

SPECIFICATION 27 10 00.00 48

Building Telecommunications Cabling System

Project Name: Anywhere, NC Army Reserve Center

Test Plan Rev. 0

Date: March 1, 2022

Prepared By: The Best Low-Voltage Company, LLC

Reviewed By: Steve Smith, RCDD



SAMPLE

Table of Contents

- 1. Part 1: Testing Objective.....3
- 2. Part 2: Test Equipment.....4
- 3. Part 3: Testing Methodology.....5
- 4. Part 4: Test Reports Delivery.....7
- 5. Appendix A: Test Equipment Data Sheets.....8
- 6. Appendix B: Certificates of Calibration.....41

SAMPLE

Part 1

Testing Objectives

1. The objective of this test plan is to document the test equipment, testing methodology, and process for the delivery of the test reports. All testing equipment will be calibrated and recertified no more than 1 year prior to conducting any test. Calibration certificates are provided with this document This test plan has been developed IAW project specifications and ARNEC requirements.

SAMPLE

Part 2

Test Equipment

Manufacturer	Model	Serial Number	Calibration Date	Used to Certify
Fluke	DSX-8000	12B986YAZ	3/15/2022	<ul style="list-style-type: none">• Category 6a• Single-Mode Fiber (Optical Loss)• Multi-Pair Copper
Fluke	OFP-Quad	94PT5QN	1/3/2022	<ul style="list-style-type: none">• Single-Mode Fiber (Optical Time Domain Reflectometer (OTDR))
Fluke	1623-2	MUTN4PLK6793	2/19/2022	<ul style="list-style-type: none">• Telecommunications Bonding Conductor (Earth-Ground Resistance)• Telecommunications Bonding Backbone (Earth-Ground Resistance)

Part 3

Testing Methodology

1. Visual Inspection.
 - a. Prior to conducting any testing, all category 6A cabling, multi-pair copper cabling, single mode fiber cabling, and all grounding/bonding components (i.e., busbars, bonding conductors, bonding lugs) will be visually inspected. This visual inspection will include.
 - i. Cabling and Components will be inspected for any rips, tears, stretch marks, irregular bends, and other deformities.
 - ii. Proper labeling of all cabling and components
 - iii. Proper cable placement, terminations, bonding connections, and required cable slack.
2. Failed Test Reports
 - a. Failed test reports will not be submitted. Any cabling or component that fails any test will have the issue(s) corrected and the testing re-done until a passing test result is obtained.
3. Cabling Testing
 - a. Category 6a Horizontal Cabling
 - i. Category 6a cabling will be tested with a permanent link test from the termination device in the EF, TER, and TR(s) to each individual modular jack. The performance testing will include the following tests:
 1. Wire map.
 2. Length (physical vs. electrical, and length requirements).
 3. Insertion loss.
 4. Near-end crosstalk (NEXT) loss.
 5. Power sum near-end crosstalk (PSNEXT) loss.
 6. Equal-level far-end crosstalk (ELFEXT).
 7. Power sum equal-level far-end crosstalk (PSELFEXT).
 8. Return loss.
 9. Propagation delay.
 10. Delay skew.
 - b. Multi-Pair Copper Cabling
 - i. Each pair of multi-pair copper cabling will be tested for wire map and length. The Fluke DSX-8000 1-pair Voice test will be used for this test.
 - c. Single-Mode Fiber Cabling
 - i. Each fiber strand will be tested end-to-end, including termination devices, from the fiber patch panel in the TER to the fiber patch panel in the EF and TR(s).
 - ii. All tests will be conducted at the 1310nm and 1550nm wavelengths.
 - iii. A compatible launch cable of 150 meters in length on both fiber ends will be used on all tests.
 - iv. Two separate tests will be conducted on each fiber strand
 - v. Optical Loss (a.k.a. Power Meter)
 1. Three-second auto-test optical loss measurement of each strand of fiber bi-directionally at 1310 and 1550nm wavelengths with distance measurement and optical loss budget calculation

- vi. OTDR
 - 1. Optical Return Loss (ORL) with graphical view of each fiber strand.
- d. Bonding Conductors
 - i. The earth-ground resistance will be tested for the telecommunications bonding conductor (TBC) and each telecommunications bonding backbone (TBB) in the EF.
 - ii. The 3-pole Fall of Potential method will be used for each bonding conductor tested.
 - iii. A passing test will indicate a resistance of 10 Ohms or less.

SAMPLE

Part 4

Test Reports Delivery

1. The test reports for this project will be delivered in one consolidated PDF document. Both the summary and detailed test reports will be included for all cables tested.
 - a. This document will include the following items in the following format.
 - i. Title Page with low-voltage contractor's RCDD Stamp (only the title page needs this stamp)
 - ii. Table of Contents. The Table of Contents will indicate the page numbers for each section and will be indexed for ease of use.
 - iii. Separate sections (with header page) for the training building and VMS. Each section will contain
 1. Draft as-build floor plans indicating the location and jack label(s) for each telecommunications outlet installed.
 2. Category 6a cabling test reports for each horizontal cable terminated in the EF, TER, and TR(s).
 3. Multi-pair copper cabling test reports for each pair terminated in the TER to the EF, and each TR.
 4. Single-mode fiber optical loss (power meter) reports for each strand terminated in the TER to the EF, and each TR.
 5. Single-mode OTDR test reports for each strand terminated in the TER to the EF, and each TR.
 6. Earth-ground resistance test reports for the EF telecommunications bonding conductor and the telecommunications bonding backbone.

