



**FTE-4000
Variable Optical Attenuator
Users Guide**

**Revision A
December 2010**



FTE-4000 Users Guide

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December 2010**

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Notes

Chapter 1 Using This Manual

This Manual contains information for the FTE4000 Variable Optical Attenuator. Although the Variable Optical Attenuator itself does not have a laser source, it is still necessary to take all precautions to ensure personal and equipment safety.

Throughout this manual there are three standard sets of precautions described below. Please conform to these for your safety, the proper care of the equipment and ease of operation.

Warning

A warning alerts to situations that could cause personal injury.

Caution

A caution alerts to situations that may cause damage to the equipment or produce poor testing conditions resulting in inaccurate test results.

Note

A special annotation that will assist the user with operational features.

Note

Chapter 3 of this manual is a quick start guide. Prior to using the quick start guide or operating the equipment in any way, it is highly suggested the user reads all safety information.

This product has been designed and tested in accordance with the Manufacturer's safety standards, and has been supplied in a safe condition.

This document contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Warning

Care should be taken when operating this equipment. Even though the Variable Optical Attenuator does not itself have a laser source, fibers under test may be active and therefore infrared optical energy may be present. Devices operated in conjunction with the VOA may produce optical radiation that could cause skin or eye damage.

Warning

Never look directly into the end of a connected fiber optic cable or fiber optic adapter of test equipment, to do so could expose the user to laser radiation and could result in severe personal injury.

Warning

To Prevent Fire or Shock Hazard:

- Do not install battery types other than those specified by the manufacturer
- Do not use the charger without the batteries installed
- Do not expose the battery charger to rain or excessive moisture
- Do not use the AC adapter when there are signs of damage to the enclosure or cord
- Ensure that you are using the correct charger for the local line voltage
- Do not use any other charger than the one provided with this instrument.

Failure to follow these warning statements may result in personal injury.

Caution

Fiber-optic connectors are easily contaminated or damaged. The connection to the VOA is a physical contact style connection and dirty or damaged connectors may impair the instruments capabilities at minimum and at worst result in the need to return the VOA to the factory for expensive repairs. Prior to making any connection to the instrument, ensure that all proper cleaning procedures have been followed.

Caution

Use UPC Finish Connectors Only!

Caution

Do not exceed the maximum input power of 27 dBm as this will result in costly damage to the FTE-4000 Variable Optical Attenuator.

Prior to using the quick start guide or operating the equipment in any way, it is highly recommended the user reads all safety information.

3.1 Basic Operation Quick Start Guide

1. Press the  button.
2. Place the VOA in line with the Source and the receiver. The fiber from the source should be connected to the adapter on the VOA marked "IN" and the fiber going to the Receiver should connect to the adapter marked "OUT".

Warning

For user eye safety we recommend the use of video inspection scopes only when inspecting connectors while working around active fiber optic equipment!

Caution

Fiber-optic connectors are easily contaminated or damaged. The connection to the VOA is a physical contact type of connection and dirty or damaged connectors may impair the instruments capabilities at minimum and at worst result in the need to return the VOA to the factory for expensive repairs. Prior to making any connection to the instrument, ensure that all proper cleaning procedures have been followed. Use UPC Finish Connectors Only!

Note

For large step sizes allow sufficient dwell time for the VOA circuitry to follow the sweep commands

3. Press the  button to toggle to the desired wavelength.
4. The Dwell Time should be set to "0.00 sec". To do this press the  button and use down directional button to set the time.

Note

When using the "Up" or "Down" buttons to set the Step Size, Dwell Time, Sweep Begin, Sweep End and the Attenuation levels, a single press of the button will move the lowest incremental step by one. Holding down the directional button will accelerate the speed of the adjustment.

5. Press the  button to shift the focus of the directional buttons to the Attenuation setting. There will be an underscore beneath one of the digits. Use the left and right buttons to select the digit to be adjusted and the up and down buttons to change the value of the digit.
6. Press the  button to activate the output at the attenuation level displayed.

Note

When the shutter is “Disabled”, the attenuation is at the maximum level of the VOA.

3.2 Sweep Mode Quick Start Guide

1. Power the  button.
2. Place the VOA in line with the Source and the receiver. The fiber from the source should be connected to the adapter on the VOA marked “IN” and the fiber going to the receiver should be connect to the adapter marked “OUT”.

