

# OPTICAL WAVELENGTH LABORATORIES



## MICRO OWL OPERATIONS MANUAL

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# Why Use An Optical Fiber Power Meter?

This question has been asked many times before and will be asked well into the future. The mentality of some cable installers is: "If I hook it up and it works, then my work here is done." However, with network communications becoming so important to organizations, speed and reliability are major priorities being placed on the building's network cabling plant. Just because the cable works when it is plugged into active equipment, this doesn't mean that the cable will support future high-speed upgrades. Even if the fiber termination looks perfect in a fiber-scope, there is still a question of performance that needs to be addressed.

Standards organizations such as the TIA or the ISO/IEC provide performance standards that the cabling plant must adhere to in order to support high-speed protocols such as Gigabit Ethernet. Fiber can be tested against these standards, ensuring that it is able to handle the high amount of traffic with a maximum amount of reliability.

These standards organizations also provide standards for administration of the cabling plant (most notably the EIA/TIA-606). These standards require a fiber link to be certified; that is, a report must be generated from appropriate test equipment for tracking and auditing purposes. These reports can also be used as verification of compliance to performance standards in case a question comes up about the quality of an installation. These signed documents cover the installer from liability provided that the link meets specified performance standards.

Our optical fiber power meters are designed with these standards in mind because we understand the importance of qualifying your fiber installations with standards-compliant test equipment. The meter you have just purchased also prints professionally formatted reports showing the conformity to these popular industry standards. You can print out these reports as a record of the original conformity to quality set by the standards. These documents signed by all associated parties may prove valuable in any future disputes concerning the installation.

If you are interested in training, we offer the OWL Certified Fiber Optic Technician course at our corporate training center in Southern Wisconsin. Call us at 1-262-473-0643 today!

# UNIT 1

**General Features &  
Fiber Optic Data  
Recording Methods**

UNIT 1

## General Features- Micro OWL

- 1 ST ADAPTER PORT** -(2.5mm) Port where fiber end to be tested is placed. Most conventional 2.5mm fiber connectors are compatible with this port (i.e. SC, ST or FC). Other fiber port adapters are available such as LC connectors. Call 262-473-0643 for additional or custom adapters.
- 2 COMPUTER PORT** -(RS-232 to PHONO) Additional cable and software allows downloading of stored readings to computer for storage and printing.
- 3 LIQUID CRYSTAL DISPLAY** -(LCD) -The main viewing area. The large digits are your measurement values either in ABSOLUTE ( $\frac{dBm}{ABS}$  or  $\frac{uW}{ABS}$ ) or RELATIVE ( $\frac{dB}{REL}$ ). Also, the value, name, wavelength(850nm), temperature in Fahrenheit, and battery life in percent. At the bottom of the LCD is the FUNCTION OPTIONS MENU, which is explained in feature item **4**.
- 4 LCD FUNCTION OPTIONS MENU** - Three distinct boxes (bottom row in LCD) that may change in content and serve as items in menu. Items can be selected by pressing the corresponding blue function keys directly below each item box in the LCD (see feature item **5**). Study the LCD carefully.
- 5 FUNCTION KEYS** **F1 F2 F3** These blue keys allow you to select the corresponding items in the LCD FUNCTION OPTIONS MENU. See feature item **4**.
- 6 ALPHA NUMERIC KEYS** **1 2 3** These yellow keys 0 through 9 have the alphanumeric characters laid out much like a telephone keypad. The alphanumeric keys can be scrolled for spelling your personalized fiber labels. This feature is discussed later in the manual.
- 7 LIST MENU KEYS** **MENU DONE** The orange keys. When MENU is pressed you are then able to access meter features in a LIST MENU format. When you press DONE the menu will "know" you have completed selecting items or entering data and will return you to previous screens.
- 8 BACKLIGHT KEY** **BACK LIGHT** This orange key toggles your back light between on and off. In order to conserve battery power, the backlight has an auto off feature.
- 9 ON/OFF KEYS** **ON OFF** An orange and a blue key to turn the unit on and off. When you turn the unit off you will need to complete 2 steps. First, you must press the **OFF** key. Then you must press the **F1** key from the FUNCTION OPTIONS MENU to complete power off.
- 10 OPTIONAL LIGHT SOURCE PORT** - A multimode (850nm or 1300nm) light source can be installed.



# General Features- Light Source

The light source might vary in model or available wavelengths. The Dual OWL shown here is just as an example of a typical light source.

- 1 850 NANOMETER (nm) ST PORT
- 2 1300 NANOMETER (nm) ST PORT
- 3 TOGGLE SWITCH SELECT - Allows you to choose between 850nm, OFF, or 1300nm. Remember, when you are finished with a test session that you return the toggle switch to the center OFF position otherwise you will drain your 9-Volt battery completely down! It is a common practice to turn on a light source one minute before use to allow the source to stabilize.
- 4 Indicator LEDs- LED indicates the selected wavelength and battery state is good when on. Don't use source if LED is off you must replace the battery!
- 5 DANGER DECAL- Multi mode light sources are generally not considered dangerous. However, our light source cases are all nearly identical. You could mistakenly grab a laser light source and **DO PERMANENT DAMAGE TO YOUR EYESIGHT! THEREFORE MAKE IT A SAFETY PRACTICE TO NEVER LOOK INTO ANY POTENTIALLY ACTIVE FIBER END OR LIGHT SOURCE!**

## HANDLING TIPS

- 1) Do NOT drop the source. Damage may occur to the case or electronic components on the circuit board may become dislodged.
- 2) Keep the source in its neoprene case when not in use. This will help protect it from the elements and accidental droppage.
- 3) Store the source in a cool dry area when not in use in order to keep it in top working condition.
- 4) Always remember to replace the rubber cap on the connector(s). This will keep dust and dirt out of them when you are not using the source.

## CLEANING TIPS

- 1) Use only 99% or better Isopropyl alcohol when cleaning the connector. Any less than 99% contains too much water and will begin to corrode the components. 99% Isopropyl alcohol is very flammable, so additional care must be taken when cleaning the detector. 99% Isopropyl alcohol can be purchased at your local drug store.
- 2) Whenever possible, use specially designed cleaning sticks to clean the detector. These do not require alcohol and do not damage the insides of the connector. Do not used sticks or swabs of any other type because they may damage the connector, or may leave behind dust or fibers that will add loss to the fiber reading.
- 3) The connectors should be cleaned at the beginning and end of the testing day to keep loss during testing at a minimum.
- 4) When cleaning the source, do not use any household cleaner that contains ammonia as this will damage any plastic it comes in contact with.





# Fiber Optic Data Recording Methods

There are four ways to use your meter to record data points for a optical fiber network. These methods are listed below.

- 1) IMMEDIATE MODE WITH A CLIPBOARD - UNIT 1
- 2) DIRECT MEMORY STORAGE - UNIT 2
- 3) MANUALLY SET REFERENCE VALUE - UNIT 3
- 4) WIZARD MODE REFERENCE VALUE - UNIT 4

Methods 1 and 2 are fairly straight forward because they do not require much user intervention. However, the measurements that are received by these two methods are not sufficient in and of themselves to produce meaningful results. This is due to the lack of a reference value. All that these first two methods will tell you is the absolute power that the meter is detecting; they cannot tell you whether your link will pass or not. In other words, you cannot determine the loss of the link without a starting point, or reference value. This reference value takes into account the output power of the light source and the loss of the test patch cord(s).

Methods 3 and 4 integrate the concept of a reference value into the measurements. Because of this, they can produce meaningful data. The meter knows the power level you began with, so it can tell you how much power the link is losing. This is especially helpful when comparing actual optical power loss to the loss requirements provided by the various national and international cabling standards, which are typically worst case scenarios. Methods 3 and 4 utilize our OWL Reporter software, which is discussed in Unit 7. The goal of the OWL Reporter software is to take information stored in the meter and print out an organized report that compares the test results against known industry standards, such as TIA-568-A or TIA-526 standards.

Only method 4, Wizard mode, will allow a link to be fully certified. Certification occurs when the human factor is completely removed from the loss calculations. The Wizard asks you four questions: fiber type, fiber length, number of connector pairs, and number of splices. Each factor is given a value consistent with the industry standards mentioned above. With the answers to these three questions and the reference value it sets autonomously, the Wizard calculates the link's cable performance margin and returns a PASS or FAIL result, based on the parameters you set when you saved the data point.

Your meter and light source are traceable to government standards set forth by the National Institute of Standards and Technology (N.I.S.T.).

## Fiber Optic Data Recording Methods, continued.

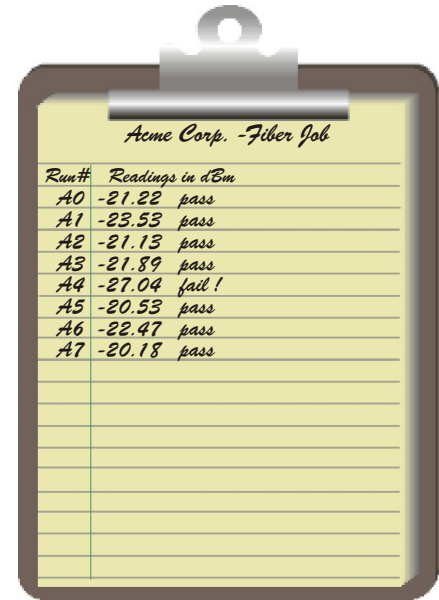
The simplest method of recording data points for fiber optic runs is using Immediate Mode with a clipboard. There is no user intervention involved other than changing the test wavelength and/or physically switching connectors to test the next fiber.

However, this is the most cumbersome method due to the fact that you must carry a clipboard to write down the test results by hand. This is the major disadvantage of this method. It works best when you have very few runs to test, or are doing spot checks on the fiber link.

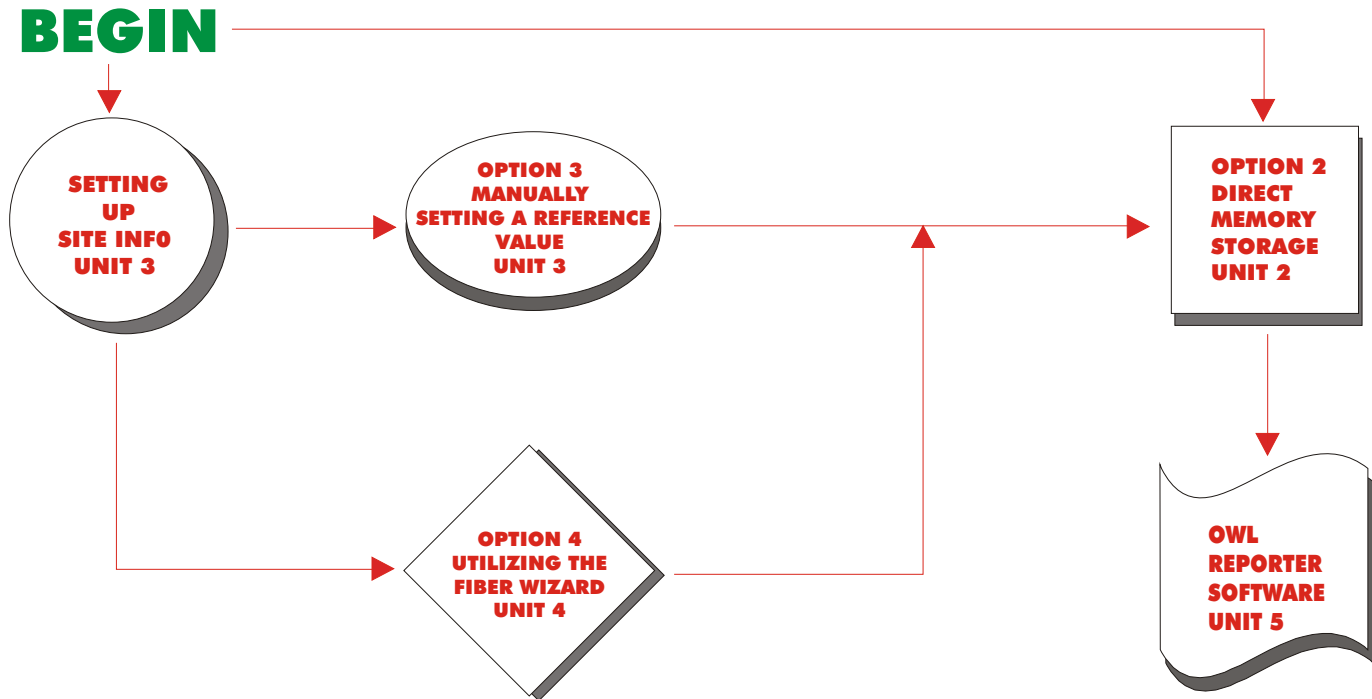
Below is an example of Immediate Mode with a clipboard.

This method of data recording is the only one that does not implement the storage capabilities of the Micro OWL. The other three methods use data point storage, and thus can be used to produce a report using our OWL Reporter software.

On the next page is a flow chart diagram that shows the paths to take to produce a report when utilizing each method. The flow chart also shows the units that cover each step of the process.



# SIMPLE FLOW CHART OF STEPS REQUIRED TO PRODUCING A TEST REPORT



# Micro OWL Data Storage

Before you begin saving data points in your Micro OWL meter, it is necessary to understand exactly how the data gets stored in the meter. For more detailed information about the points covered in this section, see the corresponding units in this manual.

The Micro OWL supports saving data points for 4 sites, each of which save information related to each respective site. Every data point that is stored is associated with one of the 4 sites, plus has a descriptive label for the set of runs within the site. When saving data points within a site, the Micro OWL automatically increments the fiber number within each wavelength for each label, starting at 00 and working its way up to 99 (after 99, you will be prompted to enter a new label). Here is an important point to note: **WHEN CHANGING TO A NEW LABEL, THE AUTO-INCREMENT NUMBER BEGINS AT 00**. Each data point stores information about wavelength, fiber type, and optical power level. For example, let's say you are testing fiber runs for a company called ACME CORP. at their headquarters for the closet supplying service for the sales area. Your site name could be ACME CORP. and your label could be HQSAL:. The colon is put at the end of the label to separate the auto-increment number from the descriptive label itself. So here's what the label looks like when you store data points for the 36 fibers in the installation. The first couple of runs would be HQSAL:00, HQSAL:01 until you reach the end which would be HQSAL:35. Now let's say you move on to the administrative part of the office. Your label could then be HQADM:, with runs going from 00 to 35 for a 36 fiber installation. Each wavelength (if you test at multiple wavelengths, like 850nm and 1300nm for multimode fiber) also has its own increment number with the same label. So you would have a data point HQSAL:00 for both 850nm and 1300, for example. Pretty simple, right?

The next aspect of data storage you need to be aware of is that data points get stored sequentially within the meters RAM. For example, you test a fiber at 850nm and 1300nm before going on to the next fiber. The first data point is 850nm, then the second is 1300nm. You continue on this way until you have saved all your data points.

