



FTE6100

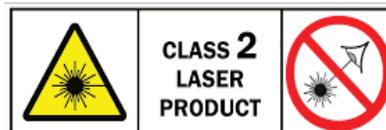
Tunable Laser Source

User's Guide

Revision A
05/2017

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This equipment contains Class 1M and Class 2 Lasers

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Chapter 1 Using This Manual

This manual contains operation information for the Terahertz Technologies Inc. FTE-6100-DWDM Tunable Laser Source. This tunable source uses a resistive style touch screen and only proper stylus devices should be used when operating this unit.

Precautions

Please read and follow all warning and caution information noted in this manual.

There are warnings, cautions and notes posted throughout this manual.

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.

Chapter 2 Safety

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.

The information in this chapter pertains to safety consideration of OTDRs in general.

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 that must be followed by the user to ensure safe operation and to maintain the product in a safe condition. Failure to follow these safety warnings and cautions can result in harm to the user or damage to the instrument.

Warning

Personnel should always be aware when working with fiber optic test equipment that active fibers may be present, therefore infrared optical energy may be present.

Warning

Never look directly into the end of a connected fiber optic cable or fiber optic interface of optical test equipment, to do so could expose the user to laser radiation and could result in 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 the correct charger is being used for the local line voltage**
- **Do not use any other charger than the one provided with this instrument.**

Chapter 2 Safety

Laser Safety

The Tunable Laser Source has been configured to provide laser radiation in the C Band of operation. (1530-1565nm) L Band may be available upon request with a range of (1565-1625nm). Please see the warning label in figure 1.1. This is displayed on the left hand side of the body of the TLS. The unit has been designed to comply with 21 CFR (Code of Federal Regulations) 1040.10 and 1040.11, for Class 1M emission limits. Although Class 1 levels are not considered to be hazardous, we suggest limiting exposure by never looking directly into the optical aperture. Also, do not under any circumstance view or inspect the laser output fibers, connectors or the fiber under test through collimating or focusing optics unless the unit is turned off, batteries are removed and the power adapter is disconnected.



Fig 2.1

The FTE6000 also contains a visual fault locator. The VFL is a Class 2 laser. Class 2 lasers are considered safe for normal operation, the output power is below 1 milliwatt. All Class 2 lasers emit visible light only.



Fig 2.2

SAFE USE GUIDANCE - GENERAL

A Class 2 laser is relatively weak. It normally would not harm an eye unless a person deliberately stared into the beam. Laser protective eyewear is normally not necessary. A Class 2 laser is not a skin or materials burn hazard.

However, even a Class 2 laser can be a distraction, glare or flash blindness hazard for pilots and drivers. NEVER aim any laser towards an aircraft or vehicle that is in motion. This is unsafe and is illegal.

Chapter 3 TLS Quick Start Guide

Prior to any operation please read the laser safety section of this chapter.

To operate the TLS at a specific wavelength/frequency/channel in CW mode follow this quick start guide.

Touch the TLS icon on the Home screen.

The Laser Output is displayed in the center of the screen. Touch this value to cycle through units of, Wavelength (nm), Frequency (THz) and Channel (Ch). 0.4nm (0.05THz), 0.8nm (0.10THz) or 1.6nm (0.20THz).

Touch and hold the blue wavelength/frequency/channel selector on the scale. Drag the selector to the desired output value.

Touch the step size indicator to cycle through step sizes until set at 0.40nm for wavelength, 50 GHz for frequency or 0.5 Ch for channel is displayed.

Touch the power value and a numeric keypad will be displayed. Enter the desired power value within the ranges set at the top of the display and touch OK.

Touch the Laser icon to energize the laser in a CW mode. Touch the Laser icon a second time to turn off the laser.

Chapter 4 Introduction

Dear Valued Customer,

Thank you for choosing Terahertz Technologies Inc. for your fiber optic testing requirements. Our professional staff is available to answer any questions or provide assistance that you require. We, at Terahertz Technologies Inc., strive to provide premier customer care and technical support by providing timely responsiveness and training. We are proud of our quality and high standards and assure you, our customer, the most user friendly and affordable fiber optic solutions to meet individual needs.

Chapter 5 Inspection and Identification

5.1 Inspection

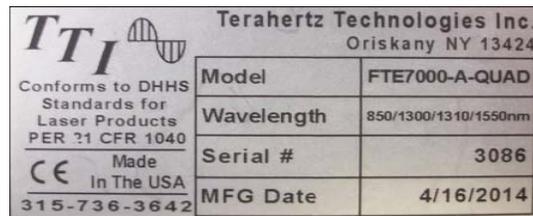
Before shipment, this instrument was inspected and found to be in perfect working order and free of defects.