Warning

For user eye safety we recommend the use of video inspection scopes only when inspecting connectors while working around active fiber optic equipment!

Caution

Fiber-optic connectors are easily contaminated or damaged. The connection to the VOA is a physical contact type of connection and dirty or damaged connectors may impair the instruments capabilities at minimum and at worst result in the need to return the VOA to the factory for expensive repairs. Prior to making any connection to the instrument, ensure that all proper cleaning procedures have been followed. Use UPC Finish Connectors Only!

3. Press the  button to toggle to the desired wavelength.
4. Press the  button and use the up or down directional button to set attenuation the step size.

Note

When using the “Up” or “Down” buttons to set the Step Size, Dwell Time, Sweep Begin, Sweep End and the Attenuation levels, a single press of the button will move the lowest incremental step by one. Holding down the button will accelerate the speed of the adjustment.

3.2 Sweep Mode Quick Start Guide *Continued*

5. Press the **Dwell** button and use up and down directional buttons to set the time.
6. Use the Left or right directional button to highlight the Sweep Begin icon. Use the up or down button to set the beginning of the sweep.
7. Use the Left or right directional button to highlight the Sweep End icon. Use the up or down button to set the end of the sweep.

Note

The Sweep function may be used to move up the dB scale or down. If the Sweep Begin value is **lower** than the Sweep End value, the sweep will progress **lower** to **higher** in dB. If the Sweep Begin value is **higher** than the Sweep End value, the sweep will progress from **higher** to **lower** in dB.

8. Use the Left or right directional button to highlight the Repeat/Single Sweep icon. Use the Select button to toggle between sweep repeat or single sweep function.
9. Press the **Shutter** button to enable the shutter and start a sweep. The sweep will begin at the beginning of the sweep if the displayed attenuation is set outside the sweep ranges. It will start at the point of the displayed attenuation if that value is between the sweep ranges.
10. Pause the sweep by pressing **dB** button.

Note

While the sweep is paused, the attenuation may be increase or decrease. This will advance or reverse the progress of the sweep. Make adjustments to the attenuation levels by using the left and right buttons to move to the desired digit and the up and down arrows to change the value of the digit. If the attenuation level is adjusted outside the sweep begin and end values, the sweep will restart at the sweep begin point .

11. Press the **Shutter** button to disable the shutter and stop a sweep.

Note

The sweep mode will NOT function if any of the following is true:

- A. The Dwell time is set to 0.00 sec.
- B. The focus of the directional buttons has been moved to the attenuation with the dB button
- C. The shutter is disabled.

Chapter 4 Introduction

The TTI FTE-4000 Variable Optical Attenuator (VOA) is a hand held instrument for a variety of applications. This easy to operate instrument is ideal for use by technicians, installers as well as engineers in the field, while also being at home in the laboratory. This standard instrument is calibrated at 1310nm and 1550nm and has a range of 2 - >40dB. The FTB-4000-80 has a range of 4 - 80db for application needing higher attenuation levels. This VOA is housed in a rugged case with a highly protective rubber boot and a water resistant front panel. This low cost instrument has a 4" color TFT display for easy viewing.

The VOA is programmable to conduct a sweep of a range of attenuations at selectable step sizes down to 0.01db with a dwell time of zero (manual) to 10 seconds in 0.01sec increments. The first and last dB level of the scan may be selected by the user. The VOA has a reference setting function which allows the user to reference out the current attenuation level which can be used to assist in setting a nominal system power.

Other applications include commissioning equipment installations, product testing, budget compliance testing, balancing transmitter power and adjusting receiver attenuation settings.

5.1 Inspection

Before shipment, this instrument was inspected and found to be in perfect working order and free of defects.

The shipping carton contains the following:

1. Hand Held Variable Optical Attenuator, with protective boot and 4-AA NiMH batteries (un-installed)
2. Universal AC/DC charger with interchangeable mains
3. USB cable
5. Hard copy manual
6. Set of interchangeable adapters, SC and FC,

5.2 Identification and Configuration

The instrument's Model/Part Number, Serial Number and Date of Manufacture are indicated on a label located on the back of the instrument behind the boot. To remove the boot, pull on the bottom of the boot and slide it backwards to release the bottom of the instrument. Pull the top of the instrument out from the top of the boot. The instrument's history is filed at the factory by model/part number and serial number.



