



OZ OPTICS LIMITED

from light sources to test equipment... components for fiber optic systems

DIGITAL VARIABLE ATTENUATOR DA-100



306-2001-3-13

OPERATING INSTRUCTIONS

S21941-004-MAN

WELCOME TO OZ!

Thank you for your purchase of an OZ Optics test instrument or fiber optic component. Our products are designed to give years of trouble-free use. We offer accurate, reliable performance, and pre-testing at the factory. This means you can use our products the same day they arrive.

OZ Optics has made components for fiber optic systems since 1985: everything from light sources to test equipment. Our vision is to harness light and make it work for you. OZ has developed a reputation for fast, versatile design, coupled with quality manufacturing. OZ products are diverse and affordable.

Our rugged and lightweight hand-held test instruments let you do everything from locating faults to measuring optical power. Anyone can use these units with minimal setup or training. We also offer a variety of components that get the specialist closer to the action—consider our great fiber optic delivery systems. We are particularly proud of our polarization-maintaining components.

We continually research and improve our products. In that spirit, we welcome your queries and suggestions. We have standard warranty and repair policies with technical support. Our experienced team of optics experts is ready and available to assist you with the development of your fiber optics system. We maintain a complete laboratory of computers and equipment to help you with your questions and applications.

See the **Contact Us** section of this document for more information.





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INTRODUCTION

The OZ Optics family of handheld test equipment includes the DA-100 Digital Variable Attenuator, which provides controlled attenuation of optical power. The DA-100 is a rugged instrument that provides versatility and accuracy in a wide range of applications. The DA-100 is simple to use: The user interface takes the guesswork out of setting precise and repeatable optical attenuation in the lab or the field.

The degree of attenuation is controlled with an internal stepper-motor that is geared to give a balance of speed and precision. The versatile design allows each unit to be custom-built and calibrated to address the specific requirements of a user-defined fiber optic system.

Optical attenuation can be set directly with the DA-100 attenuator keypad. The DA-100 is configured with a large liquid crystal display (LCD) and a simple-to-use, menu-driven user interface. The unit allows for keypad entry of the wavelength and optical attenuation. It can also operate in a mode that allows for continuous increment and decrement.

The built-in USB interface on the DA-100 enables attenuation control for computer-based applications. The host computer can send attenuation commands directly to the DA-100 using the USB cable.

When a single-mode attenuator is required, a beam blocking technique is used; when a multimode attenuator is required, a variable neutral density filter is used.

Key Features

- High power handling
- High speed, high resolution
- Wide attenuation range
- Low insertion loss, low backreflection
- Polarization insensitive
- Wide wavelength range; flat wavelength response
- Communications interface
- Wide range of connectors available
- Blocking technique for single-mode applications; variable neutral density filter for multimode fiber applications
- Multi-wavelength calibration available
- Polarization maintaining (PM) versions available
- Rugged, compact design



Applications

- Testing for bit error rate (BER)
- Simulating optical link budgets
- Designing optical receiver front-ends
- Measuring power meter linearity
- Power setting

Parts and Accessories

The standard configuration of the DA-100 includes:

- DA-100 Digital Variable Attenuator, with protective rubber boot
- USB cable
- AC/DC power supply
- Molded carrying case
- Certificate of Compliance
- Operating Instructions (this document)

Contact OZ Optics for information on other models of the Digital Variable Attenuator, or custom specifications for the DA-100.

The DA-100 Digital Variable Attenuator package includes the handheld unit, with impact-absorbent blue rubber boot (not shown), user-specified optical receptacles, USB cable, and AC/DC power adaptor. Figure 1 shows the standard configuration of the DA-100.

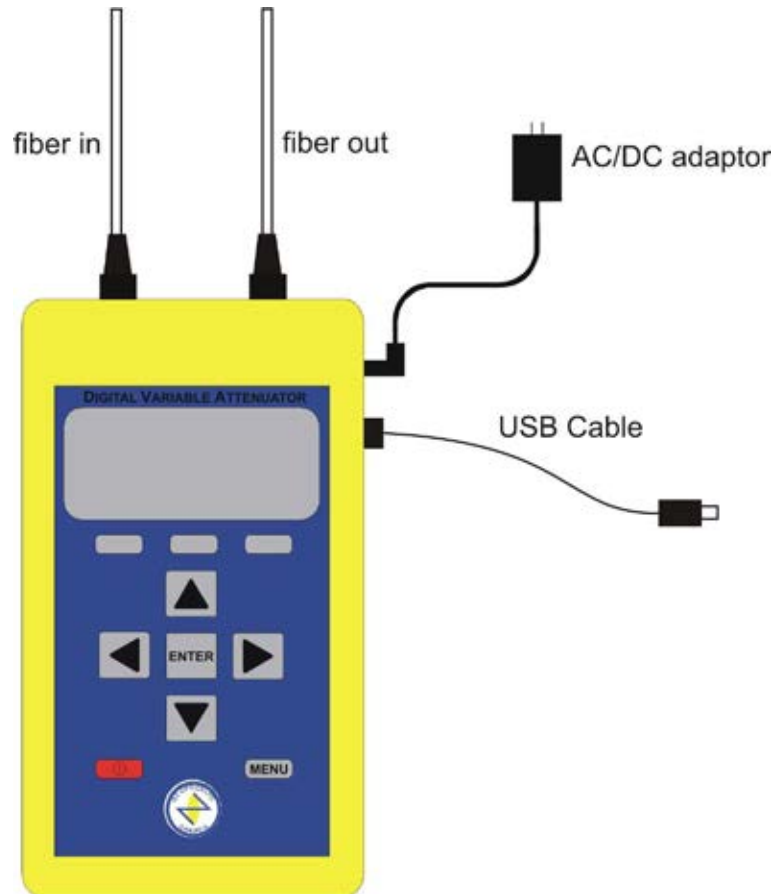


Figure 1: DA-100 Digital Variable Attenuator and Connectors

Calibration

Each unit is individually calibrated as it comes from the production line. The range of attenuation is measured and the results are programmed into the look-up table memory of the unit. Each unit can be calibrated at the factory for use at multiple wavelengths.



Note

To ensure optimum performance, return the unit to OZ Optics after one year for recalibration.



DA-100 Operating Modes

The unit can operate in a direct entry mode using the built-in keypad. This mode allows the user to program the wavelength, in nanometers, and attenuation level, in decibels, with just a few keystrokes.

Within direct entry mode, the DA-100 can also operate in a convenient increment/decrement mode. In this mode, press the left (◀) or right (▶) arrow keys on the keypad to change the optical attenuation level. On initial entry into this mode of operation, the user sets the amount by which the attenuation level increments or decrements.

A host computer can control the DA-100 remotely through the USB interface. The USB cable is a standard accessory that connects the USB receptacle on the DA-100 to any available USB port on a PC. In this mode, the DA-100 can be controlled by a host computer. This allows it to be operated remotely in situations where the physical presence of an operator is not convenient.

DA-100 Connections

The user specifies the type of input and output optical receptacles; they must be compatible with the intended application of the unit. Standard accessories include the USB cable. The standard AC/DC power adaptor connects to a 110/220 VAC wall outlet.

Attenuation Methods

The DA-100 incorporates either the blocking-type or variable neutral density filter-type attenuator mechanism, with a micro-controller to provide the intelligence. The blocking technique allows for high-speed, high-resolution attenuation under digital stepper motor control. Each DA-100 is calibrated for one or more specific wavelengths; the most accurate results are obtained when the device is used at one of these wavelengths.

Blocking Type Attenuator

In single-mode fiber applications, the blocking type attenuator is used. Light from the source fiber is collimated into a beam diameter of approximately 0.4 to 0.6 mm, within a wavelength range of 350 to 2050 nm. The width of the beam depends on the lens, wavelength, and numerical aperture (NA) of the fiber. A blocking device, shown in Figure 2, is inserted into the beam of collimated light to attain the attenuation required.

A precision stepper motor, through a reduction gear assembly, controls the blocking device. The motor drives a given number of steps from the home reference location to position the blocking device to intersect the beam.

The attenuator is calibrated so that there is a well-known relationship between the position of the blocking device and the level of attenuation.

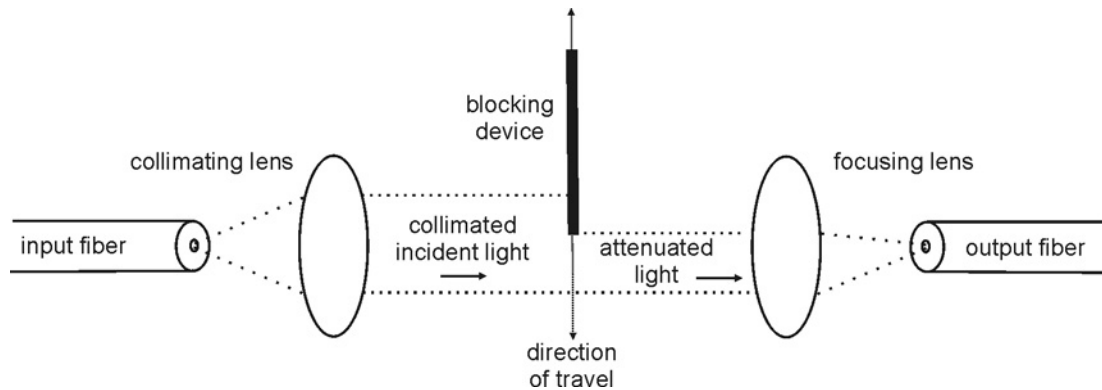


Figure 2: DA-100 Blocking for Single-mode Operation

Neutral Density Filter Type Attenuator

In multimode fiber applications, a variable neutral density filter attenuator is used, as shown in Figure 3. The filter, with attenuation that varies from 0.0 dB to over 35 dB, is inserted into the beam of collimated light. The position of the filter within the beam determines the level of attenuation. The filter position is controlled using a spring-loaded cam system connected to a precision stepper motor through a gear reduction assembly.