The shipping carton contains the following:

1. TLS with Protective boot
2. Universal AC/DC charger with interchangeable mains
3. USB cable
4. Manual on CD.
5. 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 unit. The instrument's history is filed at the factory by model/part number and serial number. The unit's serial number is also located on the top plate just above the USB Port.



TTI Conforms to DHHS Standards for Laser Products PER 21 CFR 1040 CE Made In The USA 315-736-3642	Model	FTE7000-A-QUAD
	Wavelength	850/1300/1310/1550nm
	Serial #	3086
	MFG Date	4/16/2014

Fig 5.1

Chapter 6 Description

6.1 TLS Physical Description

Instrument Enclosure

The FTE6100 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 soft damp cloth to clean up the panels 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.

Front Panel



Fig 6.1

Top panel

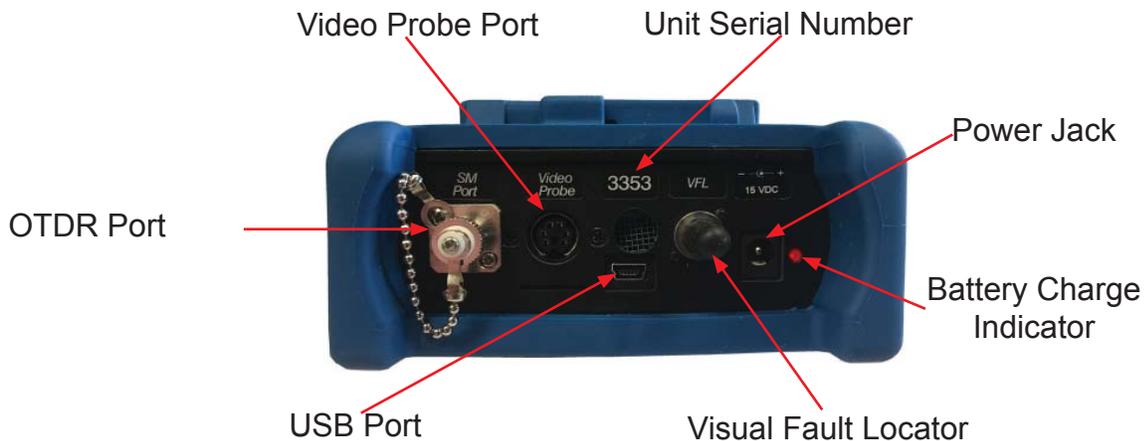


Fig 6.2

Chapter 6 Description

6.2 Home Screen Display

This unit is equipped with a 4" color TFT resistive touch display. All keyboard functions are also executable on the touch screen.