## Micro OWL Data Storage, continued.

Now, let's consider a slightly different angle using our previous example. You have to test 36 runs at two wavelengths for both the sales and administrative areas at the headquarters of ACME CORP. But this time you can only test half of each set of runs because the termination crew is only half finished in each area. You can go back and forth between the two areas, but remember, auto-incrementing begins at 00 when you change to a new label. So you save HQSAL:00 through HQSAL:17, then switch to HQADM:00 through HQADM:17. You then go back to the HQSAL: label and find that it is at 00 again!

For this reason, we recommend that all fibers associated with a specific label should be tested from start to finish before moving to another label. There are other options -- you could save the last 18 runs in our example by changing the label to reflect the last 18 runs, e.g. HQSAL2:. The least confusing method, and least time-consuming by far, is you save all the associated data points at the same time.

# UNIT 2

**Direct Storage Method,  
Setting Up Owner  
Information, &  
Immediate Mode**

# First Time Using Your Micro OWL

Your new Micro OWL meter is ready to be used right out of the box. When you turn the power on you will see our owl mascot fly across the screen. Then your display will go into Immediate Mode. Immediate Mode will look like the display in Figure 2-1. You are now ready to use your Micro OWL.

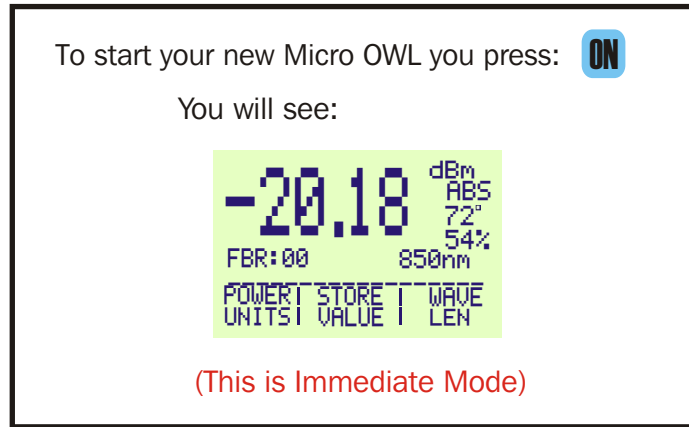


Figure 2-1

## Function Options Menu

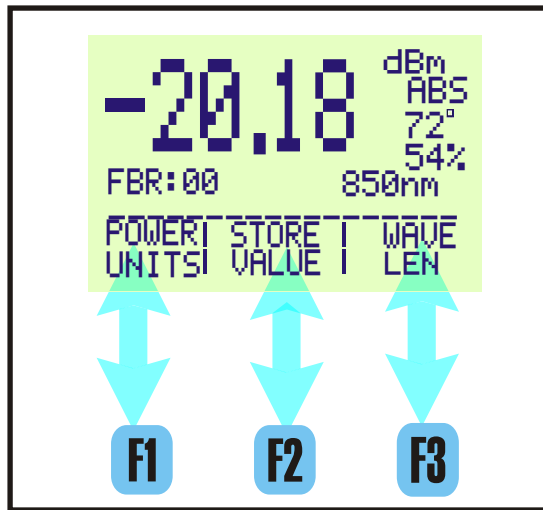


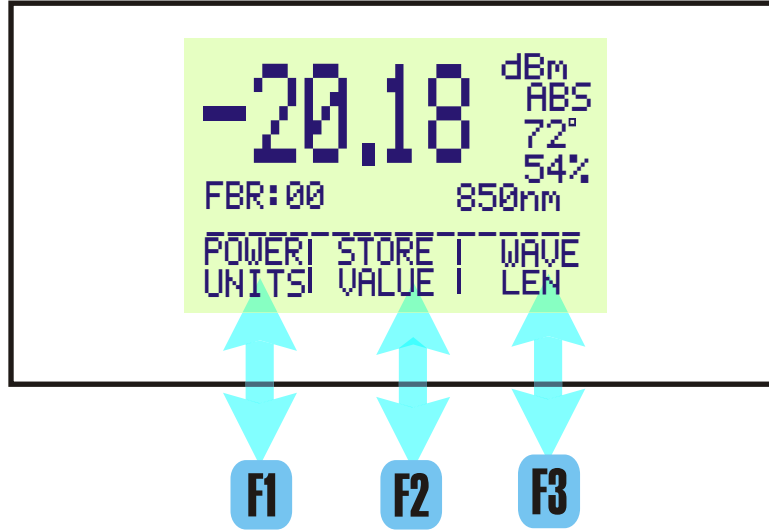
Figure 2-2

In the future it is important to note that the bottom half of your display has a small function options menu. This function options menu is vertically aligned with function keys **F1** **F2** **F3** (see Figure 2-2).

Operation in Immediate Mode begins on the next page. To begin storing data points using Option 2 - Direct Memory Storage, please turn to page 2-15. To set up the Owner information in your meter, turn to page 2-10.



## Operation in Immediate Mode



- F1** This key toggles the display between relative (REL) and absolute (ABS) mode. More detailed explanations are in Unit 4.
- F2** This key allows you to store data points. More detailed explanations are on page 2-15.
- F3** This key changes the wavelength you are testing. More detailed explanations begin on 2-5.

## Operation in Immediate Mode

Changing the Default Wavelength

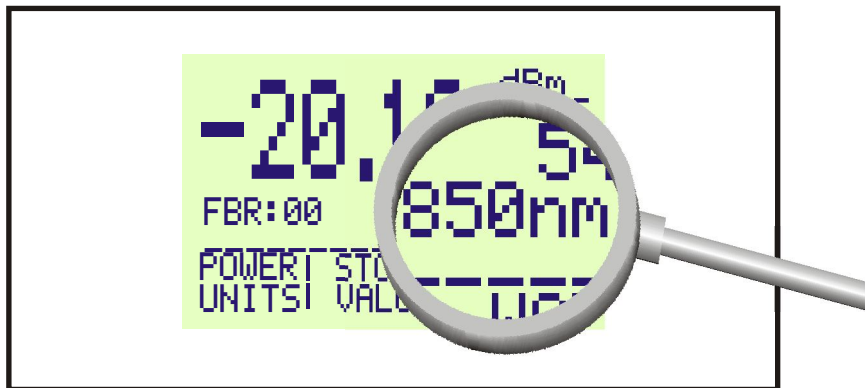


Figure 2-3

Notice the 850nm in the right center of your display (see Figure 2-3). This is the wavelength you are currently testing in nanometers (nm). It could also be expressed in scientific notation as  $850 \times 10^{-9}$  Meters.

This 850nm is important to take note of because you will need to make certain that this wavelength matches the wavelength on the light source you are using in order to make correct measurements with your meter. This will also assure compliance to testing standards. When toggling between wavelengths, the meter will show three wavelengths: 850, 1300 (or 1310 for singlemode), and 1550nm.

# Operation in Immediate Mode

Changing the Default Wavelength, continued.

To change to a different wavelength, simply press the **F3** key. You will see the **WAVELENGTH** toggle between 850nm, 1300 or 1310nm, and 1550nm. Choose the **WAVELENGTH** that matches your light source. See Figure 2-4.

## The Importance of Multiple Wavelengths

Fiber optic component manufacturers have determined that data communications over fiber optic cable is optimized at a select few wavelengths. Standards organizations have adopted this fact and have included it in their standards for testing procedures. The TIA/EIA 568-A, 526-7, and 526-14 specify that end-to-end attenuation tests for multimode fibers shall be done at 850nm and 1300nm for backbone links, and 850nm or 1300nm for horizontal links. Singlemode shall be tested at both 1310nm and 1550nm. Also, attenuation is measured and documented in one direction only but at both wavelengths for backbone cabling, and only one wavelength for horizontal cabling.

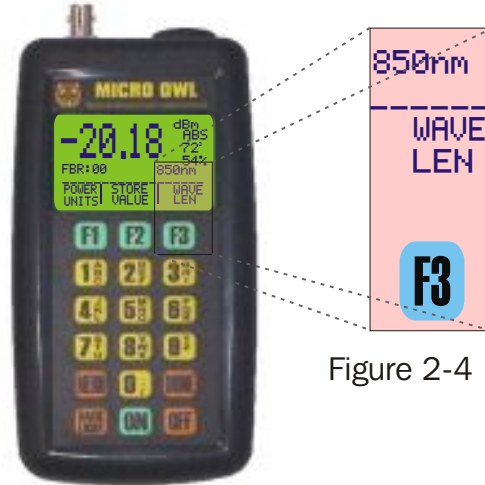


Figure 2-4

Notice how **F3** key is vertically aligned to **WAVELENGTH** and 850nm (current wavelength value)

## Operation in Immediate Mode

Changing the Default Wavelength, continued.

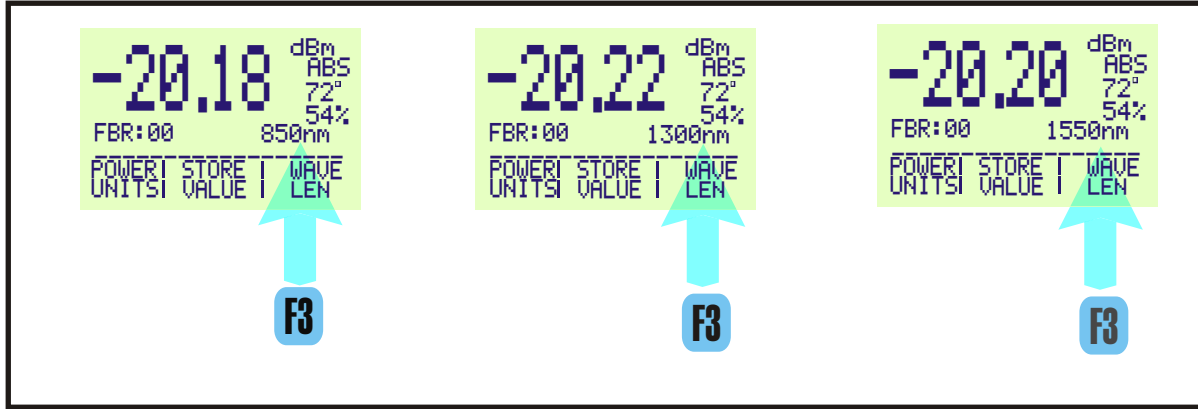


Figure 2-5

As you can see pressing **F3** key causes the wavelength to change between 850,1300 or 1310, and 1550nm.

# Operation in Immediate Mode

## OVER/UNDER Display

The upper left corner of the display shows a measurement value associated with the intensity of the light being received by the photodetector. The display will usually show a number.

There are two scenarios where no number will be displayed. This is for one of two reasons. Either the light intensity is too great for the meter to accurately read the light, or it is too low.

Depending on these two scenarios, the meter will display either OVER or UNDER as shown in the diagrams to the right.

OVER is displayed when the light intensity is too high for the meter to properly read data.

UNDER is displayed when the light intensity is too low for the meter to detect.



Figure 2-6



Figure 2-7

# Operation in Immediate Mode

## Monitor Mode

Another feature of the Micro OWL is called Monitor Mode. Monitor Mode captures data about the current fiber run and sends it to the serial port in real-time (once per second).

There are three parameters that are sent to the serial port during monitoring. These parameters are downloaded in comma delimited format.

- 1) Temperature
- 2) Wavelength
- 3) Absolute power measurement

Pressing the **5 MNO** key starts Monitor mode. The display will then look like Figure 2-8. To turn Monitor Mode off, press **DONE**

While in Monitor Mode, the auto-off feature of the meter is disabled, so be sure to turn Monitor Mode off to keep the battery from draining away.



Figure 2-8

# Operation in Immediate Mode

## Turning ON Integrated Light Source

If your Micro OWL does not have an integrated light source, then continue on to the next page.

If your Micro OWL has an integrated LED light source, there are two ways to turn it ON. The first method can be executed from Immediate Mode by pressing the **4** key.

You will notice a small picture of a light bulb appear in the upper right hand corner of your display (as shown in Figure 2-9).

To turn the LED off, press **4** again. The light bulb picture will disappear.



Figure 2-9

# Operation in Immediate Mode

## ZEROING Your Patch Cord

You may also use the REL function from Immediate Mode in order to quickly test a link for PASS/FAIL readings. Before you can do this, however, you will need to ZERO out your patch cord.

Attach your patch cord to your meter and light source, set the meter to the wavelength of the light source, and then press **0**. You will be given a confirmation message for the wavelength you are ZEROing, as in Figure 2-10. Confirm your choice by pressing **F1**. You will then be returned to Immediate Mode.

You may check that you have correctly ZEROed your patch cord by changing to REL mode. Do this by pressing **F1** from Immediate Mode. Your display will change to look like Figure 2-11.

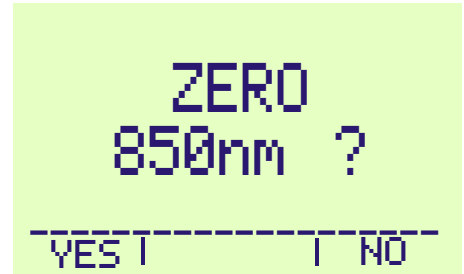


Figure 2-10



Figure 2-11



# Setting Up Owner Information

To set up the owner information, we must first enter the Main Menu. Press the **MENU** button on the keyboard. Your display should look like Figure 2-12.



Figure 2-12

Now press **4** to display the Settings screen. Your display should look like Figure 2-13. This is where you set up your owner information. NOTE: If your Micro OWL does not have an integrated light source, the screen will not show LED:OFF or LED at the bottom of the display.

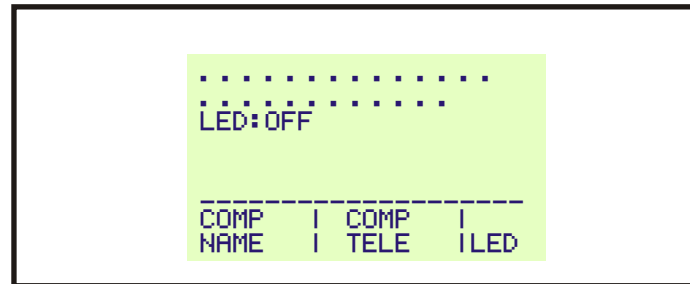


Figure 2-13

## Setting Up Owner Information, continued.

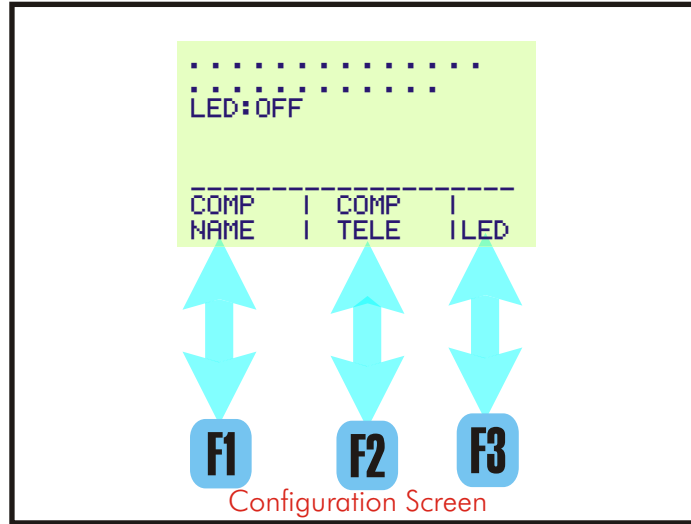


Figure 2-14

- F1** Press this key to change the Company Name field. See page 2-14 for instructions.
- F2** Press this key to change the Company Telephone Number field. See page 2-15 for instructions.
- F3** Press this key to turn the optional light source on and off. See page 2-16 for instructions. NOTE: if your Micro OWL does not have an integrated light source, then the LED:OFF or LED at the bottom of the display will not appear.