Fig 5.1

5.3 Power Requirements

The VOA is equipped with a 100-240V - 0.3A input and 9-12V , 0.66A, center positive output universal AC/DC battery charger. This charger is supplied with interchangeable mains for US, Great Britain, Europe and Australia. The instrument is shipped with 4-AA NiMH batteries (2700mAh hours). Depending on usage, fully charged battery pack will typically enable 8 hrs. of use. Fully discharged batteries require 8 -10 hours of recharging.

To replace the batteries, follow this procedure. Turn off the instrument and ensure the external power supply is unplugged. Carefully remove instrument from protective boot as described above in Section 5.2 and remove the battery cover by sliding the cover in the direction of the "Open" arrow. Only replace with 4 high quality AA NiMH batteries. Do not use batteries that are rated at less than 2500mAh. If you install NiMH batteries that are dead or less than 1 volt each, charge these batteries for one (1) hour before using the VOA.. When installing new batteries, ensure the battery contacts are engaged sufficiently.

Note

For proper maintenance, batteries require a monthly recharge.

Warning

To Prevent Fire or Shock Hazard:

- Do not install battery types other than those specified by the manufacturer
- Do not use the charger without the batteries installed
- Do not expose the battery charger to rain or excessive moisture
- Do not use the AC adapter when there are signs of damage to the enclosure or cord
- Ensure that you are using the correct charger for the local line voltage
- Do not use any other charger than the one provided with this instrument.

Failure to follow these caution statements may void the warranty of this equipment.

6.1 Instrument Enclosure

The VOA is packaged in a rugged housing which is further protected with a rubberized boot. Although the front panel is weather resistant, care must be taken to avoid liquids and contaminants around the fragile optical and electrical connectors, and the glass display. Use a mild cleaning agent and damp soft cloth to clean the panel and the outside case. See the maintenance section to clean the optical connector. NEVER open the instrument for cleaning. Return to the factory for servicing if necessary.

6.2 Physical

Front Panel



Fig 6.1

Top Plate



6.3 Display

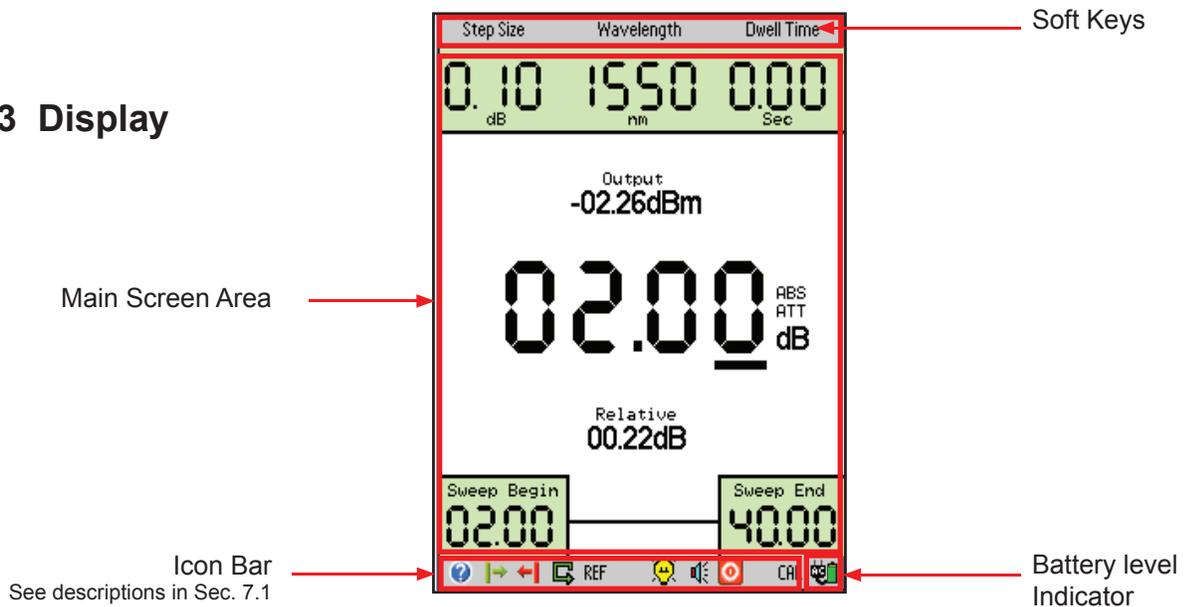


Fig 6.4

Chapter 7 Features and Preferences

7.1 Icons

The list below contains the icons found on the VOA. They control features and functions as well as allow the user to set testing parameters. This table gives the name and a brief explanation of each. More detailed explanations will be found in later sections of this chapter and in chapters to follow.