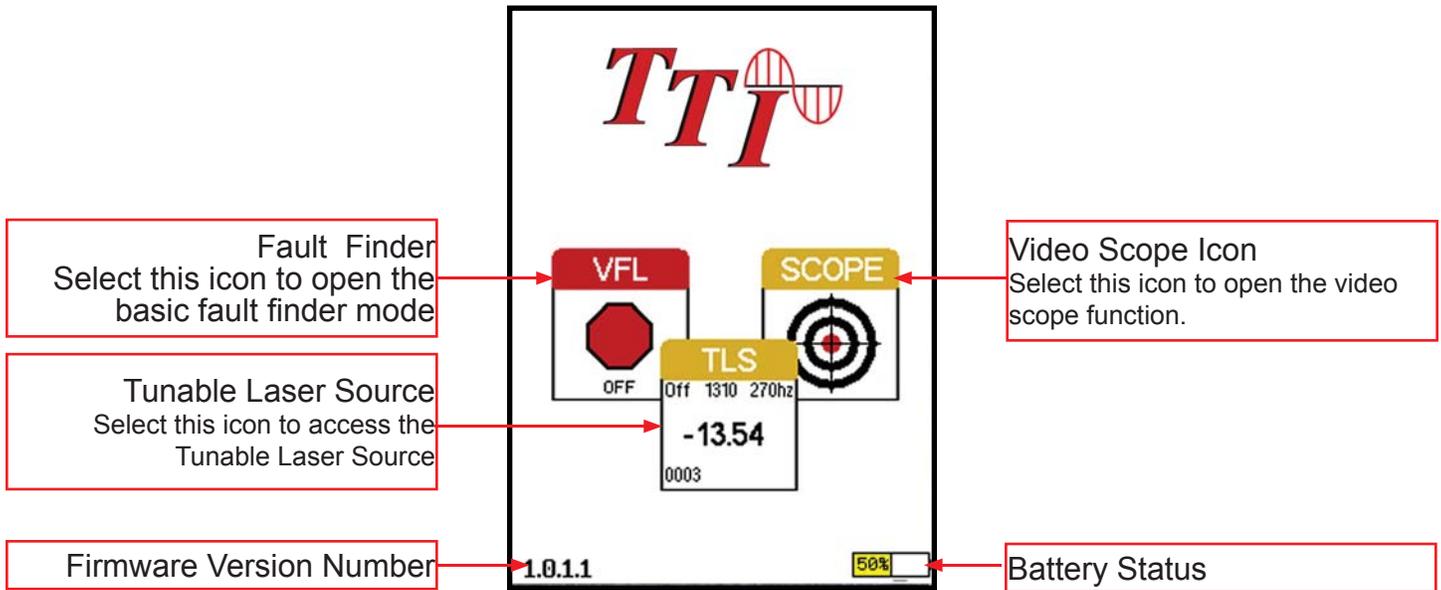


Fig 6.3

6.3 Power Requirements

The FTE-6100 is equipped with a 100-240V-0.4A input universal battery charger with 15V, 1.2A, (center positive output). The charger is supplied with interchangeable mains plugs for North America, Great Britain, Europe and Australia. The units internal power supply is an 11.1V 2600 mAh Li-ion battery. Typically, fully discharged batteries require 2 hours of recharging.

WARNING

To Prevent Fire or Shock Hazard: Do not install other battery types. 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. Do not use any charger other than the one provided with this instrument. Any other condition will void the warranty.

Chapter 6 Description

6.4 Battery Replacement

Batteries are factory installed. The unit should be returned to the factory for a new battery if required. It is suggested batteries receive a charge at least one a month.

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 the correct charger is being used for the local line voltage
- Do not use any other charger than the one provided with this instrument.

Failure to follow these caution statements could cause unsafe conditions for the operator and equipment and may void the warranty.

Chapter 7 Tunable Laser Source

7.1 Enter TLS Mode

To enter the TLS mode of operation, from the home screen, touch the TLS icon to enter the tunable laser source feature.