Appendix A

Testing Equipment Data Sheets

SAMPLE

DSX CableAnalyzer™ Series

At a Glance

The DSX CableAnalyzer™ Series is the copper certification solution of the Versiv™ cabling certification product family. The DSX Series includes the DSX-8000, which can certify cabling up to Cat 8 / 2 GHz, and the DSX-5000 which can certify up to Cat 6A / Class FA / 1GHz. The Versiv line also includes **fiber OLTS certification**, **OTDR**, and **fiber inspection** modules. Versiv reduces overall certification costs by up to 2/3, adding up to 10% to the bottom line of every job. While the fastest test time (8 seconds for Cat 6A) plays a part, the system is designed from the ground up to reduce errors and streamline certification. Full integration with the **LinkWare Live cloud service** lets the Project Manager remotely set up the testers, monitor job progress and even locate tester from any smart device.

With the DSX CableAnalyzer and Versiv, you'll save money every time you use it.



Overview

The DSX CableAnalyzer Series copper test solution enables testing and certification of twisted pair cabling for up to 40 Gigabit Ethernet deployments and will handle any cabling system whether it is a Cat 5e, 6, 6A, 8 or Class FA and I/II. Certifying a cable is one part of a process that starts with system design and ends with system acceptance. The faster that process goes, the more profitable you'll be. Unfortunately, there are a lot of things that slow the process down – setting up the tester incorrectly, testing to the wrong limits, waiting for skilled technicians to analyze and troubleshoot failures, misinterpretation of results, and producing test reports that customers cannot understand.

As part of the **Versiv cabling certification** product family, the DSX CableAnalyzer Series provides accurate, error-free certification. In the installation business there are multiple teams, varying media types and multiple testing requirements. The difference between being profitable or not is just a few percentage points. The DSX certifies copper cabling, complies with all standards including Level VI/2G accuracy, making jobs easier to manage, and getting to system acceptance faster. It's not just for the expert technicians and Project Managers. Individuals of various skill levels can improve the set-up, operation, test reporting, and simultaneously manage diverse projects.

Unique features:

- Versiv enables users to accomplish more than ever with a cable tester, by accelerating every step of the testing process
- LinkWare Live cloud service lets the Project Manager remotely set up the testers, monitor job progress and even locate tester from any smart device
- ProjX™ management system eases tasks from initial set-up of a job to system acceptance. It eliminates redundant steps, and ensures that all tests are completed correctly the first time, and every time

- Taptive™ user interface puts advanced data analysis and easy set-up and operation at the fingertips of technicians of all skill levels
- LinkWare PC management software provides unmatched analysis of test results and professional test reports
- The DSX reduces the time required to fix cabling faults with dedicated diagnostics, a simple test that locates the problem



Performance:

- Eight second Cat 6A test time contributes to the fastest way to gain certification
- Graphically displays the source of failures including crosstalk and distance to shield faults for faster troubleshooting
- Manage up to 12,000 Cat 6A test results with full graphics
- Capacitive touchscreen allows quick tester setup with easily selectable cable types, standards and testing parameters
- Over 1 billion links reported on LinkWare PC management software
- Integrated Wi-Fi allows you to easily upload results to LinkWare™ Live

Standards:

- Compliant with ANSI/TIA-1152-A Level 2G and proposed standard IEC 61935-1 Ed. 5 Level VI field tester accuracy requirements to 2000 MHz
- Supports the complete suite of Resistance Unbalance standards needed for Power over Ethernet (PoE) – IEEE 802.3bt, ANSI/TIA/EIA-568, ISO/IEC 11801 series documents
- TCL and ELTCTL measurements compliant to IEC 61935-1-1 (Draft)

- Screen continuity along path of cabling

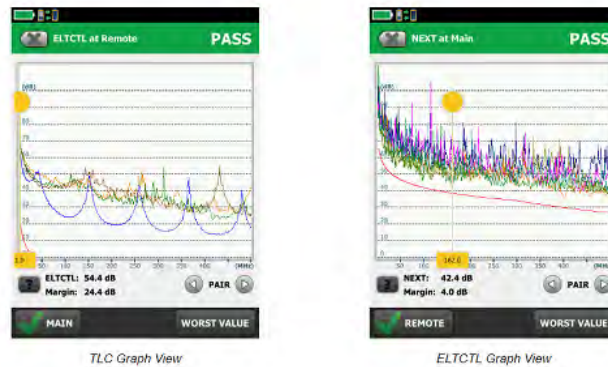
Versiv Platform is Ready for Today's and Tomorrow's Jobs

Electrically centered plug design is compliant with TIA Level 2G and IEC Level VI accuracy requirements to 2000 MHz with a future-ready design to support all hardware upgrades

The DSX CableAnalyzer Series enables cable testing and certification for network deployments up to 40 Gigabit Ethernet – whether it is an existing Cat 5e, 6, 6A, 8 or Class I/II cabling system, the DSX tests to all industry standards. The electrically centered test plug results in the Level 2G/VI accuracy required to support field testing to **Cat 8** / Class I/II, 2000 MHz. The DSX exceeds the IEC Level VI and TIA Level 2G specifications assuring you of higher confidence in results over the full frequency range. Higher performance cabling systems like **Cat 8** require more precise measurement to ensure they are providing the noise immunity required by 25G and 40G applications. Additionally, complex Alien Crosstalk link-to-link certification is simplified by integrating the measurement capability into each copper module up to 40GBASE-T testing.