| | | |
|---|---|---|
|  | Help Feature | Accesses the Optical Spectrum Analyzer's onboard help feature |
|  | Sweep Begin | Sets the beginning attenuation value of a sweep |
|  | Sweep End | Sets the final attenuation value of a sweep |
|  | Reference | Sets the reference value to the current attenuation of the VOA |
|  | Back Light | Toggles the back light between bright and dim |
|  | Calibration | This icon is reserved for factory use |
| ON OFF | | |
|  |  Repeat Mode | Toggles between repeating the sweep mode and single sweep mode |
|  |  Speaker | Toggles on and off the speaker |
|  |  Power Save | Toggles on and off the battery save feature allowing for maximum battery life |

7.2 Feature Description and Operation

Battery Level/Power Indicator

The bottom right hand corner of the screen shows the battery level indicator. In the final hour of operation the battery level indicator will change to red. A warning will sound a few minutes before the instrument automatically turns off. An AC plug will be displayed next to the indicator bar if the instrument is operating with the power adapter connected.

Note

The speaker does not need to be on for the audible low battery warning to sound.

Caution

Ensure the instrument is turned off before plugging or unplugging the Battery Charger.

Help

The VOA has an onboard help feature. To access the help feature, use the left or right button to highlight the help icon, and press Select. Scroll to the desired help category and press Select to access the help information. Use the up or down buttons to move through the help page. Press the Select button to return to the help menu. To exit the help feature, scroll to Exit line in the help menu and press Select.

USB/PC

Located on the top panel is the USB/PC port which may be used to connect the VOA to a computer for virtual instrument operation.

7.3 User Preference Settings

Back Light

Use the directional buttons to highlight the Backlight icon, press the Select button to toggle the back light to Bright or Dim.

Sound

Use the directional buttons to highlight the Speaker icon and press the Select button to toggle the speaker on or off.

Power Save

Use the directional buttons to highlight the Power Save icon and use the Select button to toggle the feature on and off. The Feature is on when the icon is red and off when the icon is greyed. When enabled, the power save feature turns off the instrument after 15 minutes of non use.

Cal

This feature is reserved for factory use.

8.1 Key Pad Operation



Power button turns the instrument On and Off.
(Hold for 1 second)



The dB button is used to shift the focus of the keypad from the attenuation indicator/selector in the center of the display to the soft keys and icon bar. If there is an underscore located beneath a digit in the Attenuation indicator/selector, the focus of the Select button and the left-right-up-down directional buttons are on the Attenuation indicator/selector. The dB button may also be used to pause a sweep of attenuation levels.

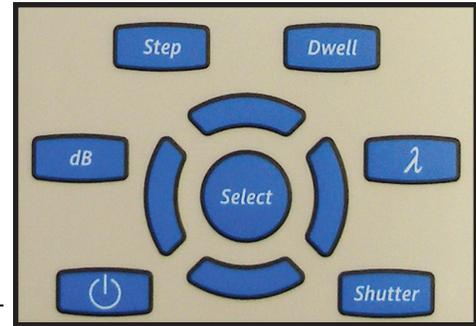


Fig 8.1



The Step button highlights the Step soft key to allow adjustment in step size with the up and down buttons.



The Dwell button highlights the Dwell soft key to allow adjustment in dwell time with the up and down buttons.



The Lambda button toggles between available calibrated wavelengths.



The Shutter button enables and disables the VOA, where “Disabled” is defined as setting the attenuation at the maximum attenuation level of the VOA and “Enabled” sets the attenuation level to the level indicated by the Attenuation on the display. If the dwell time is set to anything other than zero, the focus of the dB button is off the Attenuation, and Shutter is enabled, the sweep process will proceed.