7.2 TLS Screen Description

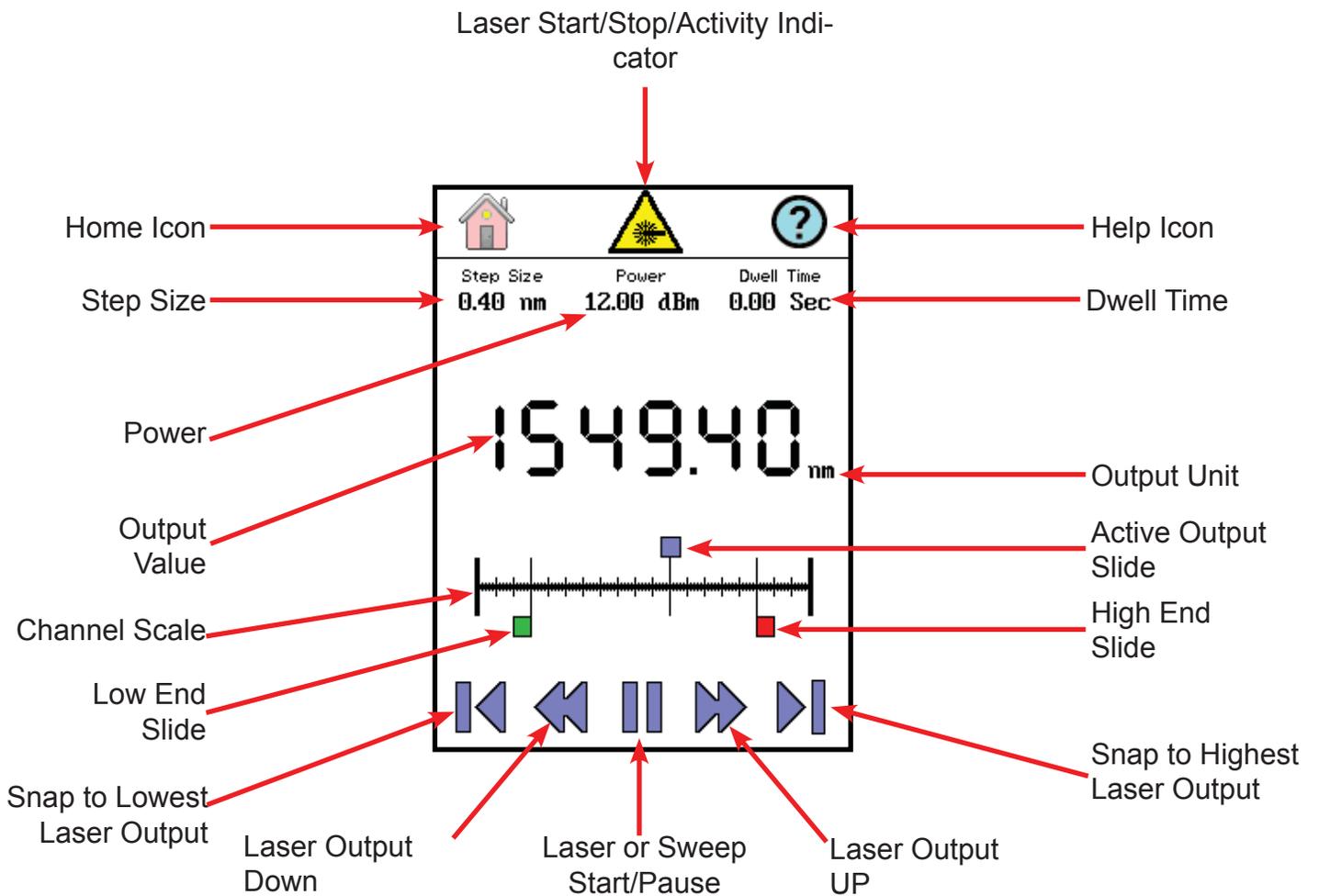


Fig 7.1

Chapter 7 Tunable Laser Source

7.3 TLS Touch Screen Operation

Laser Start/Stop /Activity Indicator	Flashing indicates active laser Starts and stops laser/sweep
Home Icon	Brings the user back to the home page
Help Icon	Opens the context sensitive help menu
Step Size	Cycles through available step sized in nm, Freq, and Ch
Power	Opens numeric keypad to enter power level
Dwell Time	Opens numeric keypad to enter dwell time or CW mode
Output Value	Laser output value in nm, Freq or Ch
Output Unit	Indicates displayed output unit
Active Output Slide	Used to select/indicate output laser
Channel Scale	Full scale of available laser output
Low end Slide	Used to select lowest laser output of sweep
High End Slice	Used to select highest laser output of sweep
Snap to Lowest laser Output	Moves the active slide to the lowest laser output set by the Low End Slide
Snap to highest laser Output	Moves the active slide to the highest laser output set by the High End Slide
Laser Output Down	Moves the low end slide down the scale
Laser or Sweep Start/Pause	Start and stops the laser/sweep
Laser Output Up	Moves the high end slide up the scale

Chapter 7 Tunable Laser Source

7.4 Set Parameters

Set Output Units

The output may be displayed in wavelength or frequency or channel. To set the units, touch the output value in the center of the screen to cycle through the available units.

Set Step Size

There are three available step sizes when selecting output or for sweep purposes. While in wavelength mode, the steps are 0.4nm, 0.8nm or 1.6nm. In Frequency mode they are 0.05THz, 0.10THz or 0.20THz, and in channel mode they are .5, 1 or 2 channel steps. The step size changes to the appropriate unit when the output units are changed. To set the step size, touch the step size indicator to cycle through the available choices.

Power Level

The power level of the signal is adjustable from approximately +7 dBm to +13 dBm in increments of 0.01 dBm. To set the power level, touch the power level indicator and a numeric keypad will be displayed. At the top of the keypad will be the available power level range. Enter the desired power to 0.01dBm. Once entered touch OK or to back out without change, touch cancel.

Dwell Time

To set the dwell time when operating in sweep mode, touch the dwell time indicator. A numeric keypad will be displayed. The dwell time may be set from 2.00 to 60.00 seconds for sweep mode operation. Enter the desired dwell time and touch OK or to exit without change touch cancel.

A dwell time of 0.00 is used for manual operation. This will set the laser to a CW mode at the output value displayed. The output may be changed with either the active output slide or the up or down channel select buttons.

Set Low and High End Laser Output

To set the low end laser output, touch the Low end slide and release. The output indicator and the Up and down arrows will change to green. The focus of the up down movement arrows and snap to end arrows changes to the low end slide. Use these arrows, or the slide to set the low end laser output.

Touch the red high end slide to change the output indicator and focus of the arrows to the high end slide to set the high end laser output.