The DSX is the first field tester to support balance measurements including Transverse Conversion Loss (TCL) and Equal Level Transverse Conversion Transfer Loss (ELTCTL). TCL and ELTCTL are important measurements found in the cabling standards. They define a minimum performance for balance, a key parameter to help determine noise immunity. Industrial network owners/operators are especially interested in this property due to the higher level of electromagnetic interference (EMI) within the industrial environment.

Fluke Networks' DSX CableAnalyzer Series has obtained Intertek (ETL) verification in accordance with the ANSI/TIA-1152-A specification for Level 2G test equipment. (Report on file.)

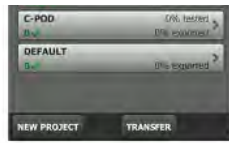


ProjX Management System Manages Complex Jobs with Ease

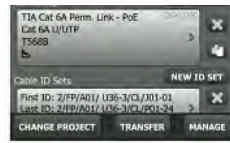
Manage up to 12,000 Cat 6A test results with full graphics

Managing the testing of multiple jobs with multiple teams, testers, and requirements is time consuming and a source of errors. Increasingly larger jobs make project organization more important than ever. The ProjX management system on the DSX CableAnalyzer Series provides individual project files for all job specific details to be saved under a simple name, eliminating the need to re-enter job specific details after starting a project. This minimizes set-up errors or lost files when switching from one job to another or utilizing multiple testers on a single job. In addition, it provides test results by cable ID, merges any changes without duplicates and defaults to the last copper or fiber module installed. ProjX management system provides real time status to completion on each job with a 0-100% scale and gives the operator the option to isolate any test requiring a second look and helps to assure nothing is overlooked. The "Fix Later" selection creates a punch list or automatic to do list for correcting any workmanship issues. ProjX enables project managers and crew leaders to be truly efficient.





Project Menu screen shows percent complete per job



Project specific screen shows up to the minute project details

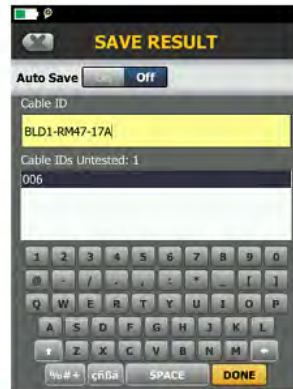
Taptive User Interface Simplifies Set Up, Eliminates Errors and Speeds Troubleshooting

Capacitive touchscreen allows quick tester setup and supports all standards

Taptive user interface is easy enough for even the newest technician to perform tests across multiple media types and testing requirements. The capacitive Taptive user interface makes all jobs easily accessible from the menu screen. Touch the job you're working on and the large display confirms the test that needs to be performed, animated instructions simplify setting the configuration making correct testing assured.



Simple Set up



Quickly enter Cable Ids with the capacitive touchscreen

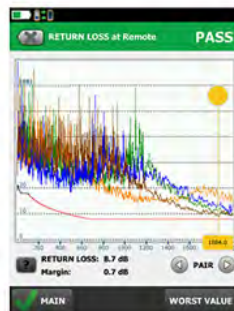
Performs with Unsurpassed Speed

Eight second Cat 6A test time and the fastest way to submit your certification results

No tester offers so much speed for so many tests. Complete copper certification to Cat 6A in 8 seconds or certify two fibers at two wavelengths in just 3 seconds. Endorsements by cabling vendors worldwide assure that Versiv is the fastest way to project completion and system acceptance. Quickly get a Pass or Fail result and easily review individual test parameters by value or drill into specific area on a graph.



Passing test result



Return loss graph



Pinch and zoom for more detail

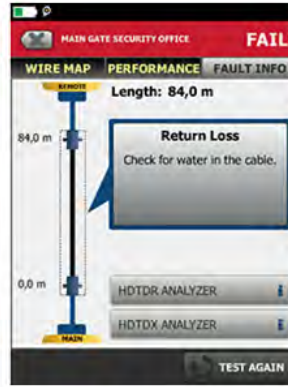
Troubleshoot Like an Expert

Graphically displays the source of failures including crosstalk and distance to shield faults for faster troubleshooting

The DSX reduces the time required to fix cabling faults with dedicated diagnostics, a simple 1 button test runs all tests and saves all data. The graphical results screen allows you to look down the cable to see exactly where any cross talk, return loss or shield faults are located on any given link. Previous testers had frequency limits of their diagnostic capabilities of up to 250 MHz only, but the DSX CableAnalyzer Series removes this limitation. This common view is easily interpreted by novice and expert users alike to isolate and act on any failed results quickly and is stored with the test result for remote analysis.