# Changing Company Name

From the configuration screen shown in Figure 2-14 on page 2-13, press the **F1** key. The screen shown in Figure 2-15 appears. To enter the company name, you must first erase the dots. Do this by pressing the **F1** key until the screen looks like Figure 2-16.

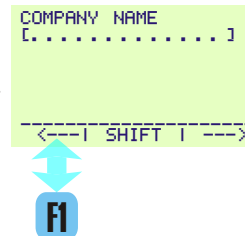


Figure 2-15

Let us set up a the meter with a test company. When we are done, you can erase the test company information and put in the correct information. Let's say we work for ACME CORP. Press the following keystrokes, IN THE EXACT ORDER THEY ARE SHOWN, to enter ACME CORP into the Company Name field.

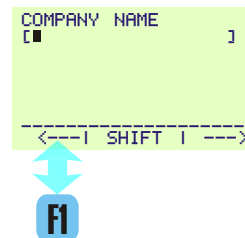


Figure 2-16



Your display should look like Figure 2-17. Now, let's enter the phone number for ACME CORP.

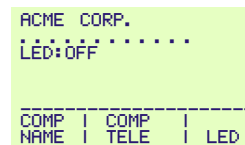


Figure 2-17

# Changing Company Telephone Number

From Figure 2-14 on page 2-13, press **F2**. The display will look like the screen in Figure 2-18. Press **F1** until all of the dots are erased.

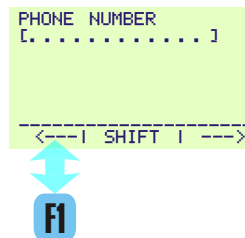


Figure 2-18

When you have erased all of the dots, the screen will look like Figure 2-19. Press the following keys, IN THE ORDER THEY ARE SHOWN, to enter ACME CORP's telephone number. NOTE: the recommended format for phone numbers is XXX-XXX-XXXX. There are just enough spaces to accommodate phone numbers in this format.

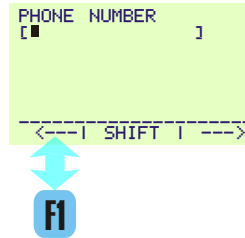


Figure 2-19



When you are finished entering the keystrokes above, press **DONE**. This will bring you back to the configuration screen. The company name, ACME CORP, and telephone number, 800-555-1212, should be listed. We can also adjust the contrast of the liquid crystal display from the configuration screen.

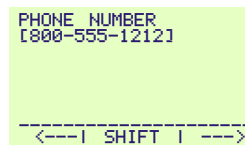


Figure 2-20

# Turning On Optional LED Light Source

This step is for Micro OWLs that have an integrated light source. Skip this step if the LED:OFF or LED at the bottom of the display do not appear.

After you are finished entering the company name and phone number, the screen should look like Figure 2-21. Press the **F3** key to turn on the optional LED light source. This is the second method of turning ON your integrated light source.

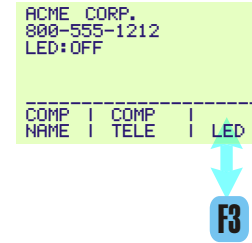


Figure 2-21

After the LED has been turned on, your screen should look like Figure 2-22. Press **DONE** to continue. In Immediate mode, you should now see a graphic of a small light bulb in the upper right hand corner of the display. This also shows that the LED is on (Figure 2-23). Now you can begin patch cord or fiber spool testing.

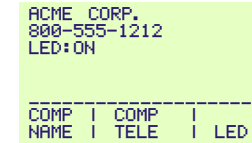


Figure 2-22

The advantage of having a light source built in to your power meter is for the capability of patch cord or pre-installation fiber spool testing. Spool tests can give you an idea about how the fiber should perform after it is installed. Pre- and post-installation test numbers can be compared to see if any damage was done during installation and/or termination.



Figure 2-23

At this time you may enter your own company information. The key things to remember when entering characters are: 1) press **F1** to back up or erase characters, 2) press **F3** to advance to the next character, and 3) press the number keys multiple times to choose the desired character.

## Option 2 - Direct Memory Storage

To begin storing data points using the direct memory storage method, you must be in Immediate Mode. If you are not there, press the **DONE** key until your screen looks like Figure 2-24. Notice the FBR: highlighted by the red box. This is a general name to give the group of fiber runs you are testing. This can be changed, along with the fiber type. You may also ZERO OUT your patch cords from this screen. Attach your patch cord(s) to your meter and light source according to the testing method you are using, and press **0**. When you change to REL mode by pressing you will notice the display change to read +0.00 and the units will be dB.

Press the **F2** key to begin direct memory storage. Notice the FBR: in Figure 2-25. This is the same label as on Figure 2-24. You can change this label by pressing **F1** multiple times to erase the label and put in your own label.

Labels are used to describe a group of runs you are testing. For example, you could use FPP1: to describe Fiber Patch Panel Number 1 in Rack number 1. You would change this name when you move to Patch Panel 2. Then you would enter FPP2. We always suggest a colon (:) after the label. This is for a reason.

Notice the label in Figure 2-24. It has the number 00 behind it. The number 00 denotes the first run in the series. From there, the numbers increment automatically, so the second run would have a 01, the third would have a 02, and so on. This continues until the number 99, when the software will ask you to enter a new label. Let's assume there are more than 100 runs in the first patch panel. Using our example above, when the software asks you to enter a new label, enter FPP1:1. When you start saving data points, they will now look like this: FPP1:100. The last 00 denotes the first run in the series, but will be labeled so that you know it is part of the same patch panel.

When you are finished entering your label, press **DONE** to continue.



Figure 2-24

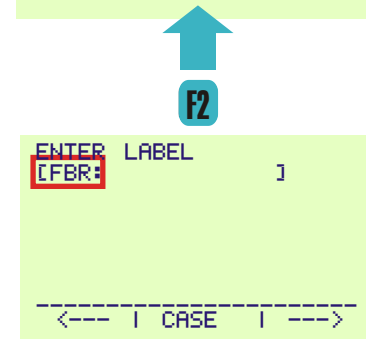


Figure 2-25

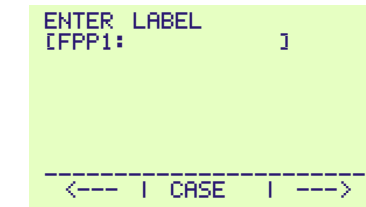


Figure 2-26

## Direct Memory Storage, continued.

Now we will choose the type of fiber associated with our label. There are four types that the meter supports:

- 62.5/125  $\mu\text{m}$  multimode
- 50/125  $\mu\text{m}$  multimode
- Indoor singlemode
- Outdoor singlemode

Although there may be other types of fiber, we use these types because they are the most common types, and are the types supported by the EIA/TIA 568-A standard.

To toggle through the types, press **F1** until you reach the type you are testing. When you see the type you are testing, press **DONE**.

For our example, let us stay at 62.5  $\mu\text{m}$  multimode fiber. After choosing 62.5  $\mu\text{m}$  fiber, the screen should look like Figure 2-28. The top line is reserved for your site name. Site setup will be explained in a later unit. Lines 2 & 3 contain the information you just entered. The fourth line down shows the absolute decibel reading and the wavelength for the fiber run you are testing.

PRINT DATA - sends information about the run to the serial port.

EDIT NAME - lets you re-enter the information about the run.

SAVE - saves the data point in memory and returns you to immediate mode so you can store the next run.

```
NAME = FPP1:
FIBER TYPE=62.5uM MM

-----
NEXT   |         |
TYPE   |         |
```

Figure 2-27

```
.....
NAME = FPP1:00
TYPE = 62.5uM MM

dBm = -21.18      850nm

-----
PRINT  | EDIT  |
DATA   | NAME  | SAVE
```

Figure 2-28

# UNIT 3

**Manual Setting of  
Optical Reference &  
Setting Up Sites**



## Setting Your Optical Reference

Your Micro OWL can be used as a tool to certify fiber optic links, capable of calculating the actual loss of a link. The methods explained earlier in this manual only focused on measuring the actual power received by the light source. Actual power readings cannot tell you whether a link will PASS or FAIL; they can only tell you how much light is being received.

Fiber optic certification is based on measuring the light energy that is lost as the light travels from one end of the fiber to the other. The only way to accomplish this is to set a value to begin our measurement. For our purposes, we will call this value the reference value.

The objective of this unit is to explain the concept of the reference value, and how to utilize this value to certify fiber runs using your Micro OWL.

As light travels down the fiber, the light energy from your active equipment is drained down by two factors: the inherent imperfections in the fiber, and the passive components of the link. When the light exits the fiber and is detected by the meter, all that the meter knows is how intense the light is. It has no idea what the light source launch power was, which can be described as the intensity of the light at the beginning of the fiber run. If the meter knows what the launch power is, it can simply subtract the launch power from the actual received power to arrive at the loss of the fiber optic link. The launch power is the reference value that you set in your meter for these calculations. Optical power is measured in decibels (dB) or decibels referenced to a milliwatt (dBm). See Appendix A for a review of the decibel.

## Setting Your Optical Reference (Continued)

In Immediate Mode, the default sampling mode is displayed as ABS (see Figure 3-1). The large numbers in the display show the absolute optical power that is detected for the selected wavelength (850nm in Figure 3-1). This value is displayed in decibels referenced to one milliwatt of optical power or dBm. Immediate mode may also display absolute power levels in units called microwatts. The upper right hand corner of the display will show “ $\mu W$ ”.

By pressing **F1**, you may toggle between ABS and REL, or relative mode. REL allows you to display the detected optical power referenced to your stored reference power (see Figure 3-2). You should see the power value change to use decibels, or dB.

This is useful if you would either like to display how much power in decibels is lost in the fiber (in which case the reference power would be the absolute light source power) or how many decibels the detected power is above or below a specific absolute power. This specific absolute power is usually the light source power minus the allowable fiber loss. In either case, the display will show you how many decibels (dB) the detected power is above or below the user defined absolute power.

Here’s an example: if you were to set the ABS value from Figure 3-1 as your optical reference, when you press **F1** to change to REL mode and leave the source connected, your screen would look like Figure 3-3. This means that you are losing 0 dB across your link. As you add length to your fiber or other sources of loss, this number will become negative. Likewise, if you increase the power of your source, this number will become positive.



Figure 3-1



Figure 3-2



Figure 3-3

# Manual Setting of Your Optical Reference



Figure 3-4

Let's begin by taking a test patch cable and carefully connecting one end to the meter and the other end to the light source. In our example, start with 850nm from the Function Options menu. Then set your light source to 850nm.

# Setting Your Optical Reference(Continued)



**PRESS MENU 3**

ENTERS YOU INTO WAVELENGTH REFERENCE MENU (NOTE:850NM SELECTED)

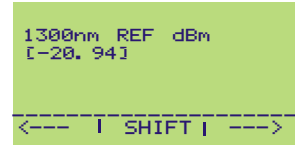
Wavelength	Ref
*850nm	-00. 01dBm
1300nm	-00. 01dBm
1550nm	-00. 01dBm

WAVE LENGTH	ADJ LCD	SET REF
-------------	---------	---------



**PRESS F2**



**PRESS DONE**

STORES VALUE AND TAKES YOU BACK TO WAVELENGTH REFERENCE MENU

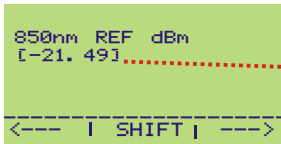
Wavelength	Ref
850nm	-21. 49dBm
*1300nm	-20. 94dBm
1550nm	-00. 01dBm

WAVE LENGTH	ADJ LCD	SET REF
-------------	---------	---------

**PRESS F2**

STORES VALUE AND REVIEWS FOR EDIT



-21.49 dBm is just an example value your result may vary.

**PRESS F1**

SELECTS NEW WAVELENGTH

Wavelength	Ref
850nm	-21. 49dBm
1300nm	-20. 94dBm
*1550nm	-00. 01dBm

WAVE LENGTH	ADJ LCD	SET REF
-------------	---------	---------

**PRESS DONE**

TAKES YOU BACK TO WAVELENGTH REFERENCE MENU

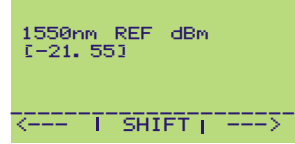
Wavelength	Ref
*850nm	-21. 49dBm
1300nm	-00. 01dBm
1550nm	-00. 01dBm

WAVE LENGTH	ADJ LCD	SET REF
-------------	---------	---------



**PRESS F2**



**PRESS DONE**

**PRESS DONE FOUR MORE TIMES TO RETURN TO IMMEDIATE MODE**

Wavelength	Ref
850nm	-21. 49dBm
1300nm	-20. 94dBm
*1550nm	-21. 55dBm

WAVE LENGTH	ADJ LCD	SET REF
-------------	---------	---------

**PRESS F1**

SELECTS NEXT WAVELENGTH

Wavelength	Ref
850nm	-21. 49dBm
*1300nm	-00. 01dBm
1550nm	-00. 01dBm

WAVE LENGTH	ADJ LCD	SET REF
-------------	---------	---------

# Setting Your Optical Reference(Continued)

Calculate Passive Fiber System Attenuation

*Acme Plant - Fiber Job*

*Maximum Loss per Run According to Standards*

<i>Passive Component</i>	<i>Loss in dB</i>	<i>Quantity</i>	<i>Sub-Total</i>
<i>Connector Pair Loss</i>	<i>0.75</i>	<i>2</i>	<i>1.5</i>
<i>MM Cable Loosm</i>	<i>3.75/km</i>	<i>2</i>	<i>7.5</i>
<i>Splice Loss</i>	<i>0.3</i>	<i>2</i>	<i>0.6</i>
<i>Passive Link Loss =</i>			<i>9.6 dB</i>

*Active Component Values*

*1300 nm Transmitter Strengths = 45uW*





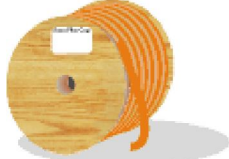
+



= Passive Loss in Decibels (dB)

# Setting Your Optical Reference(Continued)

Typical Standards-assigned Loss Values

Passive Component	Name	62.5 $\mu$ m MULTIMODE		SINGLEMODE	
		Loss in Decibels (dB) TYPICAL	Loss in Decibels (dB) 568-A	Loss in Decibels (dB) TYPICAL	Loss in Decibels (dB) 568-A
	Connector Pair dB per mated pair	ST - 0.3 568SC - 0.3	0.75	568SC - 0.3 FC PC - 0.3	0.75
	Splice db per splice	0.15 (Fusion)  0.15 (Mechanical)	0.3	0.15 (Fusion)  0.2 (Mechanical)	0.3
	Fiber Cable dB per Kilometer(KM)	3.0 to 5.0 (850nm)  0.9 to 3.0 (1300nm)	3.75 (850nm)  1.5 (1300nm)	0.3 to 1.0	0.5 (Indoor)  1.0 (outdoor)

## The Purpose of Setting Up Sites

The Micro OWL optical fiber power meter is capable of storing information for nearly 1000 data points. With all of this information, it could be difficult to read without some system of separating the data points into groups. In the Micro OWL, this information is separated by sites.