Chapter 7 Tunable Laser Source

Manual/CW Operation

To fire the laser in a CW mode, Set the output to the desired unit, set the step size if required and set the power lever to dBm level required. Set the dwell time to 0.00. When the laser is fired with the Laser Start/Stop / Activity Indicator or the Laser or Sweep Start/Pause, it will be in CW mode. To change the output laser, use the arrows at the bottom of the display to move or snap the laser to a value or use the Active Output Slide to set the desired wavelength, frequency or channel. Touch the Laser Start/Stop / Activity Indicator or the Laser or Sweep Start/Pause again to turn off the laser.

Sweep Operation

To run a sweep of the laser, set the output to the desired unit, set the step size, power level and dwell Time as described above. Use the low end and high end sliders to set the low and high end laser levels to be fired. Touch the Laser Start/Stop /Activity Indicator or the Laser or Sweep Start/Pause.

7.2 Exit Tunable Laser Feature

Touch the Home icon to return to the home screen.

WARNING:

Even if the indicator shows the laser to be off never looking into the end of a fiber connected to the TLS or directly into the connector port. Do not under any circumstance view or inspect the laser output fibers, connectors or the fiber under test through collimating or focusing optics unless the unit is turned off, batteries are removed and the power adapter is disconnected.

Chapter 8 Video Scope

8.1 Entering Video Scope Function

To operate the video scope, from the home screen, highlight the Scope icon and press the select button. If a probe is not connected already, connect the VIS300 video probe to the video probe port on the top of the OTDR.