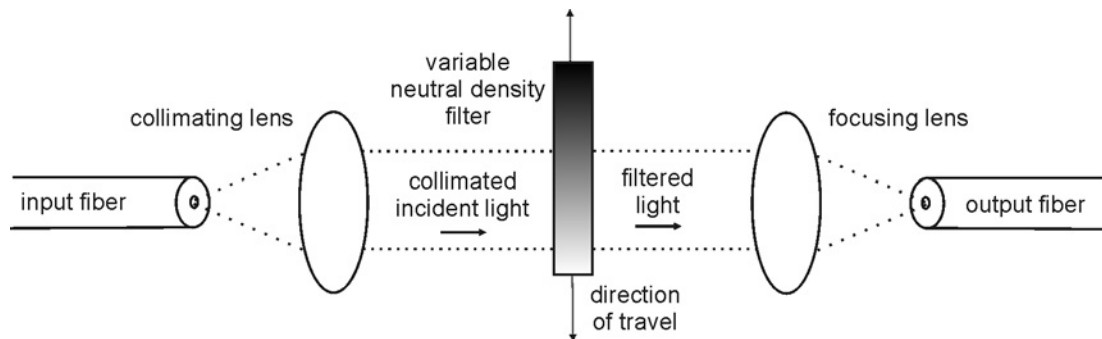


Figure 3: DA-100 Neutral Density Filter for Multimode Operation



Theory of Operation

To control the intensity of light in the system, an attenuator is placed in the optic path. The simplest type of attenuator is fixed, whereby it reduces the intensity of light by a certain amount. Ideally, this attenuator is wavelength-insensitive and absorbs different wavelengths of light to the same degree. The DA-100 Digital Variable Attenuator provides quantified and controlled variable attenuation with minimal wavelength dependency.

The intensity of light (P , in Watts) can vary over several orders of magnitude. When exposed to high optical power levels, the sensitive photo-detector of an optical power meter can become saturated or damaged, which leads to a loss of accuracy. A variable attenuator is used to avoid this problem, or to set an optical system to a known power level.

To describe wide variations in power, a relative logarithmic scale is useful, $P(\text{dB}) = 10\log(P/P_{\text{ref}})$. A negative value ($P < P_{\text{ref}}$) indicates a loss of power and can be correlated with a scale that shows per cent transmission (from 100 to 0%).

Some significant correlated values are listed in Table 1.

Table 1: Loss and Transmission Rates

dB	Transmission (%)
0	100
-0.01	99.8
-0.10	97.7
-1.00	79.4
-3.01	50
-5	31.6
-10	10
-20	1.0
-30	0.1
-40	0.01
-50	0.001
-60	0.0001



For a fiber optic system that uses single-mode or polarization-maintaining fiber, the DA-100 is designed with a blocking device that moves step-wise into the optical path. Two conditions are defined well: 100% transmission (no blocking) and 0% transmission (full blocking). The built-in calibration data accurately defines intermediate degrees of attenuation. The attenuator can drive to full optical power, fix the attenuation at a known intermediate level, or gradually drive to the limit of detection of the power measurement system.

Known attenuation levels, provided by the DA-100, are significant for bit error rate testing, simulating optical link budgets, and designing optical receiver front-ends. The device can also be used to test the linear response of a questionable power meter, or to calibrate one power meter with another.

For controlled attenuation of optical power in a low-power system that uses multimode fiber, the DA-100 is designed with a neutral-density, variable attenuator that does not change the spectral profile or the distribution of modes. This attenuator has an absorption gradient, which the stepper motor moves to various positions in the optical path.

All configurations of the DA-100 give a direct and easy means to set optical attenuation, regardless of the system-specific options chosen. At the chosen wavelength, the attenuation can be set to any value required, directly or step-wise. Keypad operations allow step-wise increments or decrements to attenuation. When attenuation must be controlled from a remote location, the DA-100 communications options are used.



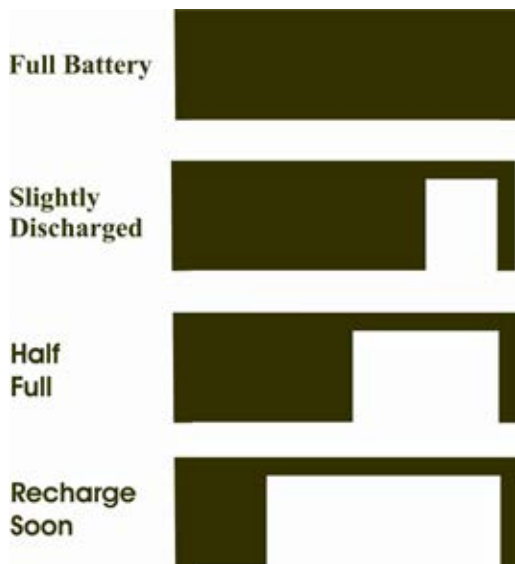
Battery Option

The DA-100-B is an alternate version of the DA-100, which incorporates a built-in rechargeable battery. The fully charged battery provides approximately six hours of continuous power, or more when used intermittently. The battery pack is automatically recharged when the unit is powered by the AC/DC adaptor.

If the battery option is installed, a battery charge indicator can be found on the display. As the battery discharges, the symbol will change to reflect the decreasing capacity.

The unit should be plugged in to charge the battery for several hours before it is first used.

Various states of charge are shown below:



	<p>Warning</p> <ul style="list-style-type: none">• Do not open the DA-100. The battery cannot be serviced by the user.• Do not incinerate the unit, as the battery may explode.• Avoid exposing the unit to excessive heat, as this may damage the battery.• Avoid contact with liquids, as this may damage the battery.
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Safety

Although the DA-100 is not a light source, caution is required with systems that use light and laser sources. Some sources have significant optical power of a specific wavelength, concentrated into a very narrow beam. Such a beam can travel great distances without dispersion and reflect into unanticipated spaces. The eye cannot detect an infrared source; therefore, the eyelid does not close to avoid exposure.

Read, and follow, the appropriate laser safety warnings. Warnings indicate that serious injury can result from improper use of the laser or other optical device.



Warning

- Never look into the end of an optical cable that is attached to an optical output device. Laser light can be invisible and can severely injure the human eye and skin.
- Read the laser safety labels that are affixed to the device. Implement a level of laser safety that is appropriate for the class of the device.
- Wear protective eyewear at all times. Ensure that the eyewear is compatible with the wavelength in use.
- Replace eyewear that is pitted, cracked, crazed, scratched, discolored, or otherwise not in perfect condition.
- Maintain a high ambient light level in the area of operation. High ambient light constricts the pupil of the eye, which can reduce eye damage.
- Avoid blocking the output beam or reflections with any part of your body.
- Enclose the path of the laser beam whenever possible.
- Do not make connections or splices when the laser is on.
- Set up experiments or operations so the laser beam is below eye level.
- Use shields to prevent the escape of unnecessary reflections or beams from the area of operation.
- Use a metal beam target as a beam dump to prevent accidental exposure.
- Ensure all devices that have an ON/OFF switch are set to the OFF position before assembling or disassembling the equipment.
- Only use the power cord supplied with the device.
- Establish controlled access to the laser operation area.
- Do not allow anyone to operate the laser who is not trained to do so.
- Do not allow anyone to service or maintain the laser who is not trained and authorized to do so.



SPECIFICATIONS

Table 2 lists the optical specifications, Table 3 lists the mechanical specifications, and Table 4 lists the environmental specifications of the DA-100 attenuator.

Optical Specifications

Table 2: Optical Specifications

Parameter	Specification	
Available wavelengths	350 to 2050 nm	
Insertion loss (connector loss not included)	Single-mode	Multimode
	1.0 dB typical	2.0 dB typical
	2.0 dB maximum	4.0 dB maximum
Repeatability	±0.03 dB for 0 to 10 dB attenuation ±0.10 dB for 0 to 30 dB attenuation	
Speed	1 dB to 30 dB within 3 s	
Resolution (<1 dB attenuation)	0.01 dB	
Power handling	≤2 W continuous wave (CW) single-mode ≤50 mW continuous wave (CW) multimode	
Polarization extinction ratio (PM fiber)	20, 25, or 30 dB	
Return loss	40 dB, single-mode, super NTT-FC/PC 50 dB, single-mode, ultra NTT-FC/PC 60 dB, single-mode, angled NTT-FC/PC 35 dB, multimode	
Accuracy, at 23 °C, from nominal values	0 to <40 dB: ± 0.3 dB ≥ 40 to <55 dB: ± 0.5 dB (single-mode) ≥ 55 to 60 dB: ± 1.0 dB (single-mode)	
Polarization dependent loss (PDL)	≤ 0.01 dB (minimum) ≤ 0.05 dB (typical)	
Wavelength dependence (typical)	0.3 dB change from 1300 to 1550 nm 0.1 dB change from 1520 to 1570 nm	

For additional information, please refer to the product's data sheet.



Mechanical Specifications


Table 3: Mechanical Specifications

Parameter	Specification
Dimensions (H x W x D)	150 x 81 x 46 mm (5.9 x 3.2 x 1.8 in.), without boot
Weight	450 g (~1 lb.)
Communications interface	Mini-B type USB port
Power supply	Universal 110/220 VAC to +12 VDC adaptor

Environmental Specifications

Table 4: Environmental Specifications


Parameter	Specification
Temperature range: Operating Storage	-10 to 55 °C (14 to 131 °F) -30 to 70 °C (-22 to 158 °F)
Humidity (storage)	<90% RH, non-condensing, at -30 to 70 °C (-22 to 158 °F)

	<p>Warning</p> <p>OZ Optics products are not authorized for use as critical components in life support devices or systems without the express written approval of OZ Optics.</p> <ul style="list-style-type: none">• Life support devices or systems are defined as devices or systems that are intended for implant into the body, or that support or sustain life. Failure of the life support device or system can result in significant injury to the user.• A critical component is defined as any component of a life support device or system whose failure to perform can reasonably be expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.
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INSTALLATION

Before connecting the Digital Variable Attenuator to the laser source and output fiber, read the complete installation instructions.

