Press, hold and release the  button to set and save the new reference value. The reference value will be displayed.

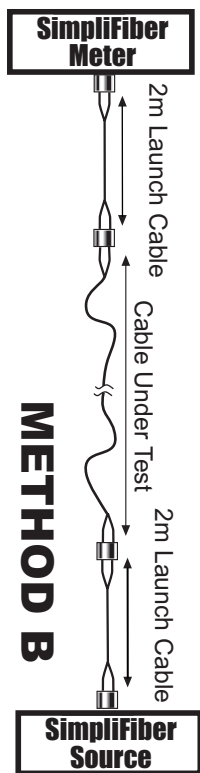


6. Disconnect the Launch Cable from the SIMPLIFIBER Meter.

## Measuring Loss using Method B

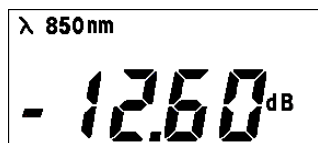
When Method B was used to set the reference, proceed as follows:

1. Do not disconnect the Launch Cable from the SIMPLIFIBER Source unit.
2. Connect the fiber to be measured between the SIMPLIFIBER Meter output and the SIMPLIFIBER Source. An extra Launch Cable and two couplers are needed.
3. SIMPLIFIBER Meter will immediately report the loss in dB.



4. Press and hold  to save the test result.

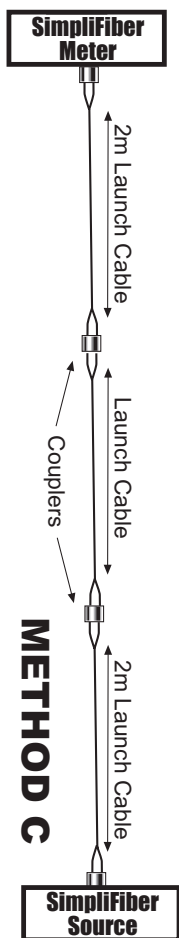
Method B removes the effect of one launch cable.



## Method C

For Method C three launch cables and two connectors are used to set the reference. All of the launch cables and connectors are canceled. Use this method when measuring an end to end system where the patch cables need to be included in the total loss measurement.


1. Connect the first Launch Cable to SIMPLIFIBER Meter.
2. Connect the second Launch Cable to SIMPLIFIBER Source.
3. Use two couplers to join the two launch cables with a third launch cable.
4. Power on SIMPLIFIBER Source






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and press .

5. Choose the appropriate wavelength, 850 or 1300, press .

### Note

*When using a light source other than*

*SIMPLIFIBER Source, press the  to select the appropriate wavelength. Both units must be set to the same wavelength.*

6. Press, hold and release the  button to set and save the new reference value. The reference value will be displayed.



7. Disconnect the third Launch Cable, located in the center, without disturbing any connections to the couplers or adapters.

## Measuring Loss using Method C


When Method C was used to set the reference, proceed as follows:

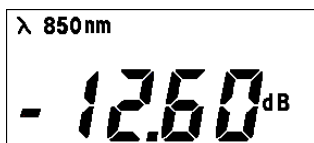
1. Do not disconnect the launch cables from the SIMPLIFIBER units.
2. Remove the launch cable located in the

center without disturbing the couplers.

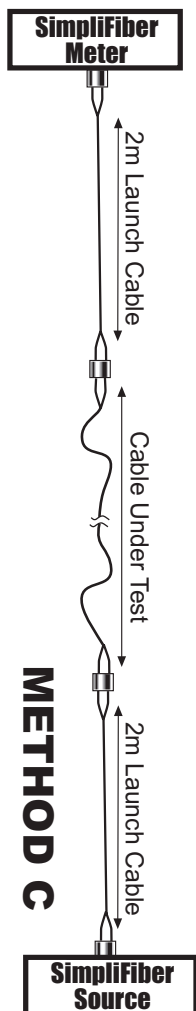
3. Connect the fiber to be measured between the launch cables.

4. SIMPLIFIBER Meter will immediately report the loss in dB.

5. Press and hold  to save the test result.



Method C removes the effect of the launch cables and the couplers.




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## *Saving Results*

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SIMPLIFIBER Meter will store 100 test results. Each test is stored in order, e.g. 5 is the fifth test that was stored.

1. To save a test result press . A number (between 1 and 100) will flash in the lower right corner of the display.

In our example 5 is the next open storage position.



2. Press and hold the  button until OK is displayed in the lower left corner of the display.



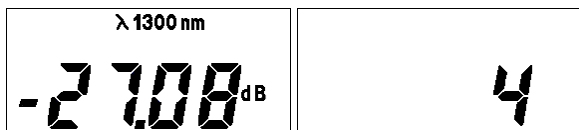
The number of the saved test will be displayed to confirm that the result was saved.

In our example test result number 5 has been saved.

## Viewing Results

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1. Press  and then  to display the last stored test.



A number (between 1 and 100) and the test result start flashing alternately.