Select button and the Directional buttons. While in the dB mode of operation, the left and right buttons move between digits of the attenuation indicator/selector in the center of the screen and the up and down buttons change the value of the underscored digits. While in the menu mode of operations, where the focus of the directional and select buttons are off the attenuation indicator/selector, the left and right buttons move through the soft keys and the icons. The up and down buttons change the value of any soft key or button that has a numeric value and the Select button is used to select icons and toggle features.

Warning

Care should be taken even though the VOA does not itself have a laser source, devices operated with the VOA may produce radiation that could cause skin or eye damage.

Warning

For user eye safety we recommend the use of video inspection scopes only when inspecting connectors while working around active fiber optic equipment!

Caution

Fiber-optic connectors are easily contaminated or damaged. The connection to the VOA is a physical contact type of connection and dirty or damaged connectors may impair the instruments capabilities at minimum and at worse result in the need to return the VOA to the factory for expensive repairs. Prior to making any connection to the instrument, ensure that all proper cleaning procedures have been followed. Use UPC Finish Connectors Only!

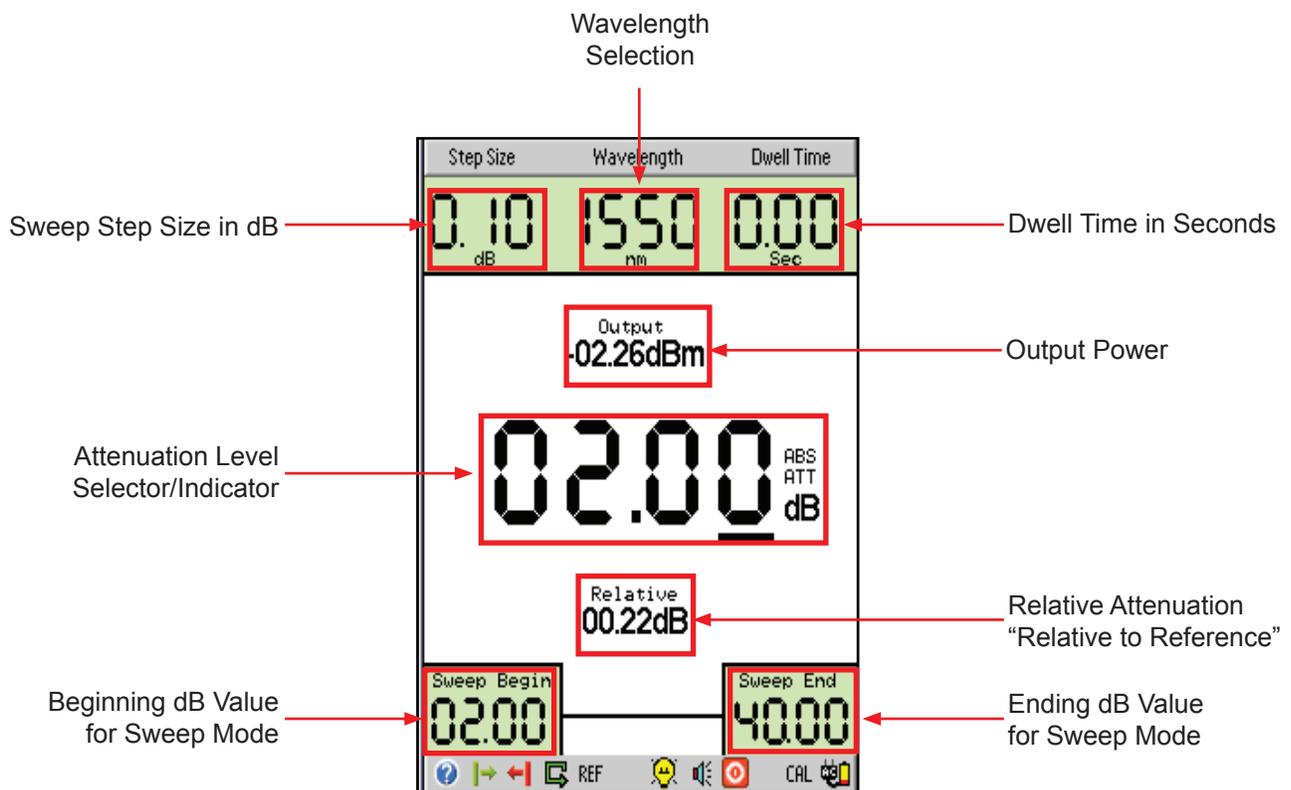
8.2 Basic Operational Display

Fig 8.3

8.3 Setting Attenuation and Sweep Parameters

Attenuation

The attenuation level of the VOA is represented by the large set of digits in the center of the display. To set the attenuation, ensure the focus of the directional buttons is on attenuation indicator/selector by looking for an underscore under one of the four digits. If there is no underscore, press the dB button and this will set the focus of the directional buttons to the attenuation indicator/selector. Use the left or right button to choose a digit to be adjusted and the up and down buttons to change the value.

Relative Attenuation

By using the reference feature, the displayed attenuation level may be referenced out of the relative attenuation. With the attenuation at the appropriate level and the focus of the directional buttons being on the soft keys and icons, use the left or right button to highlight the REF icon and press select. This will set the relative attenuation to 00.00dB and whatever the attenuation level was when the reference was set will be eliminated from subsequent Relative Attenuation readings. The latest reference value is stored in nonvolatile memory upon power off.

Output Power

The Output power is the power level (dBm) of the signal leaving the output port of the VOA. This is equivalent to the power entering the input port less the attenuation being introduced by the VOA. Although the VOA has equal bidirectional loss the output port is labeled to distinguish which port is monitored with this power meter feature.

Wavelength

There are two methods to set the wavelength. The first and quickest is to press the Lambda (λ) button. This will immediately highlight the wavelength soft key and cycle through the available calibrate wavelengths. When the focus of the directional arrows is on the soft keys and Icon bar, the left and right directional arrows may be used to move to the Wavelength soft key and the Select button may be used to cycle through the available calibrate wavelengths.