	<p>Caution</p> <ul style="list-style-type: none">• Ensure that all personnel are familiar with all operation and safety instructions provided with the laser source and that are included with this document (<i>Safety</i>, Introduction section).• Clean all optical connections, as described in the Maintenance and Service section of this document.• OZ Optics Ltd. is not liable for any damage or harm caused by misuse of the source laser, OZ Optics devices, or both.
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Checking the Shipment

When the DA-100 is received from OZ Optics:

1. Carefully unpack the items in the shipping container.
2. Retain the original packing materials and documentation that are shipped with the device.
3. Verify that the shipment contains the items that are listed on the packing slip.
4. When an item is missing or damaged, immediately inform OZ Optics. Do not attempt to repair a damaged item. Do not return the shipment without a Return Merchandise Authorization Number (RMA #). See the **Warranty** section of this document for more information on the RMA # procedure.

Always return the device in its original packing materials. These materials are selected to reduce or eliminate damage caused by ESD.

Connecting the Optical Components

The DA-100 is shipped with customer-specified optical receptacles.

Before connecting optical cables to the DA-100:

- Always inspect and clean the connectors and receptacles. See the **Maintenance and Service** section of this document for information on cleaning connectors and receptacles.
- Ensure that the optical connectors on the cables are compatible with the optical receptacles on the DA-100.

Connecting the DA-100

Direct Entry Mode

To connect the DA-100 in direct entry mode, the following components are required:

- DA-100 Digital Variable Attenuator
- AC/DC power adaptor
- Light source
- Receiving device
- 110/220 VAC wall socket
- User-supplied fiber optic patchcords that are compatible in wavelength, fiber type, fiber connector, and fiber core and cladding diameter with the attenuator, light source, and receiving device.

In the typical setup shown in Figure 4, the DA-100 optical input receptacle connects to a polarized fiber optic stable source (PFOSS) and the optical output receptacle connects to the receiving device, which in this case is a power meter.

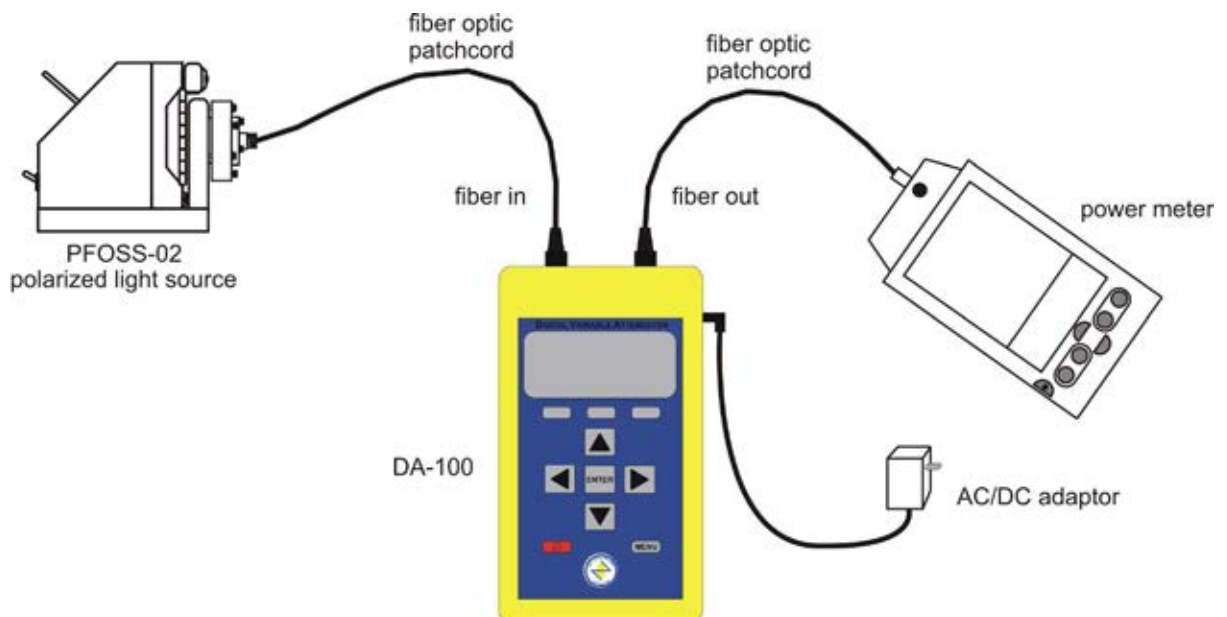



Figure 4: Typical DA-100 Direct Entry Mode Connections



To connect the DA-100 in direct entry mode:

1. Connect the AC/DC adaptor to the DA-100.
2. Plug the power cord into a 110/220 VAC wall socket.
3. Connect the light source to the input receptacle of the DA-100 with a compatible patchcord, after cleaning the connector and receptacle.
4. Connect the output fiber to the output receptacle of the DA-100 with a compatible patchcord, after cleaning the connector and receptacle.
5. Turn on the light source.
6. Press  (the ON/OFF button) on the DA-100.

Computer Control Mode

The personal computer used for computer control of the DA-100 must have one available USB port.

To connect the DA-100 in computer control mode, the following components are required:

- DA-100 Digital Variable Attenuator
- AC/DC power adaptor
- USB cable, for remote DA-100-to-PC communications
- Personal computer
- Light source
- Receiving device
- 110/220 VAC wall socket
- User-supplied fiber optic patchcords that are compatible in wavelength, fiber type, fiber connector, and fiber core and cladding diameter with the attenuator, light source, and receiving device.

In Figure 5, the DA-100 optical input receptacle connects to the light source (PFOSS-02, in this example), the optical output receptacle connects to the power meter, and the USB cable connects to the PC (not shown).

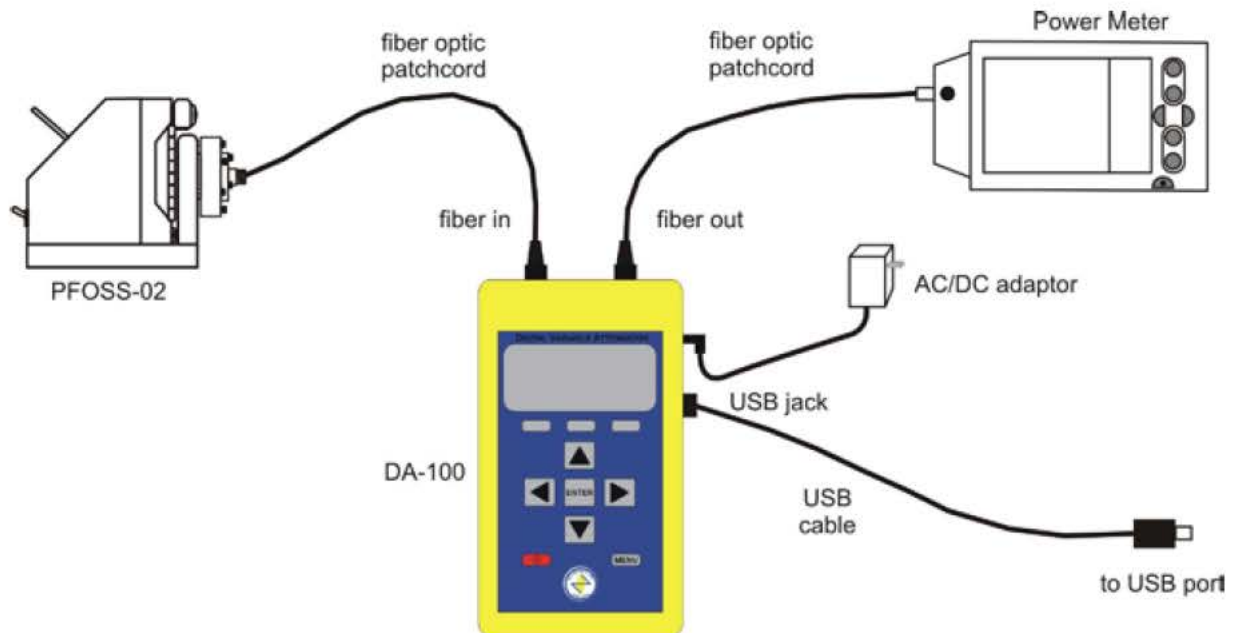



Figure 5: DA-100 Computer Control Mode Connections

To connect the DA-100 in computer control mode:

1. Connect the AC/DC adaptor to the DA-100.
2. Plug the power cord into a 110/220 VAC wall socket.
3. Connect the light source to the input receptacle of the DA-100 with a compatible patchcord, after cleaning the connector and receptacle.
4. Connect the receiving device to the output receptacle of the DA-100 with a compatible patchcord, after cleaning the connector and receptacle.
5. Connect the USB cable to the USB jack on the DA-100.
6. Connect the USB cable to a USB port on the computer.
7. On the PC, run the ASCII-based terminal software and set the COM n port parameters.
8. Turn on the light source.
9. Press  (the ON/OFF button) on the DA-100.

OPERATION

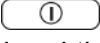
Using the Keypad

Figure 6 shows the front view of the DA-100 Digital Variable Attenuator. The keypad is designed for self-instructive, intuitive use of features. The large (3 x 5.5 cm) LCD displays the OZ Optics logo momentarily before going to the initial display.



Figure 6: DA-100 (front view)

Power On/Off

To turn on the power, press and hold the ON/OFF button () for about 2 seconds. An audible beep will be heard. The OZ Optics logo is displayed and the unit is initialized. When the wavelength, insertion loss, and attenuation are displayed, the unit can be used.

To turn off the power, press and hold the ON/OFF button, , for about 2 seconds.



Soft Keys

The blue keys below the LCD are “soft keys.” Press a key to select an “action” option that is displayed above the key.