Sites are simply a way to keep track of general information about the run: the site name, date, and reference value for each wavelength. A site name can be a company name, a division within a company, or even a section of a single building. The wavelengths for the site depend on the fiber type that is currently loaded. If no data points have been stored, or if the data points have been cleared out of memory, the meter will assume a fiber type of 62.5/125 $\mu$ m multimode fiber. The wavelengths associated with multimode fiber types will be 850, 1300, and 1550nm, and wavelengths associated with singlemode fiber types will be 850, 1310, and 1550nm. Up to four sites can be stored in the meter.

The rest of this unit will be dedicated to showing you how to set up sites in the meter.





## Setting Up Sites, continued.

**PRESS F1** until you scrolled all the way to the right and clear out any characters.

EDITS PREVIOUS DATA

```
DATE
[ ]
-----
<--- | CASE | --->
```

**PRESS** **0** **F3** **7** **F3** **0** **0** **F3** **0** **F3** **7** **F3**

**PRESS** **0** **0** **F3** **0** **F3** **7**

It should say 07-07-07 (See below)

**PRESS** **DONE**

```
ACME-PLANT
07-07-07
-----
SITE | DATE | SET
NAME |  | REF
```

You have now completed your test site information. For ease of use, the SET REF function has been added to Site Setup. Press **F3** to set the reference value for the site you are setting up. Page 3-5 has the steps to take for setting the reference value.

If you are finished setting up sites, press **DONE** until you get back to immediate mode.

## Loading Previously Saved Sites

After you have created sites, and have been using the meter for awhile, you may find it necessary to: 1) remove an old site and create a new one because you have run out of space for sites, or 2) you need to return to a site that has already been set up to continue testing for that site.

If you need to remove a site due to lack of site space, you must first download the data into our OWL Reporter software and delete it from the meter; both of these steps are covered in later chapters. Once this is complete, you may change the site. Follow the procedures outlined in this chapter, starting on page 3-9.

If you are returning to a different site than the one you have been currently using, you will need to load that site before you start storing data for that site.

From Immediate Mode, press **MENU**. From the list that appears, choose the number **5** (Figure 3-5). This will give you a list of the sites that you have stored in your meter. Press **F1** until the asterisk is in front of the site you want to use. Once you have selected the site you want to use, press **F2** to load this site (Figure 3-6). Press **DONE** until you are back in Immediate Mode, where you may begin storing data for the site you have selected.



Figure 3-5

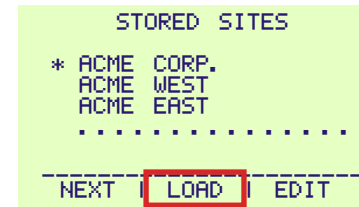


Figure 3-6

# UNIT 4

**Wizard Mode**

UNIT 4

# Wizard Mode Explained

The Micro OWL includes an advanced data capture and storage function called Wizard Mode. The purpose of Wizard Mode is to set a reference value based on the current testing environment. Factors considered by Wizard Mode are: the power being received by the meter, the approximate length of the link in meters, the number of connector pairs in the link, and the number of splices in the link. The meter will measure the power from the light source, and the user will enter the fiber length, number of connector pairs and splices. With all of this information, the Micro OWL can calculate the total passive cable system attenuation according to loss values defined in the EIA/TIA 568-A.

The Micro OWL stores the necessary information with the incrementing fiber label. After all of the runs are tested and stored, the data can then be downloaded into our OWL Reporter software (see Unit 5 for details). The OWL Reporter software will take that information and print out a professional report for either a single circuit or a summary of all runs with the same fiber label.

Wizard Mode is an advanced function and should be used only after a full understanding of the other test methods previously mentioned in this manual, as well as an understanding of the decibel and a familiarity with the EIA/TIA 568-A and TSB-72.

Continue on in this unit for step-by-step procedures on how to use Wizard Mode.

# Using Wizard Mode

From Immediate Mode (Figure 4-1), press **MENU**. The screen should then look like Figure 4-2. Make sure that you have an 850nm light source connected to the meter via a test patch cord.



Figure 4-1

From the Main Menu, press **6**. The meter will enter Wizard Mode.



Figure 4-2

For our example, we will assume a typical horizontal link using loss values defined in the EIA/TIA TSB-72, Centralized Fiber Optics. The typical link includes: 100 meters of 62.5/125µm graded-index multimode fiber, two connector pairs, and no splices. Figure 4-3 shows the current Wizard parameters. We are now ready to enter our fiber link characteristics. Press **F2** to change the fiber length.

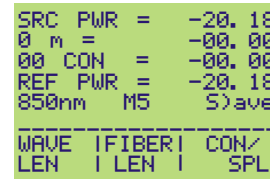


Figure 4-3

## Using Wizard Mode, Cont.

Now, we shall enter our fiber length, which is 100 meters. Press the following key sequence:



The number '100' should appear in the brackets. Press **DONE** to continue.

```
LENGTH (Meters):  
[      ]  
  
-----  
<--- |CASE | --->
```

Figure 4-4

Press **F1** to choose the correct fiber type. In our example, we are using 62.5µm multimode fiber (See Figure 4-5). Press **DONE** to continue.

```
NAME = FBR:  
TYPE=62.5um MM  
  
-----  
NEXT |   |  
TYPE |   |
```

Figure 4-5

Press **F3** to enter the number of connectors and splices we have in our link.

```
SRC PWR = -20.18  
100 m = -00.38  
00 CON = -00.00  
REF PWR = -20.56  
850nm M5 S)ave  
  
-----  
WAVE |FIBER| CON/  
LEN | LEN | SPL
```

Figure 4-6

## Using Wizard Mode, Cont.

In our example, we are using 2 connector pairs, so on the screen shown in Figure 4-7, press **2**. Press **DONE** to continue.

```
INLINE CONNECTS:  
[  ]  
  
<--- |CASE | --->
```

Figure 4-7

In our example, we are using 0 splices, so on the screen shown in Figure 4-8, press **0**. Press **DONE** to continue.

```
INLINE SPLICES:  
[  ]  
  
<--- |CASE | --->
```

Figure 4-8

## Using Wizard Mode, Cont.

This screen shows us what our relative value will be after we apply EIA/TIA 568-A loss values for the components of our link. Here is a brief description of the items on the display (all values are listed in dBm):

**SOURCE POWER:** This is the absolute power being detected by the meter from the light source.

**100 Meters:** This shows the amount of loss contained in the fiber according to the standard. This number will change with different fiber lengths and different wavelengths. Consult the standard for the actual values pertaining to the different fiber types.

**02 CON 00 SPL:** This is the amount of loss contributed by connector pairs (2) and splices (0). The standard loss values for all cable types is 0.75 dB per connector pair, and 0.3 dB per splice.

**MIN POWER OUT:** This is the relative power reading after all of the losses are applied to the initial source power.

```
SRC PWR = -20.18
100 m = -00.38
02 CONN = -01.50
REF PWR = -22.06
850nm M5 S>ave
```

```
-----
WAVE | FIBER | CON/
LEN | LEN | SPL
```

Figure 4-9

For multimode links, the standard specifies testing at 850nm and 1300 nm. Thus, relative power readings must be saved for both wavelengths. Press **7** to save the value for 850nm. Then connect a 1300nm light source and press **F1** to switch to 1300nm and press **7** again to save the value for 1300nm. Wizard mode also allows you to save a value at 1550nm if you are testing at that wavelength. Just follow the steps previously covered. After you have finished saving all of your reference values, press **DONE** twice to return to Immediate Mode.

If you need to change the fiber length, or the number of connector pairs or splices, press **F2** or **F3**, respectively. You will then be prompted to repeat the steps for the particular component you are changing.

By pressing **5**, you will be allowed to change to type of fiber you are using. By changing this setting, you will apply the appropriate losses for the new fiber type you choose. If you choose to change this number, the fibers you test from that point on will use the reference value shown on the screen. You will get inaccurate readings if you configure the Wizard to use a fiber type that is different from the type you are testing.



## Using Wizard Mode, Cont.

After you are finished saving the reference values for the wavelengths you will be testing, you may begin saving data points, which is shown in Unit 2 under the heading Option 2 - Direct Storage Method.

# **UNIT 5**

## **OWL REPORTER SOFTWARE**

**UNIT 5**

# OWL Reporter

Network performance is only as good as the cable installation and the environment the cable is in. In order to ensure that cable has been installed and terminated properly, installers need a set of standards to follow, and a way to test their work. For fiber optic networks, that is the purpose of an optical power meter and light source combination. However, it is not enough just to know if the cable passes or fails, and by how much. First, the power meter must be able to store the data points of the cables being tested. Second, customers often require a hard copy of the test results for administration purposes. Hand-written reports are not professional and cannot truly be trusted. How would you know if the readings are true? The person who tested the runs may have written down false information in order to avoid reworks. In order to preserve the trust of their customers, cable installers need a way to produce valid and professional looking reports that aren't hand-written and can truly certify cable installations. We at OWL realize the importance of standards-based certification reports. We developed OWL Reporter software for just this reason.

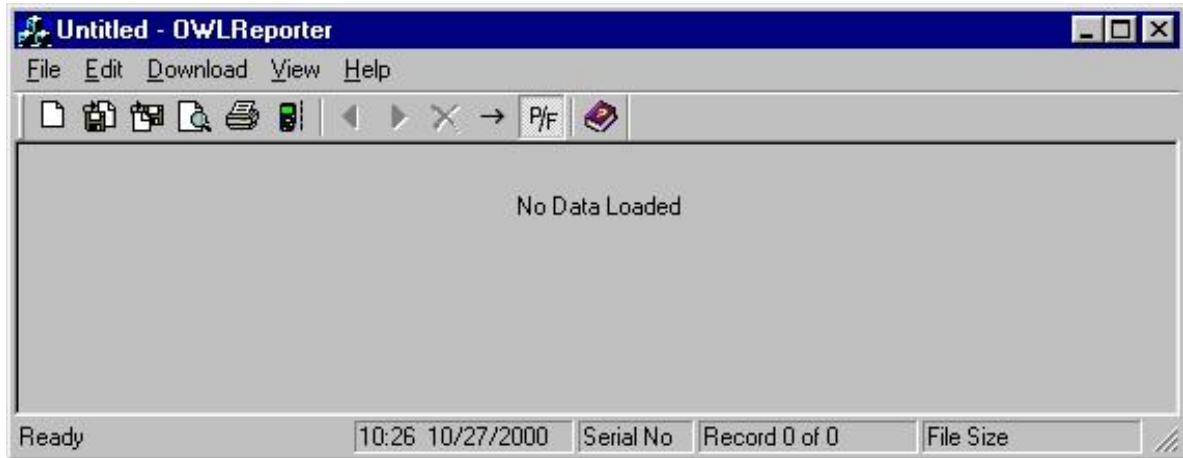
OWL Reporter is bundled with every Micro OWL optical power meter. This software is filled with features necessary for accurate reporting and certifying:

- Intuitive GUI interface
- Easy meter download
- Professional-looking circuit summary and detail printouts
- Sortable data
- View PASS/FAIL results or actual results
- Results comply with the EIA/TIA 568-A standard when using Wizard-set reference values

To learn more about the operation of OWL Reporter software, continue on in the unit.

# OWL Reporter

Opening Screen



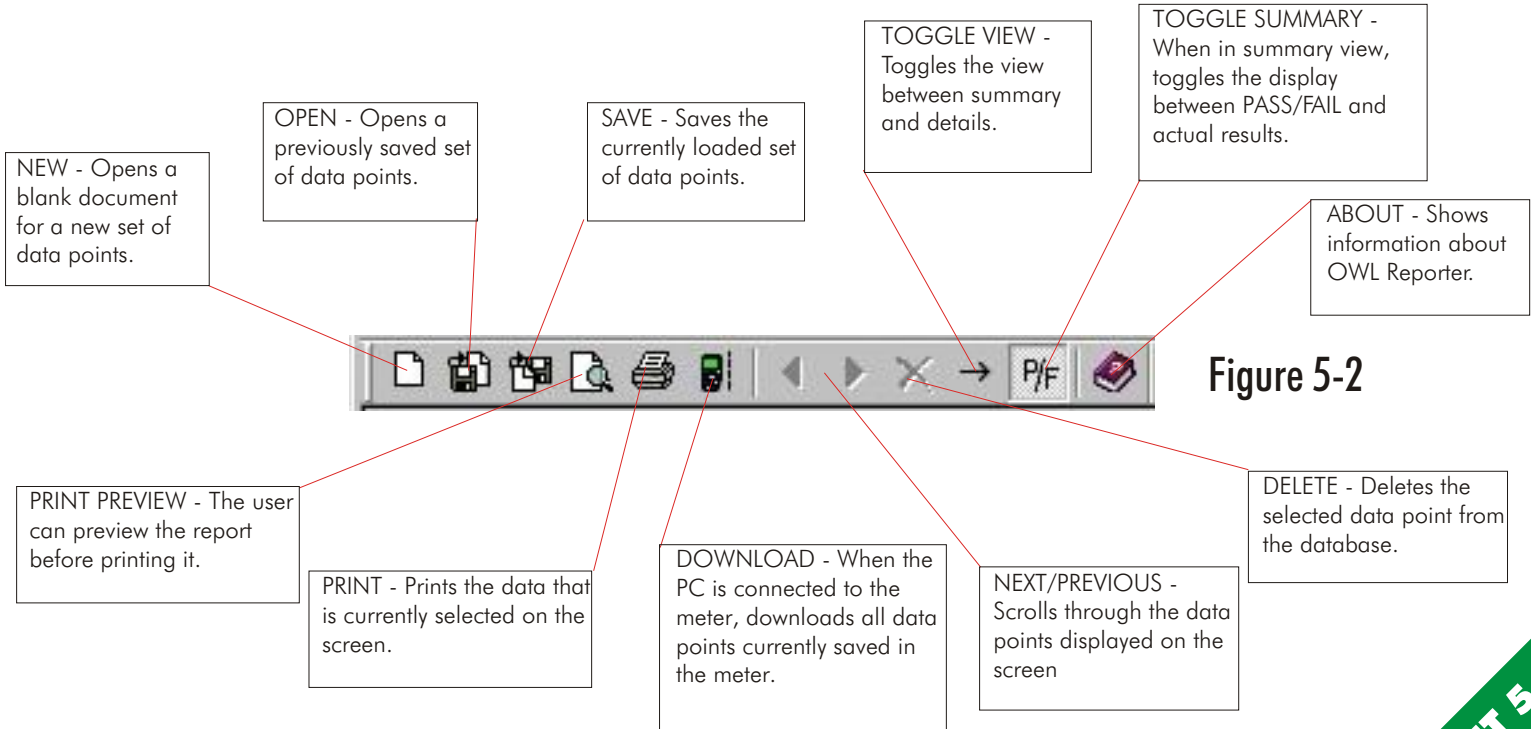
**Figure 5-1**

Figure 5-1 shows the opening screen for the OWL Reporter software. OWL Reporter opens up with no data loaded, as the figure shows. The actual screen will be larger; it has been shrunk down here to fit on the page.