Step Size

Step Size Determines the amount of dB Change per step of the sweep mode. There are two methods to set the step size. The first and quickest is to press the Step button. This will immediately highlight the Step Size soft key. Use the up or down directional buttons to set the step size. Each press of the up or down arrow will increment the step size by one hundredth of a dB. Hold the directional button down to increase the rate of change of the step size. The step size may be set from 0.01 to 10.00dB in one hundredths of a dB increments. When the focus of the directional arrows is on the soft keys and Icon bar, the left and right directional arrows may be used to move to the Step Size soft key and the up and down arrows used to set the function.

Note

For large step sizes allow sufficient dwell time for the VOA circuitry to follow the sweep commands

8.3 Setting Attenuation and Sweep Parameters *Continued*

Dwell Time

This function is used to set duration of each step in the sweep mode. There are two methods to set the dwell time. The first and quickest is to press the Dwell button. This will immediately highlight the dwell Time soft key. Use the up or down directional buttons to set the dwell time. Each press of the up or down arrow will increment the dwell time by one hundredth of a second. Hold the button down to increase the rate of change of the dwell time. The dwell time may set from 0.01 to 10.00 seconds in one hundredths of a second increments. When the focus of the directional arrows is on the soft keys and Icon bar, the left and right directional arrows may be used to move to the Dwell Time soft key and the up and down arrows used to set the function.

Sweep Begin

When the focus of the of directional buttons is on the soft keys and icons, use the left or right buttons to move to the Begin Sweep Icon. Once highlighted, use the up and down buttons to set the sweep begin dB value. The minimum level will be less than 2dB and the maximum level will be greater than 40dB in 0.01dB increments. This is instrument dependent and will differ between wavelengths.

Note

The Sweep Begin value may be lower or higher than the sweep end value. If the sweep begin is lower than the sweep end, the sweep will proceed in an ascending manner, if the sweep begin is greater than the sweep end, the sweep will proceed in a descending manner.

Sweep End

When the focus of the directional buttons is on the soft keys and icons, use the left or right buttons to move to the Sweep End Icon. Once highlighted, use the up and down buttons to set the sweep end dB level. The minimum level will be less than 2dB and the maximum level will be greater than 40dB in 0.01dB increments. This is instrument dependent and will differ between wavelengths.

Sweep Repeat

The sweep may be operated in continues mode or a single cycle. To change the sweep mode; when the focus of the directions buttons is on the soft keys and Icons, use the left or right buttons to highlight the sweep mode icon and use the Select button to toggle the sweep mode between repeat and single cycle settings.