Arrow Keys

Generally, to navigate sub-menus, active arrow keys are indicated on the right of the LCD. The left (◀) and right (▶) arrow keys highlight specific digits, and the up (▲) and down (▼) arrow keys increase or decrease values. Hold the arrow key down to change values rapidly.

Figure 7 shows four possible LCD displays. Figure 7 A displays all of the arrow symbols; therefore, all of the arrow keys are active. The highlighted digit (“6”) is neither to the extreme left nor extreme right of the field, nor is it “0” or “9”.

In Figure 7 B, “9” is entered in the second position of the field. The up arrow key is not active. Similarly, in Figure 7 C, “0” is highlighted; therefore, the down arrow key is not active.

In Figure 7 D, the left arrow key is not active because the left-most digit in the field is highlighted. Similarly, when the right-most digit is highlighted, the right arrow key is inactive.

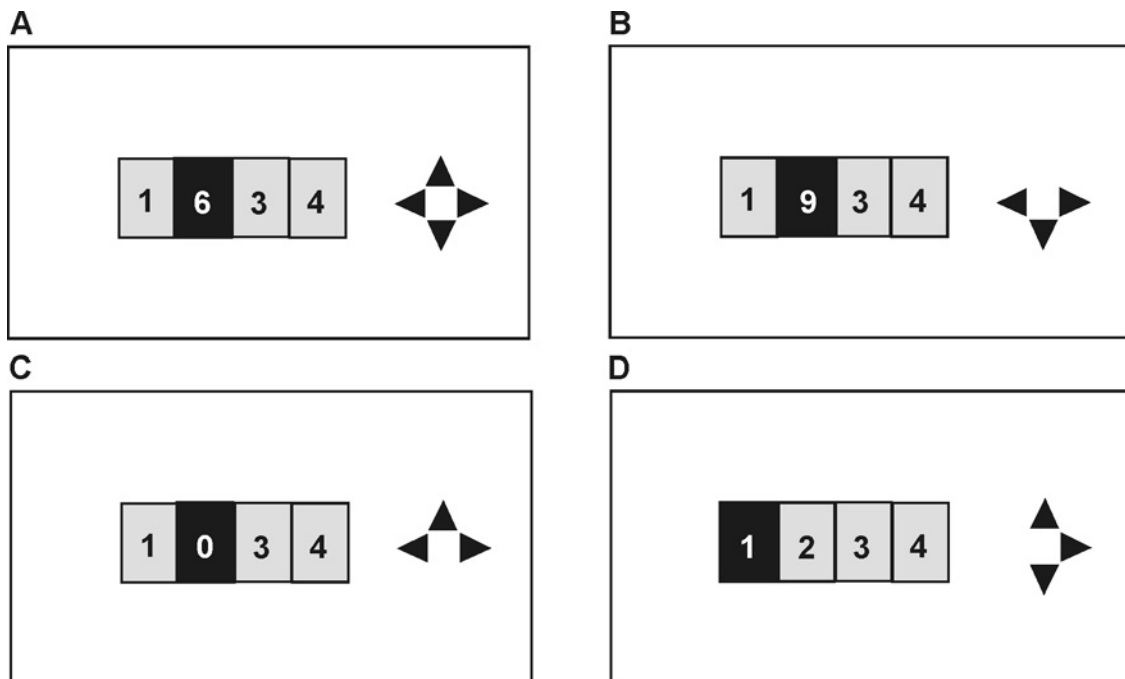


Figure 7: Using the DA-100 Arrow Keys

When more than one condition applies to a field, both relevant arrows are inactive.

When the correct numerical value for all digits in the field are selected, press the ENTER key.



Note

The LCD representations in this section are not to scale.

Initial Display

The cursor (>) indicates which parameter can be changed. Press the up or down arrow keys to select calibrated wavelength, insertion loss, or attenuation (for example, λ : 1550 nm, IL: 00.00 dB (maximum 29.99 dB), and attenuation: 00.00 dB). Press the ENTER key to highlight the parameter field. Press the left, right, up, or down arrow keys to select the value for each parameter. Press the ENTER key to save the values that are displayed.

Entering Default Parameters

Wavelength Parameter

When the cursor is pointed toward the wavelength symbol (λ) and the wavelength symbol is highlighted, the wavelength can be changed. To change the wavelength:

1. Press the ENTER button to highlight the wavelength field.
2. Press the up or down arrows to highlight the selected calibrated wavelength. If the attenuator has been calibrated at only one wavelength, then this selection cannot be changed.
3. Press the ENTER button to select the calibrated wavelength. This wavelength will be stored in flash memory and be recalled the next time the unit is turned on.

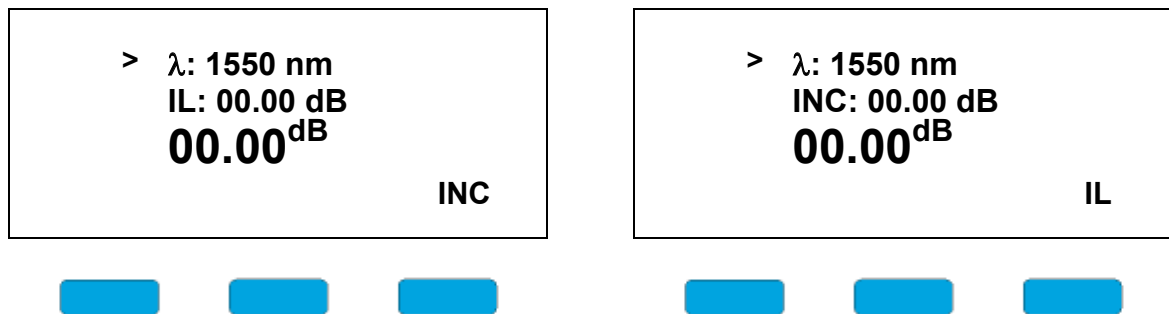
Increment Parameter

In some applications it may be desirable to make several optical measurements at a variety of attenuation levels. With the DA-100 it is possible to change the attenuation by a user-defined amount by pressing a single key. For example, if one wants to check the linearity of an optical power meter by making measurements that are spaced one dB apart, the user can set the INC parameter to 1 dB, and then change the attenuation by this amount with a single keystroke.

When the DA-100 is turned on, the second line of the display will show IL (Insertion Loss), discussed later. INC will be displayed above one of the blue "soft" keys. To set the increment amount, press the blue soft key below "INC". The second line of the display will change to "INC", while the mnemonic "IL" will now appear above the soft key that was pressed. Using the up and down arrow keys, highlight the mnemonic "INC" on the second line of the display. Press the ENTER key to change the default increment value. The first digit of the increment value will now be highlighted. Use the up or down arrow keys to change the value of the highlighted digit. When the first digit is set to the desired number, move to the next digit using the right arrow key. In a similar manner, use the arrow keys to change any of the displayed digits until the desired increment value is shown. Press the ENTER key to save this increment value as the default.



Once the increment value has been entered and saved, the attenuation can be increased (or decreased) by that amount simply by pressing the right (or left) arrow key.



To change the increment to a higher or lower number, press the blue key below INC to toggle to the INC parameter. Enter the new default increment in the increment field (INC) with the arrow keys. Press ENTER to save the new value.

Insertion Loss Parameter

The insertion loss is a measure of the minimum possible loss of light between the input and output of the unit. The insertion loss is factory-measured, with no attenuator in the optical path (100% transmission). The beam diameter varies with wavelength, and the insertion loss is similarly wavelength-dependent.

The factory-measured insertion loss is the minimum achievable loss, and includes losses from the input connector, the output connector, and the internal optical components. This IL value is recorded on the Certificate of Compliance that is included with the DA-100.

From the initial display, press the blue key below INC to toggle to the IL parameter. Enter the new default IL in the IL field with the arrow keys. Press ENTER to save the new value. If the input and output fibers are connected to the DA-100, the unit is now ready for use.

The IL can be changed to include the wavelength-specific calibrated loss of cables connected to the DA-100. The insertion loss values are saved when the unit is turned off, and these will become the default values the next time the unit is turned on.

The displayed value of attenuation will be equal to the sum of the programmed insertion loss plus the internally generated attenuation. For example, if the insertion loss is set to zero using the IL command, and the user enters a desired attenuation level of 5 dB, then the DA-100 will internally generate a loss of 5 dB. However, if the insertion loss is set to 2 dB and the user requests an attenuation of 5 dB, then the DA-100 will generate an attenuation of 3 dB, thereby giving a total signal reduction of 5 dB, as requested.



There is a limit to the maximum attenuation that can be generated within the attenuator. Typically, this is around 60 dB for single-mode devices. If the insertion loss is set to 2 dB and the maximum internally generated attenuation is 60 dB, then the user can request an attenuation of up to 62 dB. Requests for higher attenuation will be limited to the sum of the maximum possible attenuation plus the insertion loss. If the insertion loss in this example is then reduced from 2 to 1 dB, then the displayed value will automatically be reduced from 62 to 61 dB.

The displayed value of attenuation cannot be less than the insertion loss. For example, if the insertion loss is set to 1 dB, then requests for an attenuation of less than that value will automatically be increased to match the minimum insertion loss of 1 dB. If the insertion loss is then increased to 3 dB, then the displayed value of attenuation will automatically be increased to 3 dB.

It is important to realize that changing the value of the insertion loss will change the attenuation. The displayed value of attenuation is the sum of the entered insertion loss plus the optical loss provided by the attenuator. For example, if the insertion loss is set to 1 dB and the attenuation is set to 10 dB, the internal optics of the attenuator will produce a loss of 9 dB, for a total loss of 10 dB. If the insertion loss is increased to 2 dB, the loss introduced by the optical attenuator will change to 8 dB, to maintain a total loss of 10 dB. If the insertion loss were then changed to 0.7 dB, the optical loss would be increased to 9.3 dB. If the insertion loss is set to a value that is higher than the actual insertion loss, then the actual loss through the attenuator will not match the displayed value.