## Deleting Results

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1. Press  and then hold  to delete the result.



OK and the number of the deleted test will be displayed to confirm that number 4 is available again.

### *Note*

*The most recent test will be deleted first.*

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## Uploading to a PC

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Test results can be uploaded to a PC using the LinkWare software included.

1. Connect the meter's serial port to the PC using the 9-pin serial cable provided with the meter. Turn on the meter. The meter's display should show "PC".

2. If you want to add the records to an existing LinkWare database, open the database. Otherwise, open a new database.

3. Click  (**Import**). Select **SimpliFiber** from the dropdown menu.

4. In the **SimpliFiber** dialog box, enter the desired header, project name, operator name, cable number, and the date the fiber tests were performed; then click **OK**. (You can change the date format, if necessary, after uploading the records.)

5. Click **Import All Records** or **Select Records To Import**.

- If you clicked **Import All Records**, LinkWare imports all the records in the tester.
- If you clicked **Select Records To Import**, select the records you want to import; then click **Import Selected Items**.

See the LinkWare online help for additional information.



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## Chapter 3 - Measuring Power

### *Measuring Power*

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When measuring power, the overall power is reported. Use it to quickly verify cabling and equipment problems.

1. To measure power, connect the fiber optic cable to the appropriate SIMPLIFIBER 850/1300 Source output.

2. Connect the fiber optic cable to the SIMPLIFIBER Meter.

3. Power on SIMPLIFIBER Source and press .

4. To choose the appropriate wavelength,



press .

5. Power on SIMPLIFIBER Meter. The unit will auto-sense the wavelength.

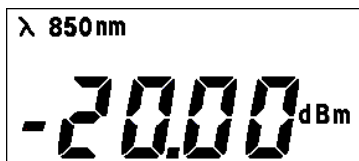
### Note

*When using a source other than SIMPLIFIBER*

Source, press  to select the wavelength.

6. Press  and then the  button to change the units from dB to dBm.

7. SIMPLIFIBER Meter will immediately report the overall power in dBm.





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# Appendix A - Technical Specifications

## *SIMPLIFIBER Meter*

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### Physical Characteristics

- Dimensions: 13.97 cm x 8.25 cm x 2.54 cm (6.25" x 3.50" x 1.25")
- Weight: 171.54 g (.38 lbs)

### Power Source

- 2 AA Alkaline batteries
- Battery Life: Varies depending on usage and battery quality. On average, the batteries will last 100 hours.

### User Interface

- Display: Custom LCD
- Size: 4.42 cm x 2.15 cm (1.75" x .85")
- Keypad: Four momentary contact keys

## Environmental

- Operating Temperature:  
0° to 45°C (32° to 113°F)
- Storage Temperature:  
-20° to 60°C (14° to 140°F)
- Humidity: 10% to 90% non-condensing
- Storage Humidity: 5 to 95%

## Serial Port

- RS-232, DB 9

## Memory

- Test Storage: 100 complete test results can be stored in nonvolatile flash memory

## Test Functions

### Optical Measurements

- Dynamic Range: +3dBm to -55dBm
- Resolution: 0.01dB
- Typical accuracy (at -20dBm): ±0.25dB

## *SIMPLIFIBER Source*

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### **Physical Characteristics**

- Dimensions: 13.97 cm x 8.25 cm x 2.54 cm  
(6.25" x 3.50" x 1.25")
  - Weight: 171.54 g (.38 lbs)
-

---

## Power Source

- 2 AA Alkaline batteries
- Battery Life: Varies depending on usage and battery quality.

850/1300 Source: On average, the batteries will last 10-50 hours, depending on Mode

1310 and 1550 Sources: On average, the batteries will last 20-100 hours, depending on Mode

## Wavelength

- 850, LED, > -20dBm
- 1300, LED, > -20dBm
- 1310, Laser, > -10dBm
- 1550, Laser, > -10dBm

## Environmental

- Operating Temperature: 0° to 45°C (32° to 113°F)
- Storage Temperature: -20° to 60°C (14° to 140°F)
- Humidity: 10% to 90% non-condensing
- Storage Humidity: 5 to 95%

## Governmental Certifications

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## Appendix B - Error Messages

### Err 1 - Invalid Reference value.

Error code 1 indicates that the reference value is 'under' or 'over' the limits.

*- Store a new Reference value.*

### Err 2 - UNDER or OVER limit.

The measured value is under or over the limit. The numeric values displayed on the LCD can range from -55.00 dB/dBm to 3.00 dB/dBm.

When a measurement is less than -55.00 dB/dBm, the measured value is UNDER the limit.

When a measurement is more than 3.00 dB/dBm, the measured value is OVER the limit.

*- Remeasure*

### Err 3 - Memory is full, cannot save result.

Error code 3 indicates that the unit's memory is full.

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- *Upload the stored test results to your PC.*
  - *Delete saved results from the unit's memory.*

### Err 4 - No results are stored in memory.

Error code 4 indicates that there are no results stored in the units memory.