High Definition Time Domain Cross talk (HTDX) shows the far end connection is clearly the issue

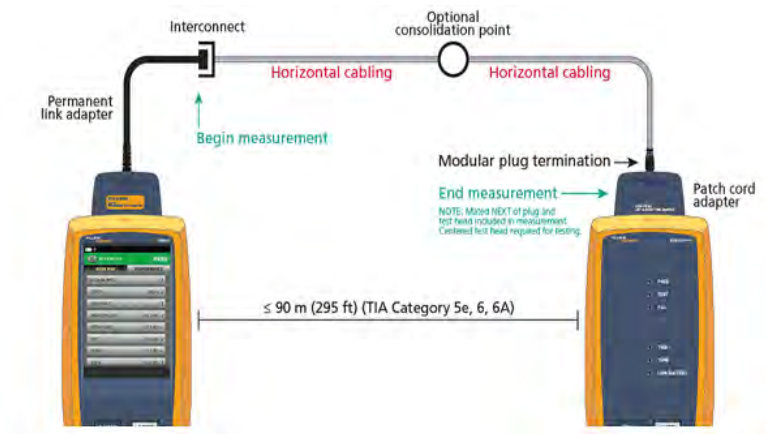


Features simple diagnostics based on decades of Fluke Networks troubleshooting experience

MPTL Certification

There may be scenarios where a typical four-connector channel is not used when connecting these types of devices— especially those that reside in the ceiling space where it is impractical to install a faceplate. Instead, there is just one patch cord in the telecommunications room and the permanent link is terminated at the other end with a plug so it can plug directly into the device, essentially eliminating the equipment cord. This creates what is now known as a Modular Plug Terminated Link, or MPTL.

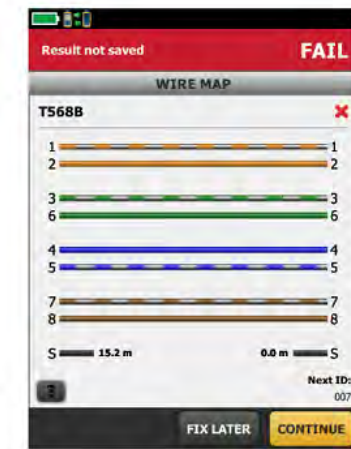
The DSX CableAnalyzer™ is capable of certifying MPTL by using a patch cord adapter on one end and a permanent link on the opposite end (see image below).



The patch cord adapters support Category 5e, 6, and 6A performance levels and work with all DSX CableAnalyzer™ models. The latest version of the Versiv/DSX firmware is required to use the MPTL testing limits.

Shield continuity historically is a direct current (DC) measurement with no distance to fault available. Other testers run a simple resistance test to verify that the shield has continuity. These tests have been shown to be inaccurate, sometime confusing a ground path as shield continuity and not correctly identifying a break in the shield. Other testers may tell you there is a break in a shield, but not pinpoint the exact location giving no indication of where to start rework. The DSX CableAnalyzer Series is the first field tester to report distance to any shield integrity issues, reporting the true status of the screen continuity. This is

especially important in datacenters and **Cat 8** installations where screen continuity is critical to maintaining alien crosstalk performance of screened cabling.



Wiremap – shows distance to fault, break and short

DSX CableAnalyzer Series Family

The DSX CableAnalyzer Series family is based on two modules: the DSX2-5000 and DSX2-8000. The DSX2-5000 certifies twisted pair Cat 5e, 6, 6A and Class FA cabling with limits up to 1000 MHz. The DSX2-8000 certifies twisted pair Cat 5e, 6, 6A, **Cat 8** and Class I/II cabling with limits up to 2000 MHz.

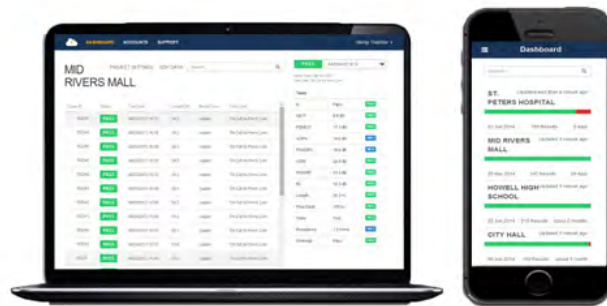
	Copper Certification	
	DSX-8000 CableAnalyzer™	DSX-5000 CableAnalyzer™
Cat 6A / Class EA test time	8 seconds	10 seconds
Cat 8 / Class I/II test time	16 seconds	
HDTDx/HDTDR diagnostic test times	≈ 3 seconds	≈ 3 seconds
Internal memory	≈ 5,000 Cat 8 with plots; ≈ 12,000 Cat 6A with plots	≈ 12,000 Cat 6A with plots
>Level V Accuracy (1 GHz)	✓	✓
Level VI/2G Accuracy (2 GHz)	✓	
Resistance Unbalance measurement	✓	✓
Shield integrity check and distance to fault	✓	✓
TCL measurement	✓	✓
ELTCTL measurement	✓	✓
CDNEXT measurement	✓	✓
CMRL measurement	✓	✓
Built-in Alien XTalk capability	✓	✓