Under most circumstances, the insertion loss will only be changed to null out a known or measurable loss within a system. Improper setting of the insertion loss can result in optical power losses that do not match the expected values. If this happens, set the insertion loss back to the factory default value.



Note

Insertion loss is affected by the cleanliness of the connectors; refer to the *Maintenance and Service* section of this document for proper connector and receptacle cleaning procedures.



Using the Menu

Main Menu

Press the MENU key to display the list of options for the DA-100. When the MENU key is pressed, the LCD displays:

MAIN MENU:

1. Device
2. Setup
3. Return

Press the arrow keys (▲ up, ▼ down) to highlight options 1 to 4; valid arrow keys are also indicated on the LCD display. When the correct option is highlighted, press ENTER to select the option.

Device Menu

From the Main Menu, press the up or down arrow keys to highlight Device and press ENTER. The Device Menu displays the model, the serial number (S/N), the calibration date (C/D) and the version of hardware and software of the device (for example, software version 0.3 and hardware version 6.B). The LCD displays:

DEVICE MENU:

DA-100
S/N: 21037-4
C/D: Sep17 2001
Ver: SV0.3_HV6.B
Return

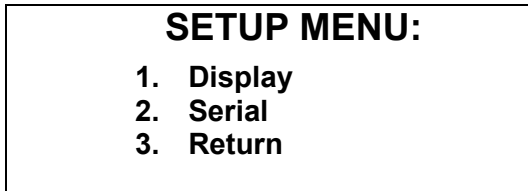
Press the ENTER key to return to the Main Menu.



Setup Menu

From the Main Menu, press the up or down arrow keys to highlight Setup. Press the ENTER key to select Setup. The Display option is highlighted.

When Setup is selected, the LCD displays:



Display Setup

The Display option on the Setup Menu is used to set the contrast on the LCD and the backlight options. The values for contrast are: 0 for low contrast, 32 for high contrast, 16 is the factory-set default. ON turns on the backlight when the device is on; OFF turns off the backlight at all times. AUTO turns on the backlight for a pre-set time following the last keypad entry. Every time a key is pressed, the internal timer is reset. If the backlight is off, then pressing any key will turn it back on, and start the timer.

From the Setup Menu, press the up or down arrow keys to highlight Display. Press the ENTER key to select Display. The contrast value is highlighted. When no changes are required to the displayed values, press the ENTER key twice to return to the Setup Menu.

The LCD displays:



To change the contrast or backlight value:

1. Press the up or down arrow keys to change the value of the contrast. It will increase or decrease by 2 counts. Hold the arrow key down to change the value continuously.
2. Press the ENTER key to save the contrast value and highlight the backlight value.
3. Press the up and down arrow keys to select OFF, ON, or AUTO.
4. Press the ENTER key to save the backlight value. The Setup Menu is displayed.
5. On the Setup Menu, select RETURN and press the ENTER key to return to the Main Menu.



Serial Setup

The DA-100 uses a USB bridge in order to communicate with a computer. Prior to communicating with a computer, a software driver must be installed on the computer. See the section on Remote Operation for instructions on installing the driver.

Even though the hardware is USB, the software treats it as if it is communicating via a COM port. This means that the DA-100 needs to be configured as if it is connected via a COM port. The settings in the DA-100 must match the corresponding settings in the software that is communicating with the unit. Consequently, the baud rate and other communication parameters must be properly set to allow the device to communicate with the computer. These parameters are set at the factory, and the user usually does not need to change them. If they do need to be changed for some reason, this section describes how to do it. There is generally no benefit to changing these settings.

The Serial option on the Setup Menu is used to display or change the parameters used for serial communication.

The factory set defaults (and other options) are:

- **Baud:** 9600 (19200, 38400, 57600, 115200, 128000, 256000), rate of transmission in bits per second.
- **Bit:** 8 (7), indicates the number of data bits per character.
- **Parity:** NONE (EVEN, ODD), indicates when there is a parity bit in the character.
- **Stop bit:** 1 (2), indicates the number of stop bits in the character.
- **Flow control:** None. There is no provision for handshaking.

From the Setup Menu, press the up or down arrow keys to highlight Serial. Press the ENTER key to select the Serial Setup menu. When the Serial Setup menu is displayed, the baud rate field is highlighted. When no changes are required to the values displayed in the Serial Setup menu, press the ENTER key four times to return to the Setup Menu.

The LCD displays:

SERIAL SETUP:

Baud: 9600
Bit: 8
Parity: NONE
Stop bit: 1



When changes are required to a value displayed in the Serial Setup menu:

1. Press the ENTER key to highlight the Baud, Bit, Parity, or Stop bit field.
2. Press the up or down arrow keys to display and select a new value for a field.
3. Press the ENTER key to save the displayed value. When the ENTER key is pressed to save the displayed value, the next field is highlighted.
4. When all changes are entered, press the ENTER key to return to the Setup Menu.
5. On the Setup Menu, select RETURN and press the ENTER key to return to the Main Menu.
6. On the PC, ensure that the communications parameters match the settings on the DA-100.

Return

From the Main Menu, press the up or down arrow keys to highlight Return. Press the ENTER key to select Return and display the main screen, as described in **Initial Display**.



REMOTE OPERATION

The DA-100 is a self-contained device, and does not need an external computer to operate it. However, for anyone who may want an automated system, it is possible to control it using a personal computer. Before writing your own program, it is suggested that you try to use a terminal program such as HyperTerminal to communicate with the unit. That will help you to fully understand the operation of the commands.

Before the DA-100 can be controlled by a personal computer, USB driver routines must be installed on the computer. Instructions for installing the USB driver are included in the following section. Depending on the operating system, the pop-up windows might look a little different than the ones shown.

The USB driver may be periodically updated by the manufacturer of the USB interface chip. The latest version of the USB interface driver may be freely downloaded from the Silicon Laboratories web site at:

<http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>

Virtual Com Port (VCP) Drivers for a number of different operating systems are supported. Click on "Download VCP" corresponding to the operating system on the computer on which the driver is to be installed. Drivers for a number of different operating systems can be found at this web site.

Driver Installation

A driver needs to be installed on the host computer to allow the PC to communicate with the DA-100. This USB driver allows the computer to treat the communications with the DA-100 as if it is occurring over a COM port. This allows the DA-100 to be controlled by programs such as HyperTerminal. The user may also write his own program to control the DA-100, using simple ASCII character strings, and treating the DA-100 as if it were connected to a COM port. The actual sequence of steps required for installing the driver may be different than what is shown here, depending on the operating system being used. In any case, the goal is to install the USB driver for the UART to USB interface..

- 1) Connect power to the DA-100, and turn it on. Connect the DA-100 to the computer using the USB cable.
- 2) After a couple of seconds, the "Found New Hardware" message will appear, as shown below:



- 3) After a few seconds, this will be replaced by:

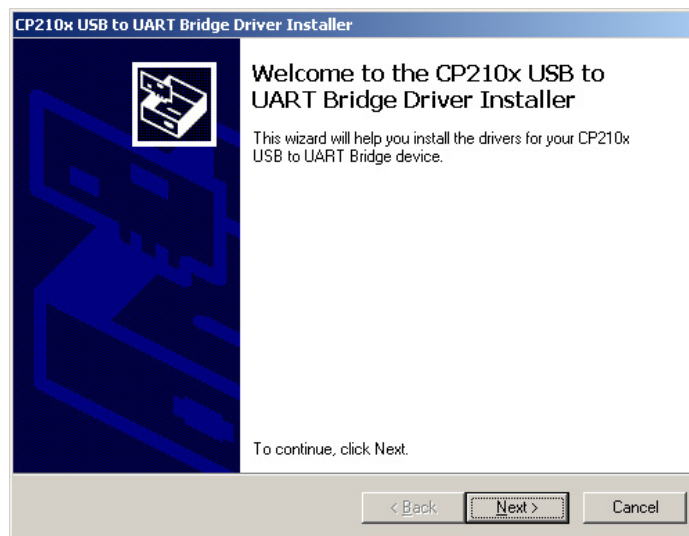


- 4) The following message will appear, to indicate that the hardware is ready to use.

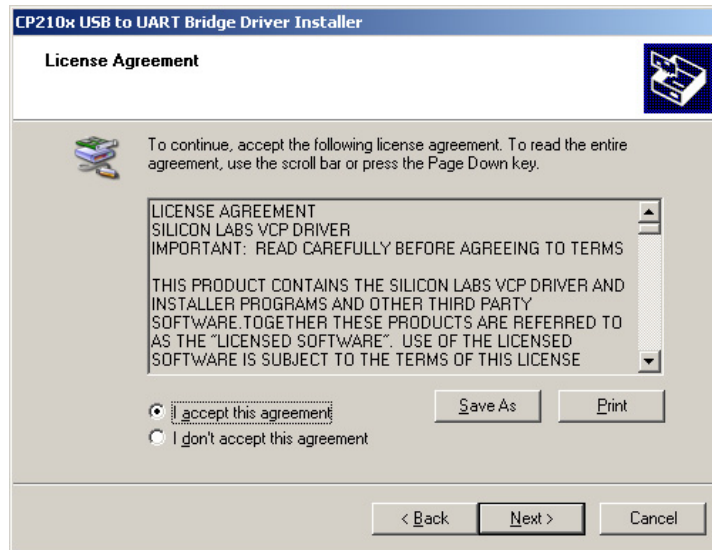


At this point, the driver installation is complete. In the event that the above messages do not appear, it may be necessary to install the files from the Silicon Labs web site. In that case, follow the sequence of steps outlined below:

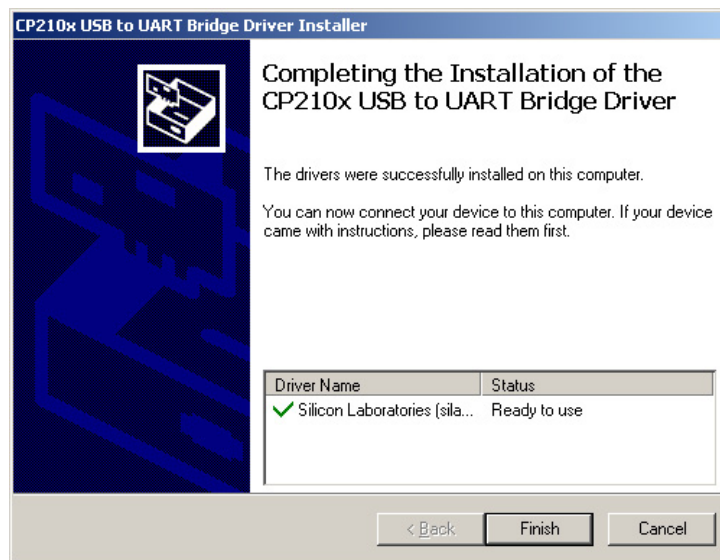
- 5) Go to the Silicon Labs website, at the following address:
<http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>
- 6) Download the appropriate VCP file, based on the operating system of the computer on which the driver will be loaded. This will download a zipped file. Decompress the file. This will produce several files.
- 7) Double click on the installation program, "CP210xVCPInstaller_x86.exe ". After a few seconds, a window similar to the one below should appear.