8.2 Video Scope Display

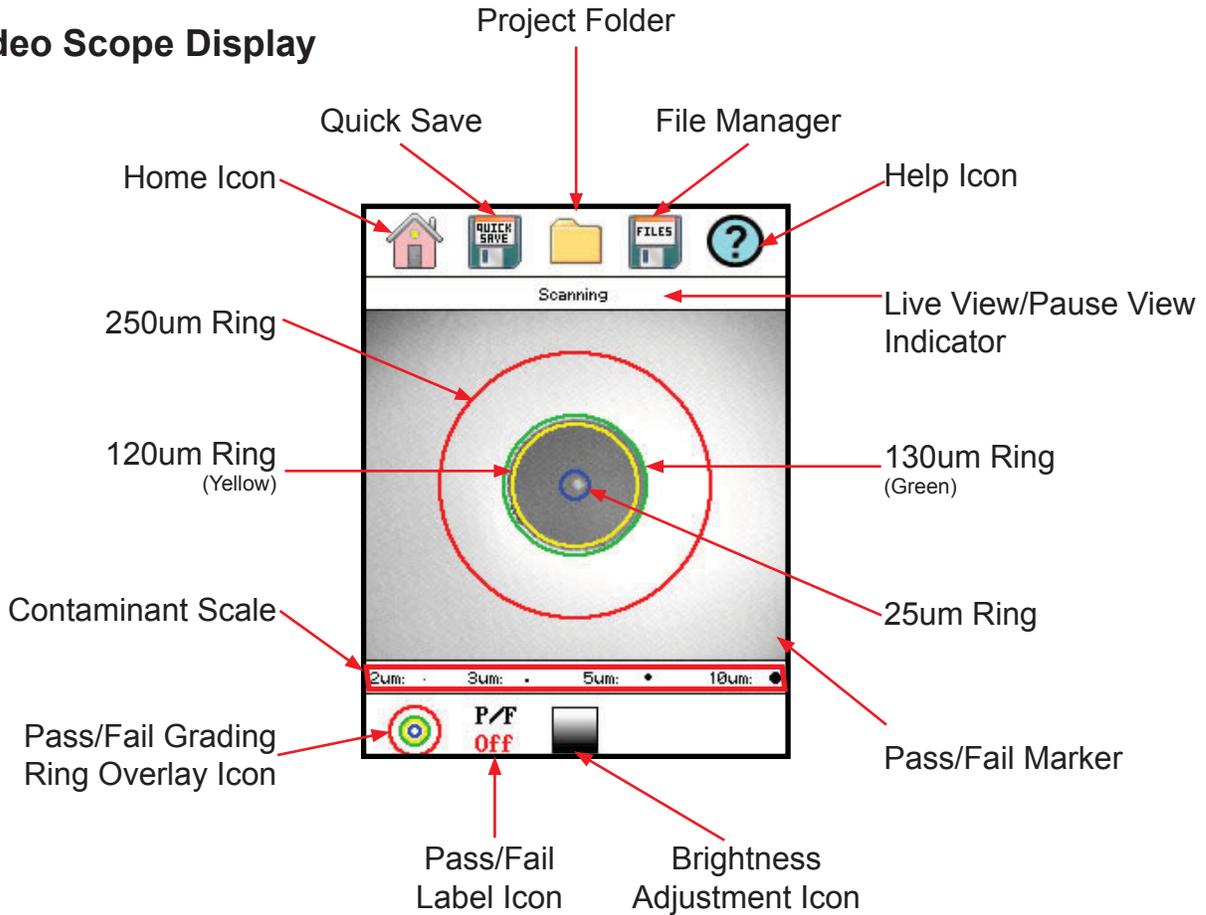


Fig 11.1

8.3 Video Scope File/help Icon Menu

The icons at the top of the display are Home, file save, project management, file management and Help.

Home

Press the menu button, use the left and right buttons to highlight the home icon and press select to return to the home Screen.

Chapte 8 Video Scope

Quick Save

Press the menu button, use the left or right buttons to highlight the quick save icon and press the select button to store a file image of the scope screen in the file folder within an active project. Scope files will be preceded by a target icon.

Project Management

To open project management, press the menu button, use the left or right buttons to highlight the project management folder icon and press select. Use the project management folder to open the project that the scope images are to be stored. When entering the video scope function, the active folder will be the one last used in the OTDR or LTS. For more information about the project management system, please refer to Chapter 9 of this guide.

File Management

To open file management, press the menu button, use the left or right buttons to highlight the file management icon and press select. Use File management to view a list of saved files or to open a stored image. File types are identified by the preceding icon. Trace files are indicated by a trace icon, LTS file by an LTS icon and scope files are preceded by scope (target) icon

Help

Press the menu button, use the left and right buttons to highlight the help icon and press select to view the help information.

8.4 Video Scope Operation Icon Menu

The following functions are only available for use when the video scope is in live scan mode.

Grading Rings

Used to turn on and off the rings that indicate the IEC61300-3-35 grading zones.

Enter the menu mode with the menu button, use the LRUD buttons to highlight the pass/fail grading rings overlay icon and press the select button. Exit the menu mode and use the LRUD buttons to center the image in the rings. Use the Pass/Fail Criteria Tables from page 44 to grade the connector end face. 2, 3, 5 and 10 micron contaminant examples are displayed just below the connector image on the video scope display.

Pass/Fail Label

Used to turn cycle through P/F (Pass/Fal) Off, P/F Man (In Red "Fail"), P/F Man (In Green "Pass") and P/F auto. To set the pass/fail indicator, press the menu button, use the left or right buttons to highlight the pass/fail icon and press select to cycle through the pass/fail states.

Chapter 8 Video Scope

Brightness

Press the menu button, use the left and right buttons to highlight the brightness icon, use the Select button to cycle through the adjustments for the brightness level.

8.5 Video Scope Operation

Video Probe Tips

There are a number of video probe tips available. To remove a tip from the Probe, grasp the probe tip and unscrew the tip retention nut from the tip. Pull the tip straight up from the probe. To place a tip on the probe, ensure the lens is clean, slide the tip on to the end of the probe and tighten the tip retention nut. Do not overtighten the retention nut.

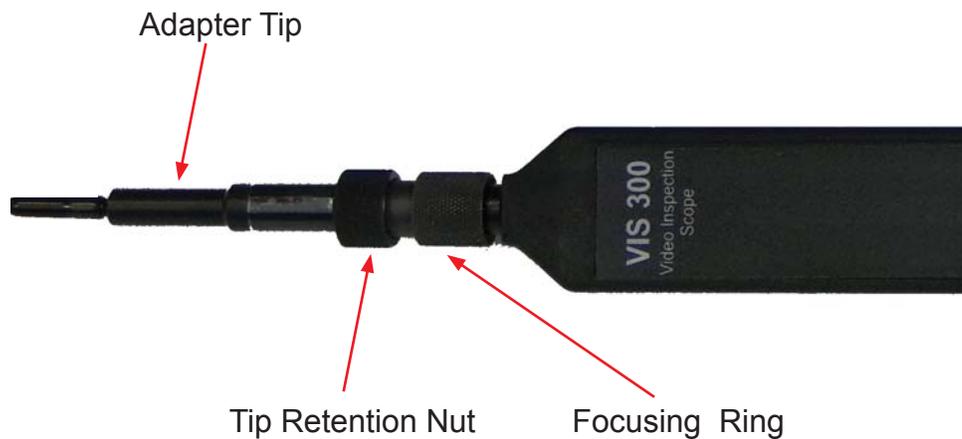


Fig 11.1

Viewing/Focusing a Connector

With the video scope turned on and the video probe plugged into the OTDR, insert a connector in to universal tip or insert the panel adapter tip into the appropriate port. The scope must be in the live scanning mode to make focus adjustments. Use the focus ring to get the connector image as sharp as possible. When using panel adapters it is possible to turn the body of the probe to while the adapter is inserted into the panel to make focus adjustments.