Before we get into the operation of the software, we should cover some of the graphical features of the software, such as the buttons and the status bar.

# OWL Reporter

## Button Bar



**Figure 5-2**

# OWL Reporter

Status Bar

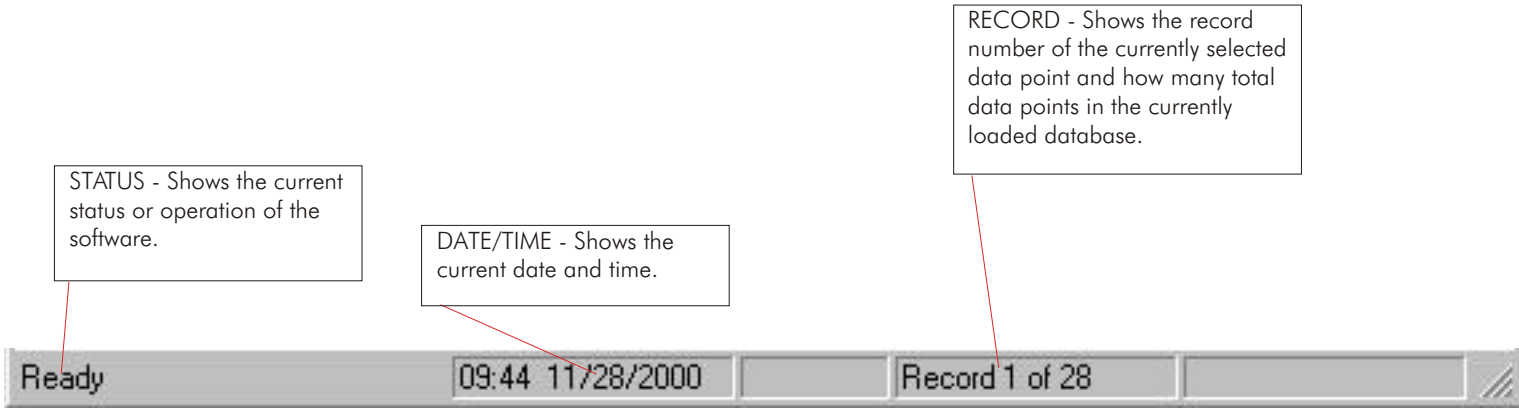
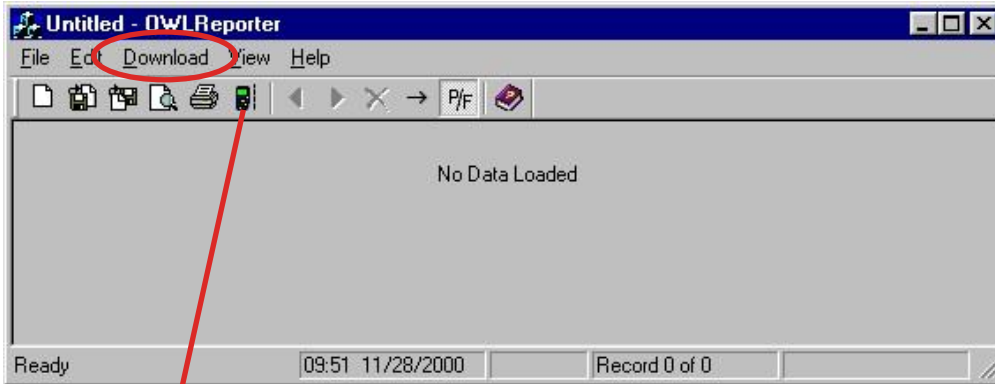


Figure 5-3

# OWL Reporter

Downloading Data



Each time you start OWL Reporter, it is necessary to load data. This can be done one of two ways: downloading new data from the meter or opening a currently saved file. First, we will cover how to download data from the meter.

**Figure 5-4**

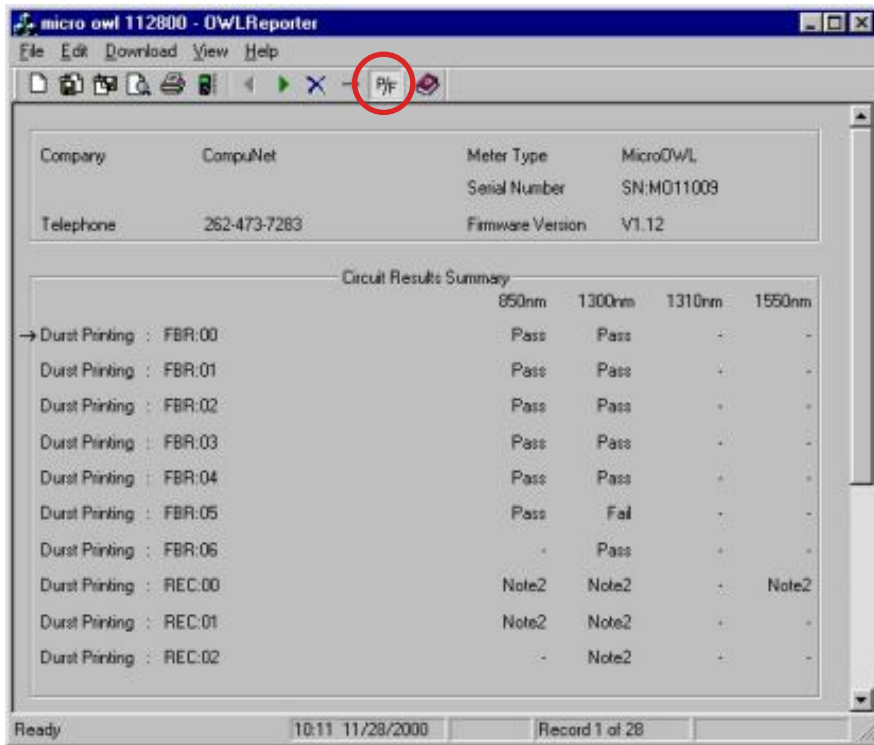


Make sure that the download cable that came with the meter is attached to any COM port on the PC (DB9) and the meter's data port (phono jack). Then press the download button (shown on the left). You may also use the Download option from the menu bar. The software automatically downloads all data that is stored in the meter. You will see the STATUS portion of the Status Bar change with the download operation steps. First, the software searches for the meter, then it transfers the data, then gives a confirmation of download success.

If the download fails, communications cannot continue and no data will download into the PC. Check the cable connections, test the current COM port, and/or try a different COM port. If none of these steps fix the problem, call our tech support line listed at the end of the manual.

# OWL Reporter

## Circuit Summary Screen PASS/FAIL View



There are two panels on this screen. The top panel shows meter related information: owner, telephone number, meter type and serial number, and software version. This information will not change unless the owner information changes or a different meter is used.

The bottom panel - Circuit Results Summary - shows the important data point information. The arrow to the left of the first data point denotes the currently selected data point. Listed from left to right is the site name, fiber label and run number, and the results for each tested wavelength. Also notice the record section of the status bar. This shows which record you are currently viewing. NOTE: the currently selected data point will always be the very first data point listed in the Circuit Results Summary panel. Please verify your data point number in the record status field. Your results may also show a note number. Notes indicate that the test failed to meet a condition required for fiber certification based on standards, or the reference value was not saved while running Wizard Mode. Setting your reference value using Wizard Mode is covered in Unit 6. The descriptions for these notes will be given at the bottom of the printout, and are listed in Appendix F.

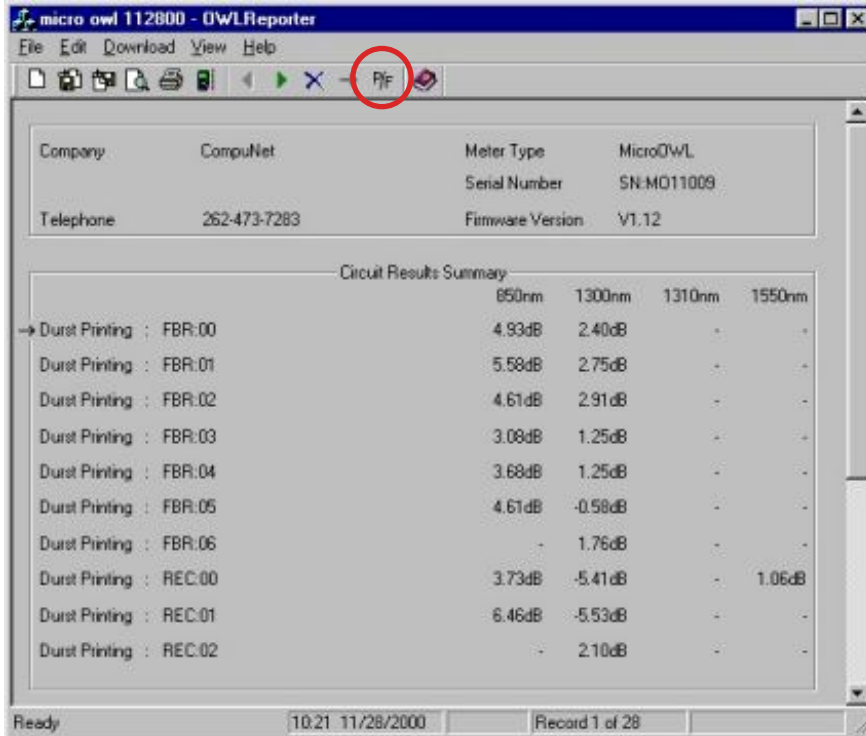
Notice the summary toggle button is depressed. This means that the summary is set to PASS/FAIL view. Unpressing this button will change the screen to Cable Performance Margin view.

Figure 5-5



# OWL Reporter

## Circuit Summary Screen Cable Performance Margin View



Notice that the Toggle Summary button is not depressed. This means actual power values are shown (in dB) rather than PASS/FAIL. These numbers reflect the cable performance margin (CPM) for each run at each tested wavelength. In our example, 4.93dB is the CPM for FBR:00 for 850nm. The resultant number shows the amount of decibels that the link can lose before it drops below the reference power for that wavelength. Negative numbers indicate that the measured power is below the reference power for the appropriate wavelength. Any additional connectors, splices, or fiber length requires you to retest the fiber with the new link configuration.

Data points are sorted according to Site Name, then Fiber Label and Fiber Number.


The EIA/TIA 568-A specifies testing fiber optic links with two wavelengths: 850 and 1300nm for multimode, and 1310 and 1550nm for singlemode. In order to get standards compliant reports, you must follow the guidelines contained in this standard.

Standards-compliant reports may be generated by OWL Reporter software only if the reference values have been saved while using Wizard Mode.

Figure 5-6

# OWL Reporter

## Circuit Summary Screen Printing the Circuit Summary Report



### Circuit Summary Report

#### Optical Wavelength Laboratories

N9623 Hwy 12, Whitewater, WI 53190

Site ID:	ACMI	Meter Type:	FiberOWL
Company Name:	ACME CORP.	Serial Number:	SN:FO21006
		Software Version:	V1.11
Telephone Number:	800-555-1212	Report Date:	11/07/2000

Circuit ID	Date	P/F	850nm	P/F	1300nm	P/F	1310nm	P/F	1550nm
FBR:00	07/07/2000	Pass	1.61dB	Pass	1.28dB	-	-	-	-
FBR:01	07/07/2000	Pass	1.49dB	Pass	1.47dB	-	-	-	-
FBR:02	07/07/2000	Pass	1.83dB	Pass	1.12dB	-	-	-	-
FBR:03	07/07/2000	Pass	1.44dB	Pass	1.16dB	-	-	-	-
FBR:04	07/07/2000	Pass	1.47dB	Pass	1.28dB	-	-	-	-
FBR:05	07/07/2000	Pass	1.42dB	Pass	1.39dB	-	-	-	-
FBR:06	07/07/2000	Pass	1.47dB	Pass	1.43dB	-	-	-	-
FBR:07	07/07/2000	Pass	1.72dB	Pass	1.51dB	-	-	-	-
FBR:08	07/07/2000	Pass	1.79dB	Pass	1.54dB	-	-	-	-
FBR:09	07/07/2000	Pass	1.81dB	Pass	1.16dB	-	-	-	-
FBR:10	07/07/2000	Pass	1.77dB	Pass	1.04dB	-	-	-	-

Installer/Technician: _____	Date: _____
Customer: _____	Date: _____

You may print out the summary results into a professional looking report (Figure 5-7). The report includes all of the information listed on the summary screens, and is useful for keeping track of general information for fiber runs associated with a certain site. Circuit specific information can also be printed, and will be covered later in this unit.

Standards for telecommunications administration highly recommend keeping hard-copy records on file as well as digitally. These records should be available to assist in any audit trails, or in case the computer files are lost for any reason.

Figure 5-7

# OWL Reporter

## Circuit Detail Screen

The screenshot shows the OWL Reporter software interface. The title bar reads 'Untitled - OWL Reporter'. The menu bar includes 'File', 'Edit', 'Download', 'View', and 'Help'. The main window is divided into several sections:

- Company Information:** Company: CompuNet, Telephone: 262-473-7283, Meter Type: MicroOWL, Serial Number: SNM011009, Firmware Version: V1.12
- Site Information:** Site ID: Durst Printing, Circuit ID: FBR:00, Date of Test: 11/02/2000, Temperature: 61.0 F, Calibration Date, Date of Download: 11/28/2000 16:10
- Circuit Characteristics:** Fiber Length (in kilometers): 0.69, Number of Connector Pairs (0.75dB per pair): 4, Number of Splices (0.30dB per splice): 0, Cable Type: 62.5um MM
- Circuit Test Results:** A table showing attenuation and power values for different wavelengths (850nm, 1300nm, 1310nm, 1550nm).