- 8) Click "Next" to continue.
- 9) Click on the circle to accept the license agreement, as shown in the following image:



- 10) Click the “Next” button to proceed. A message should appear to indicate that the driver has been installed, as shown below:



- 11) Click on the “Finish” button to exit from the installation procedure.

The unit should now be ready to be controlled by the computer.



Selecting the Serial Port

The serial port number used by the DA-100 will be assigned at the time when the software for the CP2101 to UART Bridge Controller Software is called upon. It may vary, from installation to installation. It will typically be something like COM3.

The user must ensure that the correct COM port is selected when running the application software, such as HyperTerminal, otherwise the computer will not be able to communicate with the unit.

If HyperTerminal is installed on the computer, then carry out the following steps:

- 1) Run HyperTerminal without the USB cable connected to the DA-100.
- 2) Select the item Files -> Properties.
- 3) Select the pull-down menu "Connect using". This will display the available COM ports. Note the ports that are available. If you are not able to view or select the pull-down menu, then close the "New Connection Properties" box, and then select "Call->Disconnect". Then go back to step 2.
- 4) Exit from HyperTerminal.
- 5) Attach the DA-100.
- 6) Run HyperTerminal again.
- 7) Select the item Files -> Properties.
- 8) Again, select the pull-down menu "Connect using". This will display a new list of available COM ports. There should be a COM port that was not displayed earlier. This is the COM port assigned to the DA-100. Select this COM port.
- 9) The communications settings must be set to 9600 baud, 8 data bits, 1 stop bit, and no handshaking. If these values are changed, then the changed values must be used.

If HyperTerminal is **not** installed on the computer, then carry out the following steps:

- 1) With the USB cable not connected, select: Start->Settings->Control Panel
- 2) Select: System. This should bring up the "System Property" box.
- 3) Select the Hardware tab.
- 4) Select Device Manager.
- 5) Select the plus sign beside Ports(COM & LPT).
- 6) A list of the available COM and LPT ports will be listed.
- 7) Close the Device Manager window.
- 8) Connect the USB cable between the DA-100 and the computer.
- 9) Select the Device Manager, as before.
- 10) Select the plus sign beside Ports(COM & LPT).
- 11) A new list of the available COM and LPT ports will be listed. The list should be similar to the previous list, with one additional entry. This additional entry will be the COM port number of the DA-100.
- 12) Close the device manager window. Any communications program or user-written application can now use this COM port to communicate with the DA-100. The communications settings must be set to 9600 baud, 8 data bits, 1 stop bit, and no handshaking, unless these values have been changed.



COMMUNICATIONS

The hand-held Digital Variable Attenuator is easily used with keypad control. However, the DA-100 also has options for a computer communications setup to control attenuation from a host computer. The USB jack is used to interface with the host personal computer (PC). Many applications benefit from direct control of attenuation using a PC.

Applications can be written in high-level programming languages such as Visual Basic¹ or C, and lab automation software such as LabWindows or LabVIEW². The programs can be used to develop shortcut commands to collect, analyze, and plot data.

To enable communications through a USB port, the default settings, listed in Table 5, are used. When the default settings are changed, the settings on the computer must also be changed.

Table 5: Default DA-100 Communications Parameters

Parameter	Settings
Bits per second	9600 baud
Data bits	8 bits
Parity	none
Stop bits	1 bit
Flow control	none



Note

- The unit cannot be turned on or off with a remote computer terminal.
- When the DA-100 is used in an inaccessible place, ensure that it is properly connected, configured, and powered on.

¹ Visual Basic is a registered trademark of Microsoft Corporation.

² LabWindows and LabVIEW are registered trademarks of National Instruments Corporation.



Initial Computer Display

When the DA-100 is powered-on, and USB connections are correct, the PC displays an initial message, similar to the sample shown below:

```
OZ Optics Ltd.  
DA-100  
V5.00B_2.32  
Finding home ...  
Step: 0  
Wavelength: 1550 (nm)  
Atten: 01.00 (dB)  
Ready
```

The messages identify the unit (DA-100), hardware version (V5.00B), software version (for example, 2.32), and the status of the unit after initialization (step, wavelength, and attenuation). When *Ready* is displayed, the message indicates that computer communications are enabled and the unit can begin remote operation.



Using Remote Commands


ASCII commands are not case sensitive. Do not use spaces before, after, or between a command and a query (?) or numerical data entry (<n>). To enter a command, type the command and press carriage return (<CR>). The command can be entered in upper or lower case (for example, b? or B?), but the syntax must be correct.

A correctly entered command is acknowledged at completion with "Done". An incorrect command or data entry generates the message: Error(100): Invalid command or number. The Remote commands used by the DA-100 are listed in Table 6.

Table 6: DA-100 Remote Commands

Command	Description	Command	Description
?	List Remote commands	E0	Set echo off
A?	Get current attenuation	E1	Set echo on
A<n>	Set attenuation to <n> dB	L?	Get current insertion loss
A#	Get current increment size	L<n>	Set insertion loss to <n>
A#<n>	Set default increment/decrement size	S?	Get current step
A+	Increment attenuation by set increment size	S<n>	Set step to <n>
A+<n>	Increment attenuation by <n>	S+	Increment by one step
A-	Decrement attenuation by set decrement size	S+<n>	Increment by <n> steps
A-<n>	Decrement attenuation by <n>	S-	Decrement by one step
B?	Get current baud rate and communication setting	S-<n>	Decrement by <n> steps
BL	Get baud rate list	V?	Get device name and version
B<n>	Set baud rate to <n>	V2	Get the device serial number
D?	Get date of calibration	W?	Get current wavelength
E?	Echo query	WL	Get wavelength list
		W<n>	Set wavelength



	<p>Note</p> <ul style="list-style-type: none">• A carriage return (<CR>) is ASCII code 13.• A line feed (<LF>) is ASCII code 10.• During transmission, the DA-100 ignores each incoming line feed. The unit sends a line feed after all carriage returns.
---	--

Rounding and Truncation

The DA-100 normally operates with a minimum resolution of 0.01 dB. When setting the attenuation, any characters beyond the second digit after the decimal point will be ignored. When setting the increment value or insertion loss, additional digits may be received as part of a serial string. Values will be rounded upwards to the next hundredth of a dB if the value is greater than x.xx5 dB, or truncated (rounded down to the nearest hundredth of a dB) if the value is less than or equal to x.xx5 dB. Values such as .01, 0.01, 3, 66.01 can be entered, but x.xxn values are rounded. For example, 1.006 is rounded to 1.01, 1.005 is truncated to 1.00.

Note that although the displayed attenuation has a resolution of 0.01 dB, this does not imply that any arbitrary attenuation can be set with a resolution of 0.01 dB. Due to the non-linear nature of the device, low levels of attenuation can be selected with resolution of 0.01 dB or better. However, the resolution at high levels of attenuation will generally not achieve this level of control. For example, setting the attenuation to 56.03 dB may give the same level of attenuation as setting it to 56.04 dB. The displayed value will be the same for both settings, and will have a displayed resolution of 0.01 dB.

Understanding the Values

For each calibrated wavelength, there is a maximum calibrated range and insertion loss. Insertion loss can be set while the device is active to show the initial internal insertion loss of the device, which is the total loss from the input receptacle, output receptacle, and internal optic components. Also while the device is active, insertion loss can be set to include losses generated by other inline devices that are part of the optical path.

Values are restricted to those between the initial insertion loss and the maximum calibrated range plus the initial insertion loss. For example, if the initial insertion loss is set to 1.60 dB and the DA-100 is calibrated for a maximum range to 60 dB at 1300 nm, the value displayed is between 1.60 dB and 61.60 dB.

Using the same example of an initial insertion loss set to 1.60 dB, any attempt to set a value of attenuation greater than 61.60 dB will be limited to 61.60 dB. An insertion loss entered as less than 1.60 dB will be displayed as 1.60 dB.



Commands

Attenuation

The DA-100 is calibrated at dB = 0 for 100% transmission. As the beam is attenuated, the dB values go to increasingly larger numbers, where 60 dB corresponds to 0.0001% transmission, which is near the limit of detection of most optical power meters. The dB values are positive with respect to attenuation. Values are restricted between the set insertion loss (for example, IL = 1.6 dB) and the maximum attenuation plus the set insertion loss. For example, if this total equals 61.60 dB and A90 is entered, the unit displays *Atten:61.60(dB)*.

To display or change the attenuation, use the attenuation commands, as listed in Table 6. Values must be within the range of calibration. In the example below, the starting attenuation is 1.9 dB and the current default increment is 2.0 dB. To see the result of each attenuation command on these values, follow the example in sequence from left to right.