Channel Adapter	2 GHz Range	1 GHz Range
Permanent Link Adapter	2 GHz Range	1 GHz Range
Optional accessories		
Patch cord adapter	Cat 5e, 6 and 6A patch cord	at 5e, 6 and 6A patch cord
Coax Adapter	✓	✓
M12 Adapter	✓	✓
TERA Adapter	✓	✓
GG45/ARJ45	✓	✓

LinkWare Live

LinkWare Live is a cloud-based service that lets you manage certification jobs anytime, anywhere, with anyone on any device. With LinkWare Live, you can

- Keep track of every test on every job. Get an overview of every project from any smart device. Drill down to each individual test. Instantly receive notification of incorrect test setting or cable IDs.
- Get it right the first time. Define cable IDs and test settings from your PC or tablet. Then send them to the testers or compatible labelers at the jobsite for mistake-free testing and labeling.
- Keep your testers up to date. Standards can change without notice, and an out-of-date test report can mean hours of re-testing. LinkWare Live automatically ensures your testers are running the latest.
- Stop wasting time and gas driving testers back to the office. Upload your test results straight from the job site to LinkWare Live over Wi-Fi. Then download them automatically to the right job for fast report generation with LinkWare PC.
- Avoid Project Delays. Track the last used location and monitor the status of all testers to ensure they are always calibrated and running the latest firmware.
- Supports all Versiv models: DSX CableAnalyzer Series, CertiFiber Pro, OptiFiber Pro, and the FI-7000.

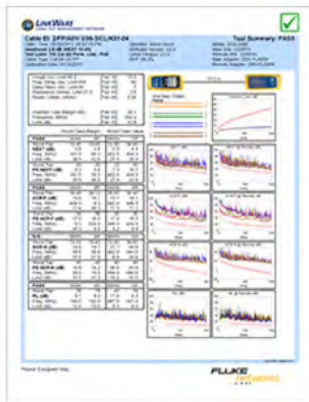


LinkWare PC Management Software

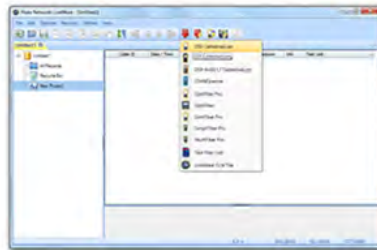
Leveraging the popular and multi-featured LinkWare PC management software application, DSX CableAnalyzer Series users can easily access the ProjX management system data, generate reports, and upgrade the software in their testers. Project Managers have full capabilities to manage workflow and consolidate test results. Users can provide the finishing touch by adding their company logo to the report and offer it unaltered to their customers for system acceptance purposes. Keep your business tools simple, no matter which Fluke Networks copper or fiber tester you are using, LinkWare PC is the software package that reports it all.

Now with LinkWare Stats, the new automated statistical report option, you can move above and beyond the page-per-link report and see your entire cabling infrastructure. It analyzes and transforms LinkWare PC test results data into charts and diagrams that reveal your cabling plant performance; this report summarizes your entire cabling infrastructure in a compact, graphical format that makes it easy to verify margins and to spot anomalies.

LinkWare PC Report



LinkWare Stats summarizes all project data



New versions of LinkWare PC are always backwards compatible with previous versions, so you can stay current and always integrate tests from different testers into test report.



DSX CableAnalyzer Series Specifications

Cable Types	
Shielded and unshielded pair LAN cabling	TIA Cat 3, 4, 5, 5e, 6, 6A, 8: 100 Ω ISO/IEC Class C, D, E, EA, F, FA and I/II: 100 Ω and 120 Ω

Standard Link Interface Adapters	
Permanent link adapters	Plug type: shielded RJ45
	Optional Plug type: ARJ45/GG45
Channel Adapters	Jack type: shielded RJ45
	Optional Jack type: Tera, GG45/ARJ45

Test Standards	
TIA	Cat 3, 4, 5, 5e, 6, 6A, 8 per TIA 568 Series

ISO/IEC	Class C, D, E, EA, F, FA, I/II certification per ISO/IEC 11801 Series
Maximum frequency	DSX-8000: 2000 MHz; DSX-5000 1000 MHz