Circuit Test Results				
	850nm	1300nm	1310nm	1550nm
Passive Cable System Attenuation				
Source Power	-26.44dBm	-20.17dBm	-	-
Fiber Loss	2.60dB	1.03dB	-	-
Connector Loss	3.05dB	3.00dB	-	-
Splice Loss	0.05dB	0.05dB	-	-
Calculated System Attenuation	5.60dB	4.03dB	-	-
System Reference Power	-26.04dBm	-24.20dBm	-	-
Absolute System Power	-21.11dBm	-21.80dBm	-	-
Cable Performance Margin	4.93dB	2.48dB	-	-
Operating Margin %	88.19%	48.29%	-	-
Pass/Fail	Pass	Pass	-	-

Ready | 15:13 05/23/2001 | Record 1 of 28

The Circuit Detail Screen shows details about individual fiber runs. For our example, we will use FBR:00. There are four panels on this screen. The panel on the top shows the owner information. Panel two shows the site information, including the site name, circuit name, test date, temperature, and the date the circuit was downloaded into OWL Reporter, as well as the date the meter was last calibrated. The third panel shows the characteristics of the circuit: fiber length, number of connector pairs, number of splices, and type of cable. These characteristics are necessary for calculating the loss value associated with passive fiber components for the EIA/TIA 568-A standard, and will only appear if the Wizard was used to set the reference power. Panel number four shows the circuit's performance characteristics.

**SOURCE POWER:** Actual power being read from the light source.

**FIBER LOSS:** Allowable loss associated with passive fiber cable attenuation.

**CONNECTOR LOSS:** Total allowable loss attributed to connectors.

**SPLICE LOSS:** Total allowable loss attributed to splices.

**CALCULATED SYSTEM ATTENUATION:** Total loss associated with passive components, i.e. fiber loss, connector loss, and splice loss.

**SYSTEM REFERENCE POWER:** Source power minus calculated system attenuation.

**ABSOLUTE SYSTEM POWER:** Absolute measured link power.

**CABLE PERFORMANCE MARGIN:** Total power the link can lose before it drops below the System Reference Power.

**OPERATING MARGIN %:** Cable Performance Margin expressed as a percentage of the Calculated System Attenuation.

**PASS/FAIL:** Certification according to the EIA/TIA 568-A standard.

Figure 5-8

# OWL Reporter

## Circuit Detail Screen

The screenshot shows the OWL Reporter software interface. The title bar reads "Untitled - OWL Reporter". The menu bar includes "File", "Edit", "Download", "View", and "Help". The toolbar contains various icons, with a red circle highlighting the left and right arrow buttons. The main display area is divided into several sections:

- Company Information:**

Company	CompuNet	Meter Type	MicroOWL
		Serial Number	SN:M011009
Telephone	262-473-7283	Firmware Version	V1.12
- Site and Circuit Information:**

Site ID	Curst Printing	Date of Test	11/02/2000
Circuit ID	FBR:00	Temperature	61.0 F
Calibration Date		Date of Download	11/28/2000 16:10
- Circuit Characteristics:**

Fiber Length (in kilometers)	0.69
Number of Connector Pairs (0.75dB per pair):	4
Number of Splices (0.30dB per splice)	0
Cable Type:	62.5um MM
- Circuit Test Results:**

	850nm	1300nm	1310nm	1550nm
Passive Cable System Attenuation				
Source Power	-26.44dBm	-20.17dBm	-	-
Fiber Loss	2.60dB	1.03dB	-	-
Connector Loss	3.05dB	3.00dB	-	-
Splice Loss	0.05dB	0.05dB	-	-
Calculated System Attenuation	5.60dB	4.03dB	-	-
System Reference Power	-26.04dBm	-24.20dBm	-	-
Absolute System Power	-21.11dBm	-21.60dBm	-	-
Cable Performance Margin	4.93dB	2.48dB	-	-
Operating Margin %	88.19%	48.29%	-	-
Pass/Fail	Pass	Pass	-	-

The status bar at the bottom shows "Ready", "15:13 05/23/2001", and "Record 1 of 28".

Notice that we are looking at Circuit ID FBR:00, and that the record status tells us that it is record 1 of 28. You may scroll through the fiber detail using the green arrow buttons on the button bar.

When doing a print preview, you will notice that all of the fiber runs in the database will show up. Just scroll to the fiber run you need to preview to check out what the actual printout will be.

Figure 5-9



# Circuit Detail Report

## Optical Wavelength Laboratories

N9623 Hwy 12, Whitewater, WI 53190

Site ID:	ACME-PLANT	Page:	1
Company Name:	ACME CORP.	Meter Type:	FiberOWL
		Serial Number:	SN:FO21006
		Software Version:	V1.11
Telephone Number:	800-555-1212	Report Date:	11/07/2000

Circuit ID:	FBR.00	Date of test:	07/07/2000
Calibration Date	07/01/2000	Temperature:	76.0 F

### *Circuit Characteristics*

Fiber Length (in kilometers):	0.10
Number of Connector Pairs:	2
Number of Splices:	0
Cable Type:	62.5uM MM

### *Circuit Test Results*

	850nm	1300nm	1310nm	1550nm
<b>Passive Cable System Attenuation</b>				
Detected Source Power	-20.07dBm	-20.00dBm	-	-
Fiber Loss	0.38dB	0.15dB	-	-
Connector Loss	1.50dB	1.50dB	-	-
Splice Loss	0.00dB	0.00dB	-	-
Total Calculated System Attenuation	1.88dB	1.65dB	-	-
Minimum Required Power (TIA-568)	-21.95dBm	-21.65dBm	-	-
Absolute System Power	-20.34dBm	-20.37dBm	-	-
Cable Performance Margin	1.61dB	1.28dB	-	-
Operating Margin	93.97%	91.83%	-	-
Pass/Fail	Pass	Pass	-	-

Installer/Tester:	_____	Date:	_____
Customer:	_____	Date:	_____

# OWL Reporter

## Circuit Detail Report

Figure 5-10 shows a sample Circuit Detail Report. It contains all of the information associated with an individual fiber run.

A hard copy of this report should be kept with summary reports and all other circuit detail reports associated with their mutual Site ID. These reports can be used for auditing purposes, and for backups of the digital data in case it is lost.

Figure 5-10

# OWL Reporter

## Saving Data Files

Once you are finished downloading your data points and have verified their accuracy, you should save the downloaded data whether you have printed the reports or not.

Data can be saved two ways. You can merge the data into an existing database, which will sort the data based on all sites within the database, or you can save smaller, separate data files.

To save your data, press the save button (highlighted in Figure 5-11) or press **F**ile on the menu bar, and click on **S**ave **A**s... to save your file. Give the file a name descriptive to the site. If you wish to merge the data, choose the existing database file, and you will be prompted to merge the data.

You may save files at any time. You do not have to be at the Summary screen.

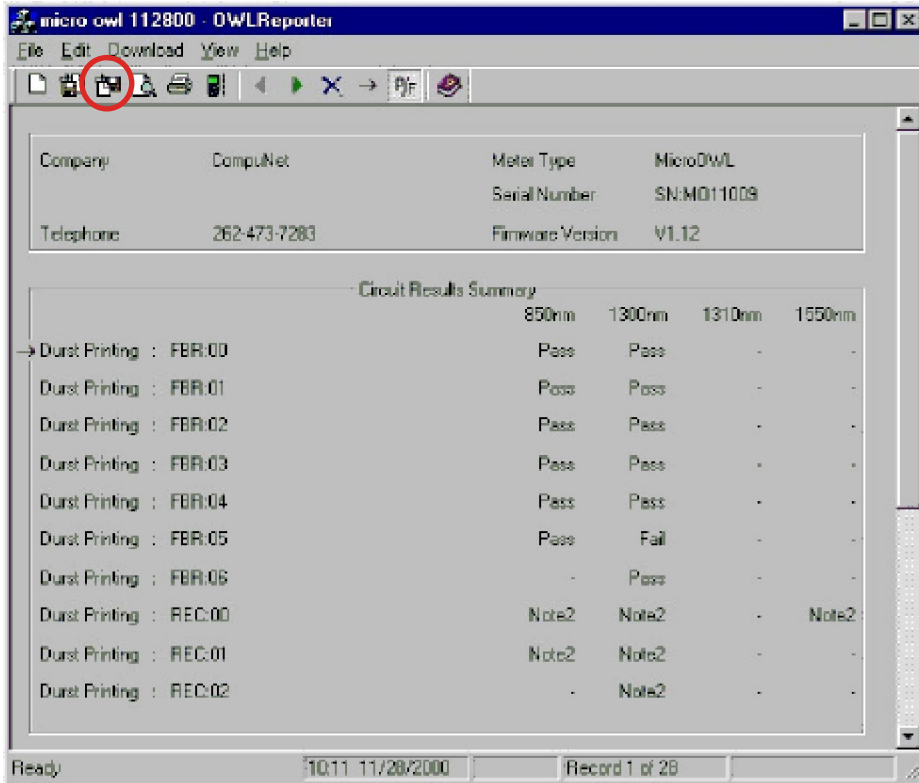


Figure 5-11

# OWL Reporter

## Opening Data Files

After you have downloaded, saved, and printed your files, you may find it necessary to retrieve circuit information from the database file. This can be done by pressing the Open button on the button bar (highlighted in Figure 5-12), or by using the File, Open command from the menu bar.

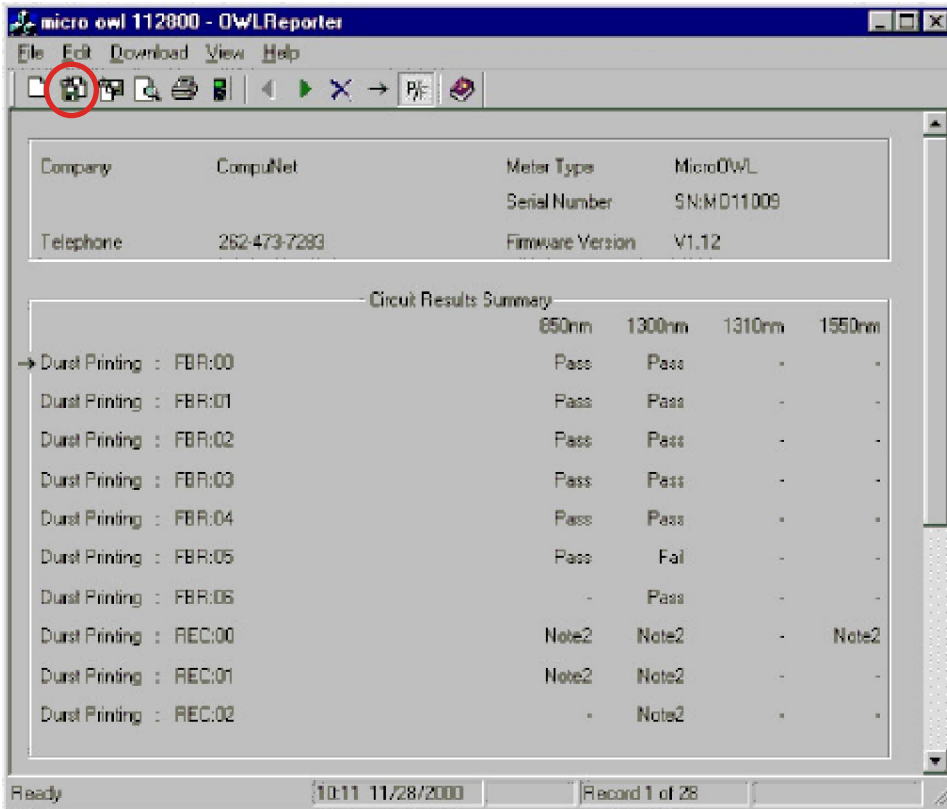
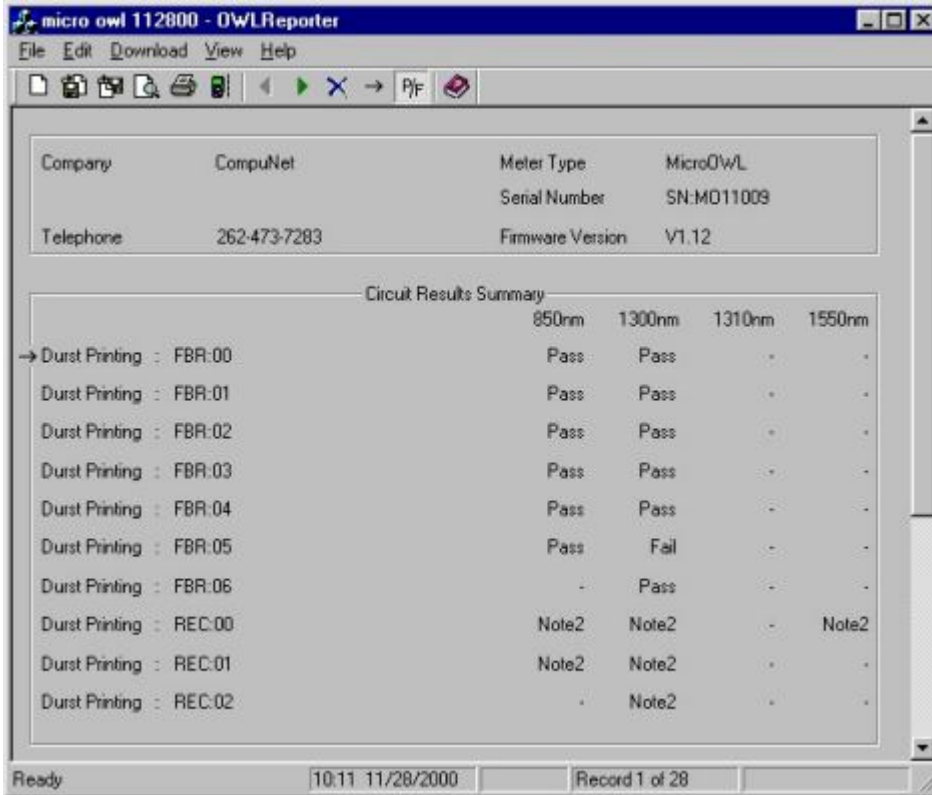


Figure 5-12

# OWL Reporter

## Deleting Circuit Information



Individual circuit records may also be deleted. You may want to do this in order to eliminate old data points in the database. This is not mandatory; the older data will not be overwritten because each data point is marked with a different download date and time.

If you must delete a Circuit ID, make sure that you have a hard copy stored in a safe place, because the data will be irretrievable after it has been deleted. We recommend leaving all tests and re-tests available electronically for auditing purposes. These database files are relatively small, so saving old circuit information will not overburden your hard drive.