<i>Input</i>	A?	A#	A+	A-
<i>Response</i>	Atten:01.90(dB) Done	INC:02.00(dB) Done	Atten:03.90(dB) Done	Atten:01.90(dB) Done

<i>Input</i>	A33.03	A#3	A+3	A-3
<i>Response</i>	Atten:33.03(dB) Done	INC:03.00(dB) Done	Atten:36.03(dB) Done	Atten:33.03(dB) Done

Note that the maximum increment value (A#n) is A#99.99. Greater values will produce an error.

Baud Rate

The baud commands display or change the baud rate. Enter B? to display current baud rate, BL to list the available baud rates, and B<n> to set the baud rate. If the baud rate is changed, the host computer must immediately change its own baud rate to continue communicating.

<i>Input</i>	B?	BL	B19200
<i>Response</i>	9600 (bps) 8NONE1 Done	Baud rate (bps): 9600 19200 38400 57600 115200 128000 256000 Done	19200 Done



Date

The date query command (D?) displays the date of calibration.

<i>Input</i>	D?
<i>Response</i>	Sep17 2001 Done

Echo

When echo is on, the command (input) is transmitted back to the sending device. When echo is off, the response to the command is transmitted, but the input is not. To use the echo command, enter E? to display the echo status, E0 to set echo off, and E1 to set echo on.

<i>Input</i>	E?	E0	E1
<i>Response</i>	Echo on (or off) Done	Echo off Done	Echo on Done

Insertion Loss

The insertion loss commands display or change the insertion loss. Enter L? to display current insertion loss or L<n> to set the insertion loss (up to 29.99 dB).

<i>Input</i>	L?	L1.45
<i>Response</i>	Loss: 01.23 (dB) Done	Loss: 01.45 (dB) Done



Step

A step is the minimum increment that the attenuator (blanking device or filter) can be moved into, or out of, the optical path. The total number of steps required to move the attenuator from the home position (0% attenuation), to maximum attenuation (100%), and back to home (0%) depends on the gear ratio of the stepper motor. Steps must always be entered as integers.

The step commands, as listed in Table 6, display or change the step. In this example, the starting step is 233, which is 233 steps from the home position. To see the result of each step command on this value, follow the example below in sequence from left to right. When instructing the attenuator to move <n> steps, the value of n must be an integer. Any characters following a valid integer are ignored. For instance, "S2000P" will be read as "S2000". Similarly, "S1234.5" will be read as "S1234".

<i>Input</i>	S?	S+	S-
<i>Response</i>	Step:233 Done	Step:234 Done	Step:233 Done

<i>Input</i>	S10	S+10	S-5
<i>Response</i>	Step:10 Done	Step:20 Done	Step:15 Done

When the DA-100 receives a step command, the attenuation value is updated to reflect the new setting.

Version

The version query command (V?) displays the model of the unit and the version of hardware (V5.00B) and software (2.32).

<i>Input</i>	V?
<i>Response</i>	DA-100 V5.00B_2.32 Done

The serial number request command (V2) displays the serial number of the unit in a string, up to a maximum of 13 characters in length.

<i>Input</i>	V2
<i>Response</i>	67123-1R



Wavelength

The wavelength commands display or set the wavelength. Enter **W?** to display the current wavelength, **WL** to list the calibrated wavelengths, and **W<n>** to set the wavelength. When setting the wavelength, the value entered must be an integer. Any characters following a valid wavelength are ignored. For instance, "W1550h" will be read as "W1550".

<i>Input</i>	W?	WL	W1550
<i>Response</i>	Current Wavelength: 0980 (nm) Done	0980 (nm) 1550 (nm) Done	1550 (nm) Done

When a new wavelength value is set, the DA-100 uses the last insertion loss for that wavelength and adjusts the attenuation for that insertion loss. The IL value for each calibrated wavelength is recorded on the Certificate of Compliance that is included with the DA-100 documentation.

Error Message

When an incorrect command is entered, an error message is displayed.

For example (with echo on), the incorrect format for a command (display calibration date) is entered:

<i>Input</i>	D01
<i>Response</i>	Error(100): Invalid command or number

To correct the error, input the correct command.



MAINTENANCE AND SERVICE

Maintenance

The DA-100 requires minimal maintenance.

- Inspect all optical connectors and receptacles before use. Worn or damaged connectors or receptacles require replacement.
- Keep the device free of dust, dirt, or other contaminants.
- When not attached to an optical system, the connector must be covered with the supplied cap, which protects the connector from dirt and contamination.
- Never disassemble the unit. This action invalidates the warranty on the device.

Cleaning the Fiber Optic Connectors

The connectors on the fibers must be kept as clean as possible at all times. Dirt on the connectors can scratch the optical surfaces and damage the connector and can affect the optical properties of the fiber. Cleaning also ensures that the ferrule or connector and the fiber mate properly.



Warning

- Turn off all light-emitting devices. Concentrated or laser light can severely damage the eye. Reflected light from a concentrated source can severely damage the eye.
- Never look directly at a beam of light, regardless of its source.
- Disconnect fiber optic cables from the light source before cleaning the ferrules, connectors, or receptacles.

Cleaning Ferrules and Connectors

Cleaning ensures that the ferrule or connector and the fiber mate properly. Dirt can also affect the optical properties of the fiber. To clean fiber optic ferrules and connectors:

1. Assemble all cleaning supplies or equipment. It is recommended that connectors be cleaned each time they are connected or reconnected.
2. Ensure all devices that have ON/OFF power switches are set to the OFF position.
3. Carefully remove the protective cap, if it is in place, from the ferrule or connector or disconnect the fiber optic cable from the device to which it is attached.
4. Inspect each ferrule or connector for visible physical defects and damage. Defects and damage to the core or cladding, indicated by a high insertion loss, can be confirmed by examination with a microscope.



5. Fold several layers of lint-free paper tissues to form a small pad. Place the pad on a firm surface.
6. Apply one or two drops of isopropanol on the pad.
7. Gently wipe the tip of the ferrule or connector across the pad of tissues. Hold the ferrule or connector perpendicular to the pad.
8. With the same motion, finish the wiping motion on a dry section of the pad of tissues.
9. Frequently refresh the pad of tissues and the isopropanol when cleaning several ferrules or connectors.
10. Carefully inspect the tip of the fiber under reflected light. The tip must be clean and shiny.
11. Ensure that the protective cap is clean and free from defects. Replace caps that are stained, worn, misshapen, or defective in any way.
12. Carefully place the protective cap on the ferrule or connector, or immediately connect the ferrule or connector to a port or receptacle.

Cleaning Receptacles

Female receptacles require periodic cleaning. Cleaning ensures that the connector and fiber mate properly and can prevent damage to the receptacle and the fiber. To clean female receptacles:

1. Assemble all cleaning supplies or equipment. It is recommended that connectors be cleaned each time they are connected or reconnected.
2. Ensure all devices that have ON/OFF power switches are set to the OFF position.
3. Carefully remove the protective cap, if it is in place, from the receptacle.
4. Use compressed air to blow dust or dirt off the connector. Do not blow air directly into the receptacle.
5. With a pair of scissors, cut off one end of a round toothpick, to make the end flat. Remove splinters, if present, from the flat end of the toothpick.
6. Wrap a single leaf of lint-free tissue, about 25 mm (about 1.0 in) square, around the flat end of the toothpick, as shown in Figure 8. The tissue must be wrapped smoothly and tightly and extend approximately 2 mm past the end of the toothpick. Taper the end of the paper slightly.

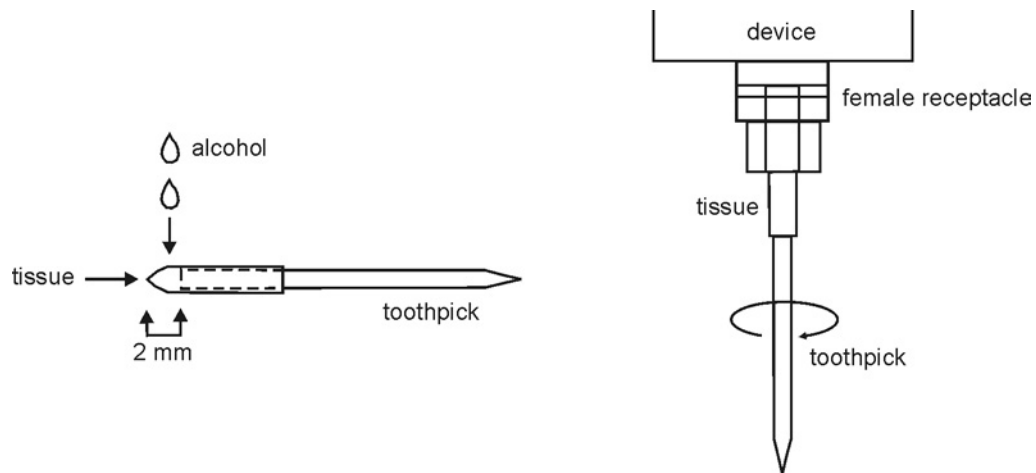


Figure 8: Cleaning Female Receptacles

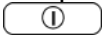
7. Apply one or two drops of isopropanol or methanol to the tip of the tissue paper.
8. Hold the device so that the receptacle of the device is pointing down. Insert the toothpick and tissue into the receptacle until the end of the toothpick is flat against the ferrule inside the receptacle.
9. Rotate the toothpick and tissue two or three turns. Remove the toothpick and tissue.
10. Inspect the tissue. If dirt is visible on the tissue, repeat Step 6 to Step 9 until the tissue remains clean. Re-wrap the toothpick with new tissue each time.
11. Use new tissue for each receptacle when cleaning more than one receptacle.

Troubleshooting

When results are other than expected:

- Ensure that the connectors are clean and free of contamination.
- Check that the fiber is securely seated in the receptacle on the connector.
- Ensure that there are no stresses applied to the digital variable attenuator or the fiber connected to it; stresses can affect the alignment.