NOTE

To make position adjustments with the LRUD buttons, the unit must not be in menu mode. Menu mode is evident when there is a light blue box positioned around one of the icons. When the touch screen is used to roughly center the connector image, the menu mode is automatically turned off.

Chapter 8 Video Scope

Centering a Connector Image

Once the image is stable and focused, use the stylus to touch the approximate center of the connector to snap the image near the center of the display and the center of the grading rings. Use the LRUD buttons to fine tune the image to the center of the display.

Pausing Image Scan

To freeze an image in position and focus level for inspection, press the scan button. This will pause the image at the current position and focus level. Simply press the scan button again to set the operational mode back to live mode for focus and position adjustments

Grading Rings

Turn on or off the grading rings by pressing menu and using the left or right buttons to highlight the grading ring icon and press select. The unit must be in live scan mode to turn the rings off or on.

Manual Pass/Fail

Use the pass/fail criteria tables on the next page to determine if the connector passes the IEC61300-3-35 standard. There is a guide to contamination size located at the bottom of the image. To mark a connector as Pass or Fail, enter the menu mode, highlight the Pass/Fail Label icon and press select to cycle through pass, fail, or no grading. This must be done in the Live Scan mode. Once the pass fail status has been entered, the scan may be paused with the scan button and the points of contamination that caused a failure may be marked on the image.

Manually Marking Points of Contamination

To mark the points of contamination the unit must be in paused mode. Pick up the contamination marker by using the stylus and touching the contamination sample size that is required. Touch the image to place the marker. The marker may be fine tuned with the stylus to cover the contamination point on the image to be marked. Once the marker is positioned properly, touch the area just below the image that states, "Place marker, touch here to apply" to lock the marker in place. Repeat this as necessary to mark all the points that need to be indicated for the pass/fail status. At this point the image should be saved with the Quick Save icon

NOTE

Marking the points of contamination should be done last, just before saving the image. Once the unit is returned to live mode the markers are removed.

Auto Pass/Fail

Once the image has been centered in the grading rings, set the P/F icon to Auto and press the scan button. The video scope will evaluate the image and grade it with Pass or Fail. Contamination will be displayed on the image.

Exiting Video Scope Operation

Enter the menu mode, use the left or right buttons to highlight the Home icon and press select.

Chapter 8 Video Scope

8.6 Pass/Fail Criteria Tables

Fiber End Face Criteria Table for Angled PC Polished Connectors

Zone	Description	Diameter	Allowable Scratches (Width)	Allowable Defects (Diameter)
A	Critical Zone	0 μ m to 25 μ m	$\leq 4\mu$ m	None
B	Cladding Zone	25 μ m to 120 μ m	No limit	No Limit < 2 μ m 5 from 2 μ m to 5 μ m None > 5 μ m
C	Adhesive Zone	120 μ m to 130 μ m	No limit	No limit
D	Contact Zone	130 μ m to 250 μ m	No limit	None $\geq 10 \mu$ m

Fiber End Face Criteria Table for Ultra PC Polished Connectors

Zone	Description	Diameter	Allowable Scratches (Width)	Allowable Defects (Diameter)
A	Critical Zone	0 μ m to 25 μ m	None	None
B	Cladding Zone	25 μ m to 120 μ m	No limit $\leq 3\mu$ m None > 3 μ m	No Limit < 2 μ m 5 from 2 μ m to 5 μ m None > 5 μ m
C	Adhesive Zone	120 μ m to 130 μ m	No limit	No limit
D	Contact Zone	130 μ m to 250 μ m	No limit	None $\geq 10 \mu$ m

Fiber End Face Criteria Table for SM PC Polished Conn. (Single Mode Fiber, RL ≥ 26 dB)

Zone	Description	Diameter	Allowable Scratches (Width)	Allowable Defects (Diameter)
A	Critical Zone	0 μ m to 25 μ m	2 \leq 3 μ m None > 3 μ m	2 \leq 3 μ m None > 3 μ m
B	Cladding Zone	25 μ m to 120 μ m	No limit $\leq 3\mu$ m None > 3 μ m	No Limit < 2 μ m 5 from 2 μ m to 5 μ m None > 5 μ m
C	Adhesive Zone	120 μ m to 130 μ m	No limit	No limit
D	Contact Zone	130 μ m to 250 μ m	No limit	None $\geq 10 \mu$ m

Chapter 9 Visual Fault Locator

9.1 VFL Safety



Caution

This Visual Fault Locator is classified as a Class II laser system and must be used with all commensurate safety precautions. Never view the light emanating from the fiber directly. Place a white piece of paper at the end of the fiber and look for the presence of a red spot on the paper.