When exiting OWL Reporter, you will be prompted to save your database. You may merge data into your old database, or you may save a new database.

Figure 5-13



# UNIT 6

**USING STORED DATA**

UNIT 6

## Using Stored Data



Once you have your data stored in the meter's memory, there are several things you can do with them. We have already discussed downloading the data into our OWL Reporter software. This is by far the easiest way to manage your data and to format it into a professional looking report.

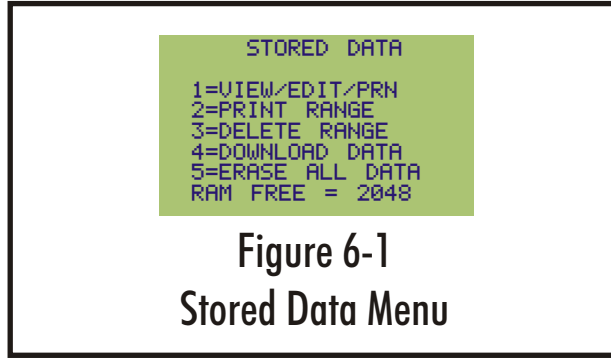
The Micro OWL can also manipulate this stored data without the use of OWL Reporter. Stored data can be dumped out to the on-board serial port to a PC terminal program, or printed to a serial printer.

Once data is downloaded, the data should be deleted in order to conserve space in the meter. This task is easy to accomplish using the friendly menu system in the Micro OWL. You can either erase a range of data, or you can delete all of the data. Erasing data does not erase everything in the meter; the owner information and site information remain intact until you change them. Only data points get erased from this menu.

Each of the options on the Stored Data menu are described in the following pages in this unit.

## Using Stored Data, Cont.

The majority of the steps in this unit take place in the Stored Data menu. To enter the Stored Data menu, press , then . The screen should look like Figure 6-1.



**OPTION 1 - VIEW/EDIT/PRN** - You may view, edit, or print any record. See page 6-4.

**OPTION 2 - PRINT RANGE** - Print a range of values based on the current fiber label. See page 6-6.

**OPTION 3 - DELETE RANGE** - Delete a range of values based on the current fiber label. See page 6-7.

**OPTION 4 - DOWNLOAD DATA** - Dump all of the data to the serial port in comma-delimited format. See page 6-8.

**OPTION 5 - ERASE ALL DATA** - Erase all data points. Note: this does not erase owner or site information. See page 6-9.

**RAM FREE** - Shows how many bytes remain for data storage. The meter has 2048 bytes, or 2 kilobytes, of storage. This amount of RAM is sufficient to store up to 1000 data points.

## OPTION 1 - VIEW/EDIT/PRINT

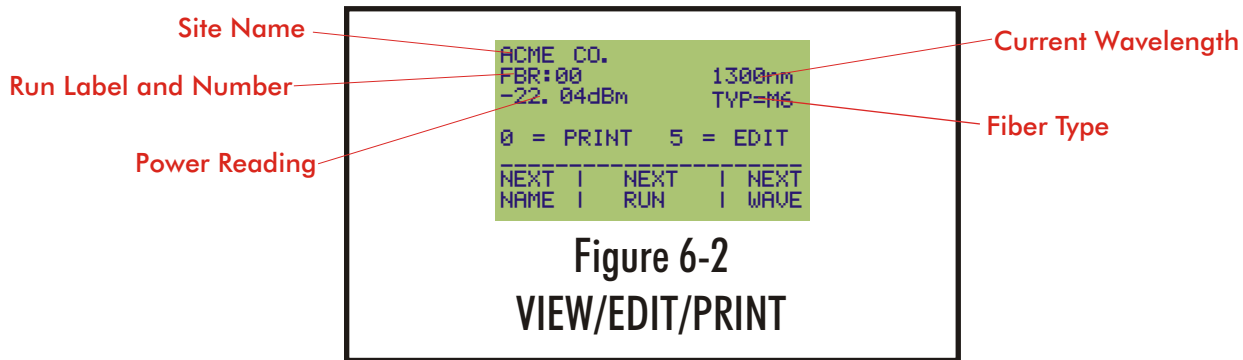


Figure 6-2 displays the information about a data point. It lists the site name, the fiber label, the fiber run number, the wavelength, the power reading, and the fiber type.

**NEXT NAME** **F1** - Toggles through all of the Run Labels for all stored sites. Toggling between run labels brings up the very first data point for that run label.

**NEXT RUN** **F2** - Toggles through all of the run numbers associated with the current run label. The wavelength does not change when toggling through run numbers.

**NEXT WAVE** **F3** - Toggles through the wavelengths associated with the current run label and number.

**PRINT** **0** SP - Prints the current data point to the serial port. See page 6-5 for more details on this function.

**EDIT** **5** MENU - Sends the user back out to Immediate Mode to re-test the current run. Editing the current run overwrites the old power reading for the current run. This allows you to re-test a fiber without having to change any of the other data point information. When the new data point is saved, the user must re-enter the STORED DATA menu.

## OPTION 1 - VIEW/EDIT/PRINT, continue.

### Print Format of Data Point Printing

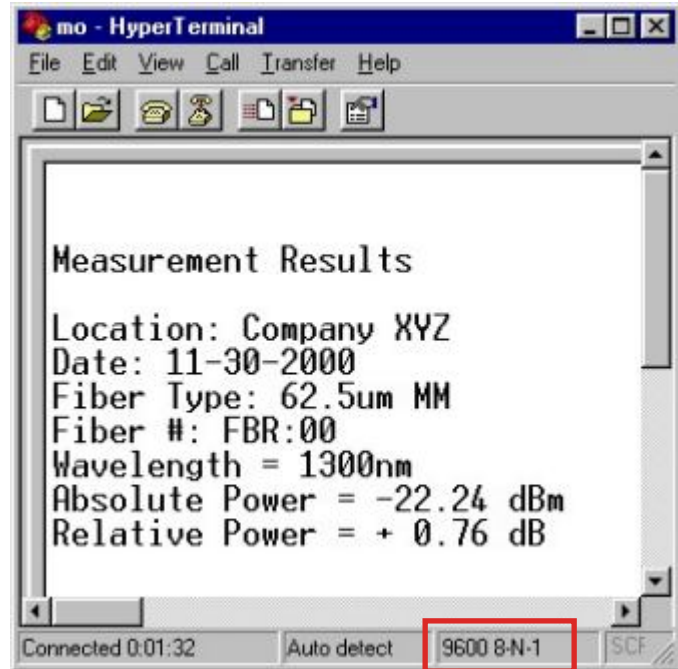
Selecting  from the VIEW/EDIT/PRN menu prints the current data point to the serial port.

Figure 6-3 shows the format of the Micro OWL printout as it is captured by HyperTerminal which comes with Windows 9X operating systems; however, any terminal program will suffice.

Notice the red box at the bottom of Figure 6-3. It shows the necessary COM port settings. The meter also uses hardware flow control. The serial port has a maximum transfer rate of 9600 baud, and any communications port set above this rate may produce unreliable results.

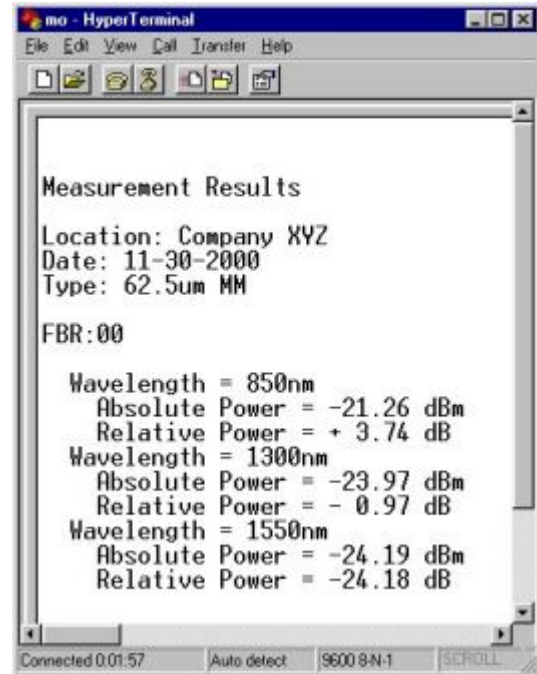
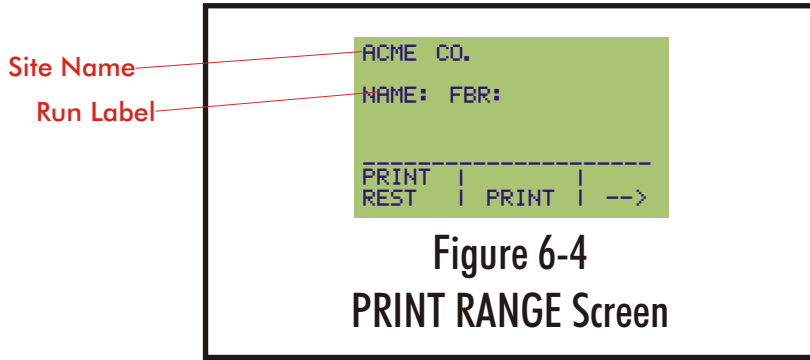
Consult your terminal program's manual to configure it for use with the Micro OWL.

You may also connect a serial printer to a COM port to print the data. The data will appear as it does in Figure 6-3.



**Figure 6-3**  
**Micro OWL Print Format**

## OPTION 2 - PRINT RANGE



Selecting **2** from the STORED DATA menu brings you to the PRINT RANGE screen. This screen allows you to print selected data to the serial port in the format shown in Figure 6-4. It displays the current Site Name, the Run Label, and three menu options:

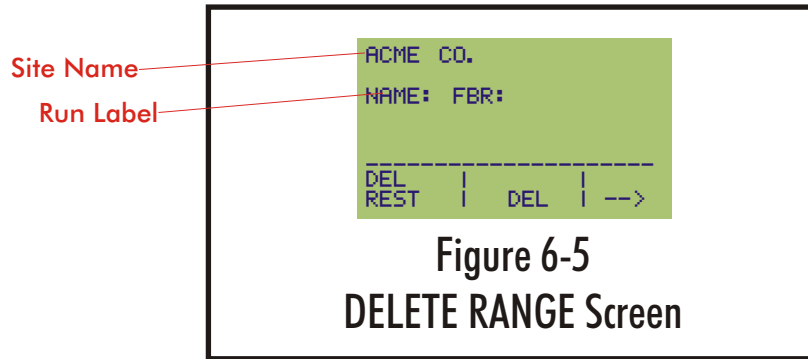
**PRINT REST F1** -This option will print all data points chronologically from the current run label to the last data point stored. After this command is executed, you will be returned to the STORED DATA menu.

**PRINT F2** -This option will print all data points pertaining to the current run label.

**--> F3** -This option allows you to scroll through all run labels for all stored sites.

**PRINT RANGE format**

## OPTION 3 - DELETE RANGE



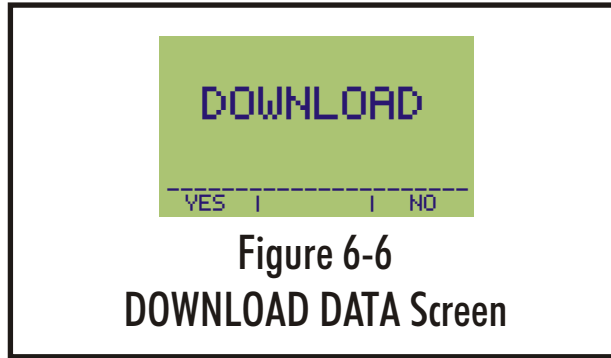
Selecting **3** from the STORED DATA menu brings you to the DELETE RANGE screen. This screen allows you to select fiber labels and delete all of the associated data points. It displays the current Site Name, the Run Label, and three menu options:

**DELETE REST F1** -This option will delete all data points from the current run label to the last data point in the last run label stored. After this command is executed, you will be returned to the STORED DATA menu.

**DELETE F2** -This option will delete all data points pertaining to the current run label.

**--> F3** -This option allows you to scroll through all run labels for all stored sites.

## OPTION 4 - DOWNLOAD DATA



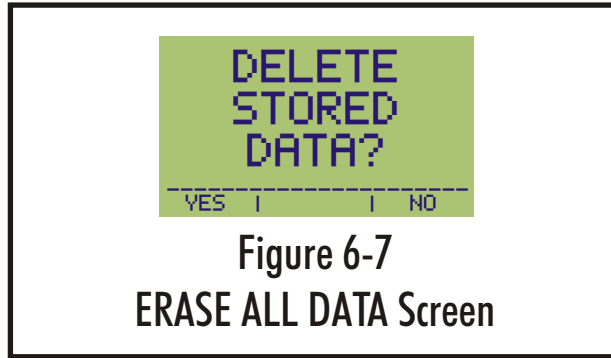
Selecting **4** from the STORED DATA menu brings you to a screen that asks you to confirm that you wish to download your data.

Pressing **F1** will download your data, while pressing **F3** will return you to the STORED DATA menu.

Downloading your data will dump all your data to the serial port in a comma delimited format. This format can easily be exported to a database or spreadsheet if you do not have our OWL Reporter software installed on the computer you are using.



## OPTION 5 - ERASE ALL DATA



Selecting **5** from the STORED DATA menu brings you to a screen that asks you to confirm that you wish to erase all of your stored data. This will not erase owner information or site information.

Pressing **F1** will erase all of your stored data points, while pressing **F3** will return you to the STORED DATA menu.

It is highly recommended to download your data into our OWL Reporter software or using OPTION 4 from the STORED DATA menu before executing this command. Erasing this data will irrevocably remove the data from RAM and it will not be recoverable.

# UNIT 7

## APPENDICES

- Appendix A - Decibel Review**
- Appendix B - Dynamic Range Review**
- Appendix C - Glossary of Terms**
- Appendix D - Micro OWL Specifications**
- Appendix E - Warranty Information**
- Appendix F - OWL Reporter Notes Descriptions**
- Appendix G - Cleaning and Care Instructions**

## Appendix A - Decibel Review

Your new Micro OWL meter has a decibel(dB) range of +5 dB to -60dB. The whole purpose of your meter is to measure light energy in decibels. But what exactly is a decibel? It is not uncommon for a technician to be using an optical power meter and not understand what a decibel really is. If you struggle a little with this review, you will find the concept not so threatening.

This is what happens when we test a link: we send light of a specified wavelength from a stable light source down the fiber optic cabling. The meter then captures this light and measures it. As light travels down this path, however, its photons encounter impurities, connector gaps, and even the glass atoms themselves. All of these factors cause attenuation in the fiber. If there is too much attenuation, your fiber optic link will fail, because it does not have enough power to trigger the circuitry in the active receiver equipment. No communications can occur in this scenario.