General Specifications

Autotest Time	DSX-8000: Full 2-way Autotest of Cat 5e or 6/Class D or E: 7 seconds Full 2-way Autotest of Cat 6A/Class EA: 8 seconds Full 2-way Autotest of Cat 8: 16 seconds
	DSX-5000: Full 2-way Autotest of Cat 5e or 6/Class D or E: 9 seconds Full 2-way Autotest of Cat 6A/Class EA: 10 seconds
Support test parameters (The selected test standard determines the test parameters and the frequency range of the tests)	Wire Map, Length, Propagation Delay, Delay Skew, DC Loop Resistance, Pair-to-Pair Resistance Unbalance, Pair Resistance Unbalance, Insertion Loss (Attenuation), Return Loss (RL), Common Mode Return loss (CMRL), Near End Crosstalk (NEXT), Far End Crosstalk (FEXT), Attenuation-to-crosstalk Ratio (ACR-N), ACR-F (ELFEXT), Power Sum ACR-F (ELFEXT), Power Sum NEXT, Power Sum ACR-N, Power Sum Alien NEXT (PS ANEXT), Power Sum Alien Attenuation NEXT Ratio Far End (PS AACR-F), Common Mode to Differential Mode NEXT (CDNEXT), Transverse Conversion Loss (TCL), Equal Level Transverse Conversion Transfer Loss (ELTCTL)
Input protection	Protected against continuous telco voltages and 100 mA over-current. Occasional ISDN over-voltages will not cause damage
Display	5.7 in LCD display with a projected capacitance touchscreen
Case	High impact plastic with shock absorbing overmold
Dimensions	Main Versiv unit with DSX module and battery installed: 2.625 in x 5.25 in x 11.0 in (6.67 cm x 13.33 cm x 27.94 cm)
Weight	Main Versiv unit with DSX module and battery installed: 3 lbs, 5oz (1.28 kg)
Main unit and remote	Lithium ion battery pack, 7.2 V
Typical battery life	8 hours
Charge time*	Tester off: 4 hours to charge from 10 % capacity to 90 % capacity
Languages supported	English, French, German, Italian, Japanese, Portuguese, Spanish, Chinese, Korean, Russian, Trad Chinese, Czech, Polish, Swedish, Hungarian
Calibration	Service center calibration period is 1 year
Integrated Wi-Fi	Meets IEEE 802.11 a/b/g/n; dual band (2.4 GHz and 5 GHz)

Environmental Specifications

Operating Temperature	32° F to 113° F (0° C to 45° C)
Storage Temperature	-22° F to +140° F (-30° C to +60° C)
Operating relative humidity (% RH without condensation)	0% to 90%, 32° F to 95° F (0° C to 35° C)
	0% to 70%, 95° F to 113° F (35° C to 45° C)

Vibration	Random, 2 g, 5 Hz-500 Hz
Shock	1 m drop test with and without module and adapter
Safety	CSA 22.2 No. 61010, IEC 61010-1 3rd Edition
Operating altitude	13,123 ft (4,000 m) 10,500 ft (3,200 m) with ac adapter
EMC	EN 61326-1

Ordering Information

DSX2-8000 Wireless models

Model	Description
DSX2-8000	2GHZ DSX-8000 CableAnalyzer with Wi-Fi
DSX2-8000/GLD	2GHZ DSX-8000 CableAnalyzer with Wi-Fi and 1 YR Gold Support
DSX2-8000MI	2GHZ DSX-8000 CableAnalyzer with Multimode OLTS, Fiber Inspection and Wi-Fi
DSX2-8000MI/GLD	2GHZ DSX-8000 CableAnalyzer with Multimode OLTS, Fiber Inspection, Wi-Fi and 1 YR Gold Support
DSX2-8000QI	2GHZ DSX-8000 CableAnalyzer with Quad OLTS, Fiber Inspection and Wi-Fi
DSX2-8000QI/GLD	2GHZ DSX-8000 CableAnalyzer with Quad OLTS, Fiber Inspection, Wi-Fi and 1 YR Gold Support
DSX2-8000QOI	2GHZ DSX-8000 CableAnalyzer with Quad OLTS, Quad OTDR, Fiber Inspection and Wi-Fi
DSX2-8000QOI/GLD	2GHZ DSX-8000 CableAnalyzer with Quad OLTS, Quad OTDR, Fiber Inspection, Wi-Fi and 1 YR Gold Support
DSX2-8000-PRO	Versiv Professional Kit with DSX-8000 CableAnalyzer, Quad OLTS, Quad OTDR, Fiber Inspection, Wi-Fi and a full complement of product accessories.
DSX2-8000-PRO/GLD	Versiv Professional Kit with DSX-8000 CableAnalyzer, Quad OLTS, Quad OTDR, Fiber Inspection, Wi-Fi and a full complement of product accessories and 1 YR Gold Support.

DSX2-8000 Non-Wireless models

Model	Description
DSX2-8000-NW	2GHZ DSX-8000 CableAnalyzer
DSX2-8QOI-NW	DSX2-8000QOI with Integrated Wi-Fi disabled
DSX2-8QOI/GLD-NW	DSX2-8000QOI with Integrated Wi-Fi disabled and 1 YR Gold Support

DSX2-8-PRO-NW	DSX2-8000-PRO with integrated Wi-Fi disabled
DSX2-8000PRONW/GLD	DSX2-8000-PRO with integrated Wi-Fi disabled and 1 YR Gold Support

DSX2-8000 Accessories

Model	Description
DSX-8000-ADD	DSX-8000 Add-on Kit
DSX2-8000-ADD-R	DSX2-8000 Add-on Kit with Remote (not compatible with original Versiv main)
DSX2-8-CFP-Q-ADD/R	DSX2-8000 with Quad OLTS Add-on Kit with V2 Remote (not compatible with original Versiv main)
DSX-8000-OPF-Q-ADD	DSX-8000 with Quad OTD Add-on Kit
DSX-PLA804S	DSX-8000 Cat 8/Class I Permanent Link Adapter Set
DSX-PLA804-RKIT	Cat 8 PLA Adapter – Plug Replacement Kit
DSX-CHA804S	DSX-8000 Cat 8/Class I Channel Adapter Set
DSX-CHA-8-TERA-S	DSX-8000 TERA Channel Adapter Set
DSX-PLA-8-TERA-S	DSX-8000 TERA Permanent Link Adapter Set
DSX-8-TERA-KIT	DSX-8000 TERA Permanent Link & Channel Adapter Set
DSX-CHA-8-GG45-S	DSX-8000 GG45/ARJ45 Channel Adapter Set (2 GHz)