Problem: When the ON button is pressed, nothing happens.

Action: Verify that the connections between the device and the AC/DC power adaptor and the power adaptor and the wall receptacle are correctly in place. Press  (the ON/OFF button). Hold the button down for at least 2 seconds. If the LCD does not display the OZ Optics logo and the DA-100 is receiving adequate power, contact OZ Optics technical support.



Problem: There is difficulty setting up computer communications.

Action: Ensure that the unit is powered on and is in the initial display. If the unit is in a sub-menu, press ENTER to return to the initial menu. Verify that the cables have good connections. Verify that the PC settings match those on the DA-100 (defaults are 9600 baud, 8 data bits, no flow control, parity none, and one stop bit).

Problem: There are no readings at the start of a new session, with no response to new commands.

Action: The DA-100 must take a few readings before the first result is displayed. When the DA-100 is first turned on, it automatically drives to the step-zero home position and then displays last value of attenuation recorded (for IL = 0, the time from step zero to maximum attenuation is ~12 s). The stepper motor is geared (typically 485:1) for an optimal balance of speed and precision. With computer control, a task must end before a new command can be entered. To see the entered commands, ensure that echo is on.

Problem: When using the DA-100 for fiber optic budget calculations, the numbers don't seem to add up. Is there a problem with the calibration?

Action: Ensure that the settings for the wavelength and insertion loss are correct. Ensure that all connectors are clean. It is recommended that reliable patchcords be reserved specifically for connection to the DA-100. Refer to the Certificate of Compliance supplied with the unit that indicates the measured insertion loss.

Problem: How many steps must be driven before the beam begins to be blocked? How is this number calculated?

Action: Set the insertion loss to zero and enter a level of attenuation. Drive to *A0* for 100% transmission or *A0.01* for 99.8% transmission. Next, enter a step query (*S?*) to display the number of steps from home position to initial blocking. For 0.0001% transmission, enter *A60* followed by *S?* to display the number of steps from home position to full blocking.

Service

The internal components of the DA-100 do not require service by the user. Contact Technical Support at OZ Optics Limited to determine if service is required. See the **Contact Us** section of this document for more information.



WARRANTY

This warranty applies to the DA-100 Digital Variable Attenuator.

Warranty and Service

OZ Optics Limited (Seller) warrants the items manufactured and sold by the Seller to be free of defects in material and workmanship for a period of one (1) year from date of shipment. The Seller's obligation under its warranty is limited in accordance with the period of time and all other conditions stated in all provisions of this warranty.

This warranty applies only to defects in material and workmanship in products manufactured by the Seller. The Seller makes no warranty whatsoever concerning products or accessories not of its manufacture. Repair, or at the Seller's option, replacement of products or defective parts therein shall be the sole and exclusive remedy for all valid warranty claims.

Warranty Period

The applicable warranty period shall commence on the date of shipment from the Seller's facility to the original purchaser and extend for the stated period following the date of shipment. Upon beginning of the applicable warranty period, all customers' remedies shall be governed by the terms stated or referenced in this warranty. In-warranty repaired or replacement products or parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced products or parts. Repair or replacement of products or parts under warranty does not extend the original warranty period.

Warranty Coverage Limitations

The following are expressly NOT covered under warranty:

1. Any loss, damage and/or malfunction relating in any way to shipping, storage, accident, abuse, alteration, misuse, neglect, failure to use products under normal operating conditions, failure to use products according to any operating instructions provided by the Seller, lack of routine care and maintenance as indicated in any operating maintenance instructions, or failure to use or take any proper precautions under the circumstances.
2. Products, items, parts, accessories, subassemblies or components, which are expendable in normal use or are of limited life, such as but not limited to bulbs, fuses, lamps, glassware, etc. The Seller reserves the right to revise the foregoing list of what is covered under this warranty.

Warranty Replacement and Adjustment

The Seller will not make warranty adjustments for failures of products or parts that occur after the specified maximum adjustment period. Unless otherwise agreed, failure shall be deemed to have occurred no more than seven (7) working days before the first date on which the Seller receives notice of failure. Under no circumstances shall any warranty exceed the period stated above unless expressly agreed to in writing by the Seller.



Liability Limitations

This warranty is expressly in lieu of, and excludes, all other expressed and implied warranties, including but not limited to warranties of merchantability and of fitness for particular purpose, use or applications, and all other obligations or liabilities on the part of the Seller, unless such other warranties, obligations or liabilities are expressly agreed upon to in writing by the Seller.

All obligations of the Seller under this warranty shall cease in the event of its products or parts thereof have been subject to accident, abuse, alteration, misuse or neglect, or which have not been operated and maintained in accordance with proper operating instructions.

The seller accepts no responsibility or liability for the failure of any device, product, or assembly into which products manufactured or sold by the seller are installed or affixed to. In no event shall the Seller be liable for incidental, consequential, special, or resulting loss or damage of any kind howsoever caused. The Seller's responsibility for damages shall not exceed the payment, if any, received by the Seller for the unit or product or service furnished or to be furnished, as the case may be, which is the subject of claim or dispute.

Statements made by any person, including representatives of OZ Optics, which are inconsistent or in conflict with the terms of this warranty, shall not be binding upon OZ Optics unless reduced to writing and approved by an officer of the Corporation.

Warranty Repair Return Procedure

Before returning any item to OZ Optics, a *Return Merchandise Authorization Number (RMA #)* must be issued by OZ Optics.

A technical support person first attempts to resolve the problem without returning the item. When the problem cannot be resolved without returning the item, an RMA# is issued, and an RMA form is faxed to you. Follow the instructions on the RMA form when returning the item.

Non-Warranty Repair

When a product is returned for any reason, the Customer and its shipping agency shall be responsible for all damage resulting from improper packing and handling, and for loss in transit, notwithstanding any defect or nonconformity in the product. By returning a product, the owner grants the Seller permission to open and disassemble the product as required for evaluation. In all cases, the Seller has the sole responsibility for determining the cause and nature of failure, and the Seller's determination with regard thereto shall be final



CONTACT US

Company Information

OZ Optics Limited
219 Westbrook Road
Carp, Ontario, Canada, K0A 1L0

Contact OZ Optics Limited by:

E-mail: sales@ozoptics.com
Web: www.ozoptics.com
Telephone: (613) 831-0981
Toll-free: 1-800-361-5415
Fax: (613) 836-5089

Technical Support

To resolve a problem with the DA-100, contact Technical Support at OZ Optics Limited. Support is available by:

Telephone: (613) 831-0981 ext.: 3318
Fax: (613) 836-5089
E-mail: customer.service@ozoptics.com

Please be prepared to supply the following information:

1. Your name and company or organization
2. Your telephone number, fax number, or other preferred method of contact
3. The complete part number and serial number. These numbers are normally printed on a label affixed to the device.
4. The hardware and software version of the unit
5. The purchase order number used to purchase the device (optional)
6. A brief outline of your setup, including the laser source in use
7. The specific details of the problem and any remedial actions you have already taken

A technical assistant will be available to help you.



Response, Repair, and Warranty Questions

We want to hear from you! Response and feedback let us know if our products work for you. If you use one of our products in an unusual way, we'd like to know. That helps us develop new applications.

We have a wide range of products, with new ones on the way. For an update or a catalogue, check out our website, or contact us by telephone, e-mail, or fax.

Call us if you have a problem! Our support staff will connect you with the right person by telephone or online (www.ozoptics.com).

If you need to ship the product back to the company, we will issue a *Return Merchandise Authorization Number* (RMA #) that lets us keep track of the repair during every step of the process.

You can also apply for an RMA # online at:

customer.service@ozoptics.com

Our warranty? Our standard warranty is included with this document—please read the entire **Warranty** section. In summary, it warrants OZ Optics test equipment products to be free from defects in material and workmanship for one year after shipment. We will repair, or replace (at our option), any of our products that prove to have defects in their construction. This guarantee is void if the product was handled carelessly or operated in excess of the specified electrical, optical or environmental limits. We cannot guarantee product suitability for all applications.

For repair, we bear the sole responsibility to determine the cause and nature of the failure—do not disassemble the product. For detailed warranty information, refer to the **Warranty** section of this document or contact OZ Optics Limited.

Questions? We have data sheets or application notes for all our products. Whatever your application, chances are you'll find a solution on the pages of our catalogue. For your convenience, we have included a document request form on the next page.

ASK OZ HOW!



Documentation Order Form

To request information about OZ Optics Limited products, please copy and send this form.

Please send me information on the following OZ Optics products:

Test Equipment

- Optical Power Attenuator
- Smart Detector Head
- Backreflection Meter
- Digital Variable Attenuator
- Polarized Stable Source
- Visible Fault Locator
- Digital Tunable Filter
- Digital Variable Reflector
- LED, Laser Stable Sources
- POCKETPOWER Meter

Fiber Optic Delivery Systems

- Fiber Optic Point Source
- Wave-Division Multiplexors
- Fiber Optic Isolators
- Receptacles and Adaptors
- Collimators and Focusers
- Attenuators and Filters
- Patchcords and Connectors
- Termination Kits

Polarization Maintaining (PM) Components

- PM Fiber Optic Circulators
- Polarization Controllers
- Faraday Rotators/Mirrors
- Polarized Stable Sources
- Polarization Analyzers
- Beam Splitters/Combiners
- PM Master Patchcords
- Fiber Polarizers

Complete Catalogue (only a few products are listed above)

Other: _____

Ask us about our new micro-electromechanical systems (MEMS): V-groove fiber arrays, metallized fiber, hermetic seal patchcords, and tapered and lensed fibers.

Please print, or enclose a business card.

Name	
Company	
Address	
Address	
Telephone	
Fax	
E-mail	
Reply to me by	Telephone <input type="checkbox"/> Fax <input type="checkbox"/> E-mail <input type="checkbox"/>