8.4 Conducting a sweep

Start/Stop Sweep Mode

In order for the VOA to conduct a sweep, three conditions must be met.

1. The Dwell time is set to a value greater than 0.00 sec.
2. The focus of the dB button must be off the Attenuation indicator/selector.
3. The shutter is enable.

Use the Shutter button to start or stop a sweep by enabling or disabling the shutter. When the shutter is enabled, a sweep will start at the Sweep Begin attenuation level if the displayed attenuation is set outside the sweep ranges. It will start at the point of the attenuation indicator/selector value if that value is between the sweep begin and sweep end values.

Pause Sweep Mode

A sweep may be paused by pressing the dB button. While the sweep is paused, the attenuation may be increase or decrease to advance or reverse the progress. Make adjustments to the attenuation levels by using the left or right buttons to move to the desired digit and the up or down buttons to change the value of the digit. If the attenuation level is adjusted outside the sweep begin and end values, the sweep will restart at the sweep begin point .

Note

Adjustments may be made to any of the parameters while a sweep is in progress. Use the directional buttons or the hard buttons to select the parameter and make changes as desired.

9.1 Battery Replacement

To replace the batteries, follow this procedure. Turn off the instrument and ensure the external power supply is unplugged. Carefully remove instrument from protective boot as described above in Section 5.2 and remove the battery cover by sliding the cover in the direction of the open arrow. Only replace with 4 high quality AA NiMH batteries. Do not use batteries that are rated at less than 2500mAh. If you install NiMH batteries that are dead or less than 1 volt each, charge these batteries for one (1) hour before using the VOA. When installing new batteries, ensure the battery contacts are engaged sufficiently.

Warning

To Prevent Fire or Shock Hazard:

- Do not install battery types other than those specified by the manufacturer
- Do not use the charger without the batteries installed
- Do not expose the battery charger to rain or excessive moisture
- Do not use the AC adapter when there are signs of damage to the enclosure or cord
- Ensure that you are using the correct charger for the local line voltage
- Do not use any other charger than the one provided with this instrument.

Failure to follow these caution statements may void the warranty of this equipment.

Note

For proper maintenance, batteries require a monthly recharge.

9.2 Calibration and Verification

Periodic verification of the VOA is recommended to ensure that your instrument remains within specification. Although not imperative, we recommend a calibration and verification once every year to make certain the instrument is functioning properly and performing to its rated specifications. Consult the factory for service.

9.3 VOA Adapter Replacement

The VOA is supplied with two easily interchangeable adapters per port, SC/FC. To change an adapter, remove the two screws that hold the adapter in place, pull the adapter straight up from ferrule. It is suggested that you clean the exposed ferrule with appropriate cleaning method and lint free wipe anytime you replace the adapter.

Note

In order to receive the best performance from your equipment, care should be taken to adequately clean the ferrule of any connector to be connected to the VOA. In the event that the port needs to be cleaned, be certain the instrument is off and use a method specifically designed for cleaning fiber optic connectors.

Note

When replacing the adapter with one that does not have a chained protective cap, use the small screw in place of the larger screw that retains the end of the chain to the adapter base.

Chapter 10 Specifications

Specifications

| | |
|----------------------|--|
| ATTENUATION RANGE | FTE-4000-4 2 to 40dB FTE-4000-8 4 to 80dB |
| WAVELENGTH RANGE | 1310, 1550 nm |
| RESOLUTION | .01 dB |
| UNCERTAINTY | +/- 0.5 dB* |
| REPEATABILITY | +/- 0.1 dB |
| INSERTION LOSS | <2 dB |
| RETURN LOSS | 50 dB |
| MAX INPUT POWER | 27 dBm |
| GRAPHICAL DISPLAY | 4 in Color TFT |
| DIMENSIONS | 7.75 x 4.5 x 2.25 inches |
| WEIGHT | 2 lbs |
| BATTERY | Rechargeable NiMH - 8 hours operating time |
| POWER | 100-240 universal US, GB, EU, AU Mains |
| ENVIRONMENTAL | Operation 0°C to + 40°C |
| ACCESSORIES INCLUDED | Universal power supply. FC and SC adaptors, Windows™ Compatible Software, USB Cable and Manual |

* Based on measurements made with factory fresh/cleaned connectors.