DSX-8000 Gold Support models

Model	Description
GLD-DSX-8000	1 year Gold Support, DSX2-8000 or DSX-8000
GLD3-DSX-8000	3 year Gold Support, DSX2-8000 or DSX-8000
GLD-DSX-8000MI	1 year Gold Support, DSX2-8000MI or DSX-8000MI
GLD3-DSX-8000MI	3 year Gold Support, DSX2-8000MI or DSX-8000MI
GLD-DSX-8000QI	1 year Gold Support, DSX2-8000QI or DSX-8000QI
GLD-DSX-8000QOI	1 year Gold Support, DSX2-8000QOI or DSX-8000QOI
GLD3-DSX-8000QOI	3 year Gold Support, DSX2-8000QOI or DSX-8000QOI
GLD-DSX-8000PRO	1 year Gold Support, DSX2-8000-PRO or DSX-8000-PRO
GLD3-DSX-8000PRO	3 year Gold Support, DSX2-8000-PRO or DSX-8000-PRO

GLD-DSX-8-ADD-R	1 year Gold Support, DSX2-8-ADD-R or DSX-8000-ADD-R
GLD3-DSX-8-ADD-R	3 year Gold Support, DSX2-8-ADD-R or DSX-8000-ADD-R
GLD-DSX8-CFPQADD/R	1 year Gold Support, DSX2-8-CFP-Q-ADD/R or DSX-8-CFP-Q-ADD/R
GLD3-DSX8-CFPQADDR	3 year Gold Support, DSX2-8-CFP-Q-ADD/R or DSX-8-CFP-Q-ADD/R

DSX2-5000 Wireless models

Model	Description
DSX2-5000	1GHZ DSX-5000 CableAnalyzer with Wi-Fi
DSX2-5000/GLD	1GHZ DSX-5000 CableAnalyzer with Wi-Fi and 1 YR Gold Support
DSX2-5000QI	1GHZ DSX-5000 CableAnalyzer with Quad OLTS, Fiber Inspection and Wi-Fi
DSX2-5000QI/GLD	1GHZ DSX-5000 CableAnalyzer with Quad OLTS, Fiber Inspection, Wi-Fi and 1 YR Gold Support

DSX2-5000 Non-wireless models

Model	Description
DSX2-5000-NW	1GHZ DSX-5000 CableAnalyzer

DSX2-5000 Accessories

Model	Description
DSX-ADD	DSX-5000 Add-on Kit
DSX2-ADD-R	DSX2-5000 Add-on Kit with Remote (not compatible with original Versiv main)
DSX2-CFP-Q-ADD-R	DSX2-5000 with Quad OLTS Add-on Kit with Remote (not compatible with original Versiv main)
DSX-OFQ-Q-ADD	DSX-5000 with Quad OTDR Add-on Kit
DSX-PLA011S	DSX-5000 TERA Cat 7A/Class FA PLA Set
DSX-CHA011S	DSX-5000 TERA Cat 7A/Class FA CHA Set
DSX-CHA-5-GG45-S	DSX GG45/ARJ45 Class FA Channel Adapter Set (1 GHz)

Accessories for the DSX CableAnalyzers Series

Model	Description
-------	-------------

DSX-PLA004S	DSX Cat 6A/Class EA Permanent Link Adapter Set
DSX-PLA004-RKIT	Cat 6A/Class EA PLA Adapter – Plug Replacement Kit
DSX-CHA004S	DSXcCat 6A/Class EA Channel Adapter Set
DSX-COAX	DSX Coax Adapter Set
DSX-CHA021S	DSX M12 4-Position Adapter Set
DSX-PC5ES	DSX Patch Cord Test Adapter Set for Cat 5e patch cords
DSX-PC6S	DSX Patch Cord Test Adapter Set for Cat 6 patch cords
DSX-PC6AS	DSX Patch Cord Test Adapter Set for Cat 6A patch cords
DSX-PC5E	Single Patch Cord Adapter for Testing Cat 5e MPTL
DSX-PC6	Single Patch Cord Adapter for Testing Cat 6 MPTL
DSX-PC6A	Single Patch Cord Adapter for Testing Cat 6A MPTL
Versiv-TSET	VERSIV Headphones
VERSIV-BATTERY	VERSIV Battery
VERSIV-ACUN	VERSIV Charger
VERSIV-STRP	VERSIV Hand Strap
VERSIV-STND	VERSIV Demo Stand

DSX-5000 Gold Support models

Model	Description
GLD-DSX-5000	1 year Gold Support, DSX2-5000 or DSX-5000
GLD3-DSX-5000	3 year Gold Support, DSX2-5000 or DSX-5000
GLD-DSX-5000QI	1 year Gold Support, DSX2-5000QI or DSX-5000QI
GLD3-DSX-5000QI	3 year Gold Support, DSX2-5000QI or DSX-5000QI
GLD-DSX-ADD-R	1 year Gold Support, DSX2-5000-ADD-R or DSX-ADD-R
GLD3-DSX-ADD-R	3 year Gold Support, DSX2-5000-ADD-R or DSX-ADD-R
GLD-DSX-CFP-Q-ADDR	1 year Gold Support, DSX2-CFP-Q-ADD/R or DSX-CFP-Q-ADD-R
GLD3-DSX-CFP-Q-ADD	3 year Gold Support, DSX2-CFP-Q-ADD/R or DSX-CFP-Q-ADD-R

For a complete list of models, options, accessories and specifications please visit www.flukenetworks.com/dsx.