Simply put, a decibel is a measure of the ratio of the power received at the end of a link relative to the power you started with, which is known. This fraction calculates the relative power. This calculation is similar to test scores or percentages.

$$\frac{\text{AMOUNT OF LIGHT POWER LEFTOVER AT THE END OF LINK}}{\text{AMOUNT OF LIGHT POWER IN THE BEGINNING OF YOUR LINK}} \times 100 = \text{Relative power out as a \%}$$

If test results were kept in percent or fractions, the average person wouldn't have difficulty in grasping the concept of decibels. Unfortunately, in scientific measurement, graphing power measurements has become too cumbersome due to their wide range of possible values; a person would need to paste lots of sheets of graph paper together to plot these power functions by hand. So scientists came up with a little trick to "squeeze" the graph down to a more presentable size. The trick uses logarithms (logs). Logs are fairly simple -- most of us have already encountered logs in pre-algebra class. They didn't seem so important then, but they are important to the understanding of decibels. Logs expressed in Base 10 are just a way to state how many zeros there are in a number.

## Appendix A - Decibel Review

For example,  $\log(10)=1$ ,  $\log(100)=2$ ,  $\log(1000)=3$ . Notice the pattern. Logs simply express how many places there are after the first number. Let's work with a number that isn't 10, 100, or 1000. For instance the  $\log(2014)=3.304$ . Notice that 2014 has three digits beyond the first, thus the "3" in the 3.304. Also notice how it relates to the "3" in  $\log(1000)=3$ . Remember, logs are a tool we use to "squeeze" our measurements down so they will fit on graph paper.

$$\mathbf{LOG}\left(\frac{\text{AMOUNT OF LIGHT POWER LEFTOVER AT THE END OF LINK}}{\text{AMOUNT OF LIGHT POWER IN THE BEGINNING OF YOUR LINK}}\right) = \mathbf{RELATIVE POWER AS A POWER OF 10}$$

Power is measured in watts (w), therefore:

$$\mathbf{LOG}\left(\frac{W_{\text{END OF LINK}}}{W_{\text{BEGINNING OF LINK}}}\right) = \mathbf{RELATIVE POWER AS A POWER OF 10}$$

Mathematicians and scientists must have noticed that the shrinking effect of the graph was a little excessive. Logs in optical decibels get multiplied by 10. Thus we finally have :

$$\mathbf{10 LOG}\left(\frac{W_{\text{END OF LINK}}}{W_{\text{BEGINNING OF LINK}}}\right) = \mathbf{RELATIVE POWER IN dB}$$

Remember: Decibels are simply the ratio of the power received by the receiver over the power sent out by the light source at the start of link.

## Appendix A - Decibel Review

There are other decibels to consider. The decibel we previously described is "dB" is called relative. This is because it is a ratio as was explained. With ratios there is no way to tell what absolute value we had at the start or end of a link. To solve the problem we can always reference our optical power to a fixed value of one milliwatt (1 mW). One milliwatt of power will replace the denominator of our equation.

$$10 \text{ LOG} \left( \frac{W_{\text{END OF LINK}}}{1 \text{ mW}} \right) = \text{ABSOLUTE POWER IN dB}$$

So when we are given a value of absolute power in dBm we know that it is the power relative to 1 mW and we can calculate the actual power in mW if necessary. We can also compare values in dBm to each other because they are relative to the same reference (1 mW). However, we cannot compare values in dB to each other because we do not know if they are relative to the same reference.

## Appendix B - Dynamic Range Review

Now that you have a clearer understanding of the decibel, we can begin to study the dynamic range feature of the Micro OWL. The dynamic range of the Micro OWL is +5 to -60 dBm, but what exactly does this mean?

Dynamic range is defined as the difference between the minimum and maximum power levels that a photodetector can reliably sense, and still maintain acceptable accuracy. In the case of the Micro OWL, the dynamic range is 65dB.

Any power level reaching the detector that is greater than +5 dBm is too powerful to accurately measure. Likewise, any power level below -60 dBm will be too weak to be sensed.

Power levels within the dynamic range produce acceptable readings. It is interesting to note that the Micro OWL remains accurate over the upper 96% of the 65 dB dynamic range and then gets progressively worse as the power levels drop off.

The limits of dynamic ranges depend on certain factors. The minimum level depends on the sensitivity of the receiver. The sensitivity of the receiver can be increased by using different materials, such as germanium (Ge) or indium/gallium/arsenide (InGaAs). The characteristics of these materials allows the detector to be responsive at lower power levels. The maximum level depends on both the size of the receiver area , and also the amplifier used.

## Appendix C - Glossary of Terms

Absorption	The loss of power in an optical fiber, resulting from conversion of optical power into heat and caused principally by impurities, such as transition metals and hydroxyl ions, and also by exposure to nuclear radiation.
Acceptance angle	The half-angle of the cone within which incident light is totally internally reflected by the fiber core. It is equal to $\arcsin(\text{NA})$ .
Attenuation	A general term indicating a decrease in power from one point to another. In optical fibers, it is measured in decibels per kilometer at a specified wavelength.
Bandwidth	The transmission capacity of a system.
Buffering	<ol style="list-style-type: none"><li>1. A protective material extruded directly on the fiber coating to protect the fiber from the environment (tight buffering).</li><li>2. Extruding a tube around the coated fiber to allow isolation of the fiber from stresses on the cable (loose buffered).</li></ol>
Buffer Tubes	Loose-fitting covering over optical fibers used for protection and isolation.
Bundle	Many individual fibers contained within a single jacket or buffer tube. Also, a group of buffered fibers distinguished in some fashion from another group in the same cable core.
Cladding	The outer concentric layer that surrounds the fiber core and has a lower index of refraction.
Connector	A mechanical device used to provide a means for aligning, attaching, and achieving continuity between fibers.



## Appendix C - Glossary of Terms

Consolidation Point	A location for interconnection between horizontal cables that extend from building pathways and horizontal cables that extend into work area pathways.
Core	The central, light-carrying part of an optical fiber; it has an index of refraction higher than that of the surrounding cladding.
Cross-Connection	A connection scheme between cabling runs, subsystems, and equipment using patch cords or jumpers that attach to connecting hardware on each end.
Decibel (dB)	In fiber optics, a standard logarithmic unit for the ratio of the power that was received over the power that was originally sent.
dBm	Decibel referenced to a milliwatt.
dB $\mu$	Decibel referenced to a microwatt.
Detector	An optoelectronic transducer used in fiber optics for converting optical power to electric current. In fiber optics, usually a photodiode.
Diffraction	The bending of radio, sound, or light waves around an object, barrier, or aperture edge.
Dispersion	A general term for those phenomena that cause a broadening or spreading of light as it propagates through and optical fiber. the three types are modal, material, and waveguide.
Entrance Facility	An entrance to a building for both public and private network service cables including the entrance point at the building wall and continuing to the entrance room or space.

## Appendix C - Glossary of Terms

Equilibrium Mode Distribution (EMD)	The steady modal state of a multimode fiber in which the relative power distribution among modes is independent of fiber length.
Equipment Room	A centralized space for telecommunications equipment that serves the occupants of the building. Equipment housed herein is considered distinct from a telecommunications closet because of its nature or complexity of the equipment.
Frequency	Of a periodic wave, the number of identical cycles per second. Usually expressed in Hertz.
Fresnel Reflection	The reflection that occurs at the planar junction of two materials having different refractive indices; Fresnel reflection is not a function of the angle of incidence.
Graded-index Fiber	An optical fiber whose core has a nonuniform index of refraction. The core is composed of concentric rings of glass whose refractive indices decrease from the center axis. The purpose is to reduce modal dispersion and thereby increase fiber bandwidth.
Horizontal Cross-Connect (HC)	A cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone, equipment.
Index of Refraction	The ration of the velocity of light in free space to the velocity of light in a given material.
Insertion Loss	The loss of power that results from inserting a component, such as a connector or splice, into a previously continuous path.
Interconnection	A connection scheme that provides for the direct connection of a cable to another cable or to an equipment cable without a patch cord or jumper.

## Appendix C - Glossary of Terms

Intermediate Cross-Connect (IC)	A cross-connect between the main cross-connect and the horizontal cross-connect in backbone cabling.
Laser	Light Amplification by Stimulated Emission of Radiation. A light source producing, through stimulated emission, coherent, near monochromatic light. Lasers in fiber optics are usually solid-state semiconductor types.
Light-Emitting Diode (LED)	A semiconductor diode that spontaneously emits light from the PN junction when forward current is applied.
Main Cross-Connect	The cross-connect in the main equipment room for connecting entrance cables, backbone cables, and equipment cables.
Material Dispersion	Dispersion resulting from the different velocities of each wavelength in an optical fiber.
Modal Dispersion	Dispersion resulting from the different transit lengths of different propagating modes in a multimode optical fiber.
Mode	A possible path followed by light rays.
Multimode Fiber	A type of optical fiber that supports more than one propagating mode.
Numeric Aperture (NA)	The number that expresses the light-gathering ability of a fiber.

## Appendix C - Glossary of Terms

Optical Time Domain Reflectometry (OTDR)	A method of evaluating optical fibers based on detecting backscattered (reflected) light. Used to measure fiber attenuation, evaluate splice and connector joints, and locate faults. Also, the equipment used to perform such measurements (Optical Time Domain Reflectometer).
Photodetector	An optoelectronic transducer, such as a PIN photodiode or avalanche photodiode.
Photodiode	A semiconductor diode that produces current in response to incident optical power and used as a detector in fiber optics.
Photon	A quantum of electromagnetic energy; a particle of light.
Receiver	An electronic device which converts optical signals to electrical signals.
Responsivity	The ratio of a photodetector's electrical output to its optical input in an optical fiber.
Singlemode Fiber	An optical fiber that supports only one mode of light propagation above the cutoff wavelength.
Source	The light emitter, either an LED or laser diode, in a fiber optic link.
Spectral Width	A measure of the extent of a spectrum. For a source, the width of wavelengths contained in the output at one half of the wavelength of peak power. Typical spectral widths are 20 to 60 nm for an LED and 2 to 5 nm for a laser diode.
Splice	An interconnection method for joining the ends of two optical fibers in a permanent or semi-permanent fashion.

## Appendix C - Glossary of Terms

Step-Index Fiber	An optical fiber, either multimode or singlemode, in which the core refractive index is uniform throughout so that a sharp step in refractive index occurs at the core-to-cladding interface. It usually refers to a multimode fiber.
Telecommunications Closet (TC)	An enclosed space for housing telecommunications equipment, cable terminations, and cross-connects. The closet is the recognized cross-connect between the backbone cable and horizontal cabling.
Tight Buffer	A cable construction where each fiber is tightly buffered by a protective thermoplastic coating to a diameter of 900 $\mu\text{m}$ .
Transmitter	An electronic package which converts an electrical signal to an optical signal.
Wavelength	The distance between the same two points on adjacent waves; the time required for a wave to complete a single cycle.
Work Area (WA)	A building space where the occupants interact with telecommunications terminal equipment; i.e. PCs, telephones, and other office equipment.

## Appendix D - Micro OWL Specifications

Detector Type:----- Ge (1mm)  
Calibrated Wavelengths:----- 850, 1310, 1550  
Measurement Range:----- +5 to -60 dBm<sup>1</sup>  
Accuracy:-----  $\pm 0.15$  dBm<sup>2</sup>  
Resolution:----- 0.01  
Battery Life:----- up to 100 hours (9V)  
Connector Type:----- ST  
Operating Temperature:----- -10 to 55 C  
Storage Temperature:----- -30 to 70 C  
Size:----- 2.75"W x 4.94"H x 1.28"D  
Weight:----- 116g  
Data Storage Points:----- up to 1000  
Download Data Points:----- OWL Reporter Software  
Absolute/Relative Measurements:----- Yes  
Battery Capacity Display:----- Yes  
Backlight:----- Yes  
NIST Traceable:----- Yes

1- +5 to -55dBm@850nm, 0 to -60dBm@1310/1550nm

2- +5 to -45dBm

## Appendix E - Warranty Information

Your Micro OWL comes standard with a one-year limited warranty which covers the meter against manufacturing and assembly defects. Any returns not related to these types of defects are not covered under the warranty. Call tech support at (262) 473-0643 with any warranty concerns you may have.

Over time, the meter may lose its accuracy. This is natural for equipment of this type due to the electronic components used. Re-calibration may be necessary to restore the meter to its original accuracy. Re-calibration is not covered under warranty, but is offered as a service. Call OWL at (262) 473-0643 for more details on our re-calibrations services.

## Appendix F - OWL Reporter Notes Descriptions

When used with Wizard set references, OWL Reporter is able to certify your fiber runs according to the EIA/TIA 568-A cabling standard. There are three conditions which cause a fiber run to be non-certifiable. OWL Reporter informs the user of the presence of these conditions in the form of notes. The descriptions for these notes and their remedies are given below.

Note 1 The reference value was not saved via Wizard Mode. You must run the Wizard to set your reference.

Note 2 The fiber type saved during Wizard setup for the site does not match the fiber type saved with the fiber run at that site. You must re-run the wizard with the correct fiber type.

Note 3 The EIA/TIA 568-A does not support the selected wavelength for the fiber type saved in the data point. No fix needed; testing at extra wavelengths does not affect the required wavelength.

OWL Reporter will only display a note for one condition. This does not mean that only one condition is not met. Note 1 takes precedence over Note 2, which takes precedence over Note 3.



## Appendix G - Care Instructions

The Micro OWL is a sensitive piece of scientific equipment. Great care should be taken when handling and cleaning it.

### **HANDLING TIPS**

- 1) Do NOT drop the meter. Damage may occur to the case or electronic components on the circuit board may become dislodged.
- 2) Keep the meter in its neoprene case when not in use. This will help protect the meter from the elements and accidental droppage.
- 3) Store the meter in a cool dry area when not in use in order to keep the meter in top working condition.
- 4) Always remember to replace the rubber cap on the connector. This will keep dust and dirt out of it when you are not using the meter.

### **CLEANING TIPS**

- 1) Use only 99% or better Isopropyl alcohol when cleaning the detector. Any less than 99% contains too much water and will begin to corrode the components. 99% Isopropyl alcohol is very flammable, so additional care must be taken when cleaning the detector. 99% Isopropyl alcohol can be purchased at your local drug store.
- 2) Whenever possible, use specially designed 2.5mm cleaning sticks to clean the detector. These do not require alcohol and do not damage the insides of the connector. Do not use sticks or swabs of any other type because they may damage the zirconium ferrule or the coating of the detector inside the connector, or may leave behind dust or fibers that will add loss to the fiber reading.
- 3) The detector port should be cleaned at the beginning and end of the testing day to keep connector loss during testing at a minimum.
- 4) When cleaning the meter itself, do not use any household cleaner that contains ammonia as this will damage any plastic it comes in contact with.
- 5) The case is splash-proof, so it is not necessary to clean the inside of the meter.
- 6) Only use lint-free cloths. Anything else may scratch the plastic of the display.