9.2 VFL Description

The Visual Fault Locator emits visible (red) light at the 650 nm wavelength. Its intended function is to allow an operator to identify the exact location of a break, microbend, or other discontinuity in a fiber optic cable. As the radiation is visible, light emanating from a break or micro bend enables the user to locate the exact position of a fault even at very short distances that would not be detectable by conventional means such as an Optical Time-Domain Reflectometer, (OTDR). It is also useful for identifying a particular fiber in a cable by exciting the fiber to be located with visible radiation.

9.3 VFL Operation

The Visual Fault Locator is access from the Home screen.

The fiber to be tested is connected to the VFL port of the OTDR by means of a standard 2.5 mm fiber optic connector. The source may be used in one of its two modes, Modulated or Continuous. In the modulated mode the laser is turned on and off at a 6 Hz rate. The laser is on for approximately one third of the cycle. This mode is helpful in permitting the user to identify the source radiation in the presence of high levels of ambient light. It also aids in conserving battery life.

The usable range for fault location depends on many factors, the type of fiber, the type of cable, the overall loss.

To activate the VFL, tap the VFL icon to cycle through the available states of off, Continuous and Modulated.

Chapter 10 Specifications



Caution

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

Tunable Laser Source	
Range	Frequency 191.5 - 196.25 THz Wavelengths 1527.4-1565.4nm ITU Channels 15 - 62.5
Frequency Accuracy	1.5 GHz
Line Width	1 MHz
Side Mode Suppression Ration	40 dB
Maximum Output Power	13 dBm (Typ.)
Output Power Range	6 dB
Power Setting Resolution	0.01 dB
Power Variation over Wavelength Range	± 0.5 dB
Minimum Channel Spacing	50 GHz (0.4nm)
Fiber Type	9/125 µm
Relative Intensity Noise	-140 dB/Hz

TTI reserves the right to change specifications without notice.

Visible Fault Locator	
Emitter Type	Laser Photo diode 1100 - 1700nm InGaAs -70+9dBm with interchangeable FC Adapter
Wavelength	650nm ±5nm
Connector Type	2.5mm Universal
Output Power	1mW Max.

Laser Safety



TTI reserves the right to change specifications without notice.

Chapter 10 Specifications

General	
Display	4" color touch screen
Power Supply / Charger	100-240V universal
Battery	Li-ion 10 hr typ.
Storage Temperature	-20 to 60 C
Operating Temperature Range	Operation 0°C to + 40°C
Dimensions (without rubber boot)	8.4607" L x 3.89" W x 1.65" H (215mm L x 99mm W x 42mm H)
Weight	1.6 lbs.
Communications ports	USB
Connector Styles	FC and SC Interchangeable
Accessories Included	Universal power supply with mains for US, UK, CE and AU. Interchangeable FC and SC adaptors, Windows TM Compatible Software, USB Cable, Manual on CD, 2 stylus and Rubber Boot

TTI reserves the right to change specifications without notice.

Chapter 11 Repair/Warranty

11.1 Repair Information

If repair is required, simply call the factory at 1-310.338.9971 for return instructions and an RMA number.

11.2 Warranty Information

This product, including all mechanical, electrical, and optical parts and assemblies are unconditionally warranted to be free of defects in workmanship and material for a period of one (1) year from the date of delivery.

This warranty does not apply to expendable parts such as batteries or optical panel connectors, nor to any instrument or component which has been subjected to misuse, alteration, or fiber connector damage. It is the customer's responsibility to understand all the instructions and specifications prior to operating this instrument. This warranty does not extend to any loss or damage consequent to the failure of the warranted product.

Chapter 12 Version Control

Through a Program of continuous improvement the upgrade of the features and performance of this instrument are an on going process. The instrument firmware version is accessible in the lower right corner of the home screen. The version changes and approximate release dates are as follows.

FTE-6100	V1.0.0.2 - 05/2017-	Original release
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