- *SIMPLIFIBER's memory is empty.*

### Err 5 - Wavelength cannot be changed.

Error code 5 indicates that the wavelength cannot be changed while the SIMPLIFIBER Source unit is in AUTO mode.

- *Change mode to CW prior to changing the wavelength*

### Err 6 - Calibration is expired.

Calibration values are corrupted

- *Send unit in for calibration*

### Err 7 - Communication error between SIMPLIFIBER Meter and PC.

Communication between PC and SIMPLIFIBER cannot be established.

- *Verify connection between SIMPLIFIBER and the PC and retry.*

## Err 8 - Connection error between SIMPLIFIBER and PC

Connection between SIMPLIFIBER and PC is broken.

- *Verify connection between SIMPLIFIBER and the PC and retry.*

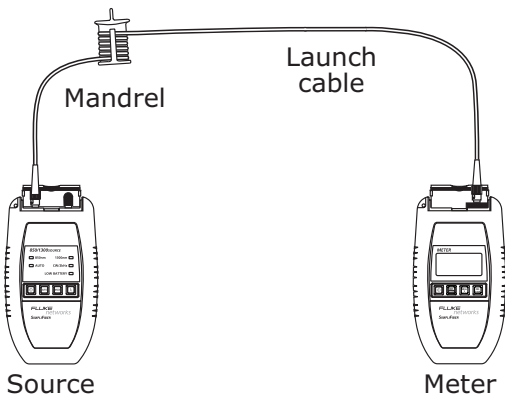
## Appendix C - Using Mandrels on Multimode Fiber

Fluke Networks strongly recommends the use of standardized mandrels when using an LED source and an optical power meter to measure loss in multimode fiber cabling. The mandrels act as mode filters. They remove unwanted high-order modes from the optical signal when testing with an LED source that overfills the fiber. The resulting launch condition is more uniform, which generally improves instrument-to-instrument measurement consistency and repeatability.

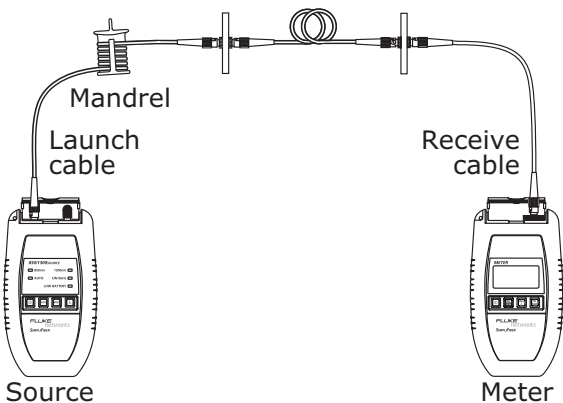
Fluke Networks offers TIA/EIA-568-B compliant multimode mandrels for 3 mm test jumpers. The Fluke Networks *NF-MANDREL Instruction Sheet* provides information on these mandrels. You may download the instruction sheet from the SimpliFiber manuals page on the Fluke Networks website.

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Place the mandrel on the launch cable connected to the LED source, as shown in Figures C-1 and C-2. Set the reference with the mandrel in place. Leave the mandrel in place while measuring loss.



**Figure C-1. Referencing with a Mandrel**



**Figure C-2. Testing with a Mandrel**

Industry standards specify mandrel diameters and number of wraps. Refer to your local standards for details. Tables C-1 and C-2 list recommended mandrel diameters for several of the key standards.

**Table C-1. Mandrel Diameters for  
250  $\mu\text{m}$  Buffered Fiber**

Fiber Core Size	Standard	Mandrel Diameter*
50 $\mu\text{m}$	TIA/EIA-568-B.1 7.1	25 mm (1.0 in)
	ISO/IEC TR 14763-3 6.22	15 mm (0.6 in)
	ISO/IEC 61300-3-34	18 mm (0.7 in)
62.5 $\mu\text{m}$	TIA/EIA-568-B.1 7.1	20 mm (0.8 in)
	ISO/IEC TR 14763-3 6.22	20 mm (0.8 in)
	ISO/IEC 61300-3-34	20 mm (0.8 in)
*Wrap the fiber around the mandrel 5 times.		

**Table C-2. Mandrel Diameters for  
3 mm (0.12 in) Jacketed Fiber**

Fiber Core Size	Standard	Mandrel Diameter*
50 $\mu\text{m}$	TIA/EIA-568-B.1 7.1	22 mm (0.9 in)
	ISO/IEC TR 14763-3 6.22	12 mm (0.5 in)
	ISO/IEC 61300-3-34	15 mm (0.6 in)
62.5 $\mu\text{m}$	TIA/EIA-568-B.1 7.1	17 mm (0.7 in)
	ISO/IEC TR 14763-3 6.22	17 mm (0.7 in)
	ISO/IEC 61300-3-34	17 mm (0.7 in)
*Wrap the fiber around the mandrel 5 times.		



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