Specifications are subject to change without notice

Chapter 11 Warranty and Repair

11.1 Warranty Information

LIMITED WARRANTY

TERAHERTZ TECHNOLOGIES INC. (TTI) WARRANTS THAT TO THE FIRST PURCHASER, FOR A PERIOD OF ONE YEAR FROM THE DATE OF RECEIPT, THAT THIS PRODUCT (THE PRODUCT) WILL BE FREE FROM DEFECTS IN MATERIALS AND MANUFACTURING. THE FOREGOING WARRANTY IS THE ONLY WARRANTY, EXPRESS OR IMPLIED, GIVEN BY TTI, I.E., THERE IS NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. TTI HEREBY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY OTHER THAN THE WARRANTY IN THE FIRST SENTENCE TO THE FULLEST EXTENT PERMITTED BY LAW. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY IS REPAIR OR REPLACEMENT AT TTI'S OPTION OF ANY PRODUCT THAT PROVES TO BE DEFECTIVE IN MATERIALS OR MANUFACTURING WITHIN TWO YEARS OF RECEIPT OF THE PRODUCT. NOTE: THIS WARRANTY DOES NOT APPLY TO ANY PRODUCT WHICH HAS BEEN SUBJECT TO MISHANDLING, MISUSE, OR SERVICE BY UNAUTHORIZED PERSONNEL OR TO ANY PRODUCT WHICH HAS BEEN DAMAGED, MODIFIED, ALTERED OR TAMPERED WITH. TO THE FULLEST EXTENT OF THE LAW, TTI DISCLAIMS ALL LIABILITY FOR ANY OTHER DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ALLEGED TO BE CAUSED BY A DEFECTIVE PRODUCT, I.E., TTI WILL NOT BE RESPONSIBLE FOR ANY PERSONAL INJURY, PROPERTY DAMAGE OTHER THAN THE COST OF REPLACING THE PRODUCT OR ANY OTHER MONETARY DAMAGE SUCH AS LOST WAGES OR PROFITS CAUSED BY ANY USE, ATTEMPTED USE OR INABILITY TO USE THE PRODUCT. NOTE: BY USING THE PRODUCT, YOU AGREE THAT REPAIR OR REPLACEMENT AT TTI'S OPTION WILL FULLY SATISFY TTI'S WARRANTY OBLIGATION TO YOU, WHETHER IN CONTRACT, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHER APPLICABLE LAW.

11.2 Repair Information

If repair is required, simply call the factory @ 315-736-3642 or visit www.terahertztechnologies.com/RMAs.html for return material authorization (RMA) information.

Chapter 12 Troubleshooting Guide

| Symptom | Possible Cause | Solution |
|---|--|---|
| LCD dark | Power not on | Press ON/OFF key |
| | Batteries require recharging | Recharge batteries |
| | Batteries are missing, in backwards or need replacement | Check polarity, replace batteries, or contact factory for servicing |
| LCD white | Power cycled too quickly | Turn off wait 10 seconds – turn on |
| Instrument locked Up | Unexpected Operational Mode | Turn off (hold ON/OFF button in for 1 second) wait 10 seconds – then depress On/Off button to turn the instrument on. |
| Instrument will not conduct a sweep | Dwell time set to zero | Set dwell to a time greater than 0.00 sec. |
| | Focus of operation is on attenuation | Press the dB button to shift focus |
| | Shutter disabled | Press the Shutter button to enable shutter |
| Low or no power being displayed | Defective cord or dirty connector | Replace or clean cord |
| | Fiber Output port requires cleaning | Clean and inspect port |
| | Angle polish mated with UPC polish | Examine connector ends for damage. Use UPC Connectors ONLY! |
| USB hookup to PC not functioning properly | USB baud rate not set properly or too quick for computer | Set port baud rate properly or decrease Baud rate in instrument and certification software |
| | PC drivers not set properly | Un-install & re-install certification software and drivers |

Chapter 13 Version Control

Through a program of continuous improvement, we upgrade the features and performance of the instrument in an on going process. The instrument firmware version is accessible upon power-up in the bottom right-hand corner of the display. The version changes and approximate release dates are as follows.

FTE-4000

V1.0 – 10/2010 - Original release - Requires version 1.0 software