About Fluke Networks

Fluke Networks is the worldwide leader in certification, troubleshooting, and installation tools for professionals who install and maintain critical network cabling infrastructure. From installing the most advanced data centers to restoring service in the worst weather, our combination of legendary reliability and unmatched performance ensure jobs are done efficiently. The company's flagship products include the innovative LinkWare™ Live, the world's leading cloud-connected cable certification solution with over fourteen million results uploaded to date.

1-800-283-5853 (US & Canada)

1-425-446-5500 (International)

<http://www.flukenetworks.com>

Descriptions, information, and viability of the information contained in this document are subject to change without notice.

Revised: March 29, 2021 6:26 PM

Literature ID: 4342554F

© Fluke Networks 2018

OptiFiber[®] Pro OTDR

Built for the enterprise

As enterprise networks and data center architectures evolve, IT infrastructure administrators demand better OTDR technology to maintain fiber network performance. OTDRs designed for Telco networks are no longer acceptable as they are purpose-built for users with extensive optical background and training. Network engineers, Storage Area Network (SAN) designers and cable installers require an easy-to-use and efficient OTDR to minimize network down time.

The OptiFiber Pro OTDR will:

- Accelerate fiber certification with trace times as short as two seconds in Quick Test mode
- Maximize efficiency with a smartphone user interface that allows anyone to perform expert fiber troubleshooting and certification
- Quickly test data center fiber with pre-programmed settings
- Troubleshoot data center fiber links with short patch cables and many connectors
- Easily characterize all connectors, splices and areas of high loss with graphical EventMap™ view
- Increase return on investment by enabling OTDR project sharing among users and different jobs
- Reduce network downtime by quickly and precisely identifying faults on all fiber types
- Facilitate results reporting and management with integrated LinkWare™ software to generate detailed and standards compliant

Designed for enterprise fiber

Many OTDRs (Optical Time Domain Reflectometers) used for fiber troubleshooting are designed for carriers and contain cumbersome and complicated features that enterprise users don't need. Few OTDRs are built with features and usability for enterprise network engineers, SAN designers and cable installers.

As enterprises consume more storage resources and adopt higher bandwidth (40G, 100G) data center architectures, the resilience of the cabling infrastructure becomes highly dependent upon maintenance tools to ensure fiber reliability. OptiFiber Pro is the industry's first purpose-built OTDR that meets the unique challenges of an enterprise fiber infrastructure. With its simple smartphone user interface and powerful feature set, the OptiFiber Pro turns anyone into an efficient and expert premise fiber troubleshooter or installer.



Benefits

- Increases the reliability and availability of data center and storage area networks
- Maximizes operator efficiency with task focused, simplified usability
- Enhances productivity with fast trace times, one-button set ups and integrated reporting
- Saves money by reducing expensive OTDR training and detailed trace analysis
- Eliminates the need to invest in a second OTDR to troubleshoot LAN and campus networks

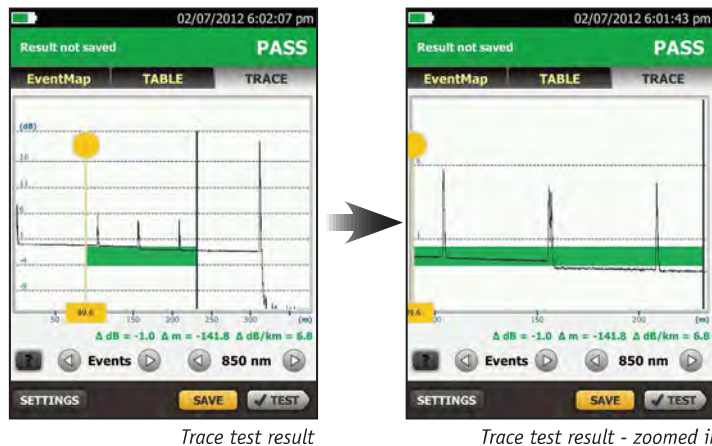


Smartphone user interface

Most OTDRs are designed for a myriad of applications, causing the user interface to be difficult to navigate and interpret. OptiFiber Pro combines the latest “gesture-based” interface technology with a capacitive touchscreen to deliver the most innovative and user-friendly OTDR.

Advantages:

- Single-touch tap and swipe control for selecting and scrolling menu items
- Multi-touch pinch to zoom for easy magnification control on a graphical fiber trace
- Task-focused design to reduce back and forth navigation through screens
- Capacitive touchscreen eliminates the need to recalibrate unlike legacy touchscreens
- Context sensitive on-screen help that gives users additional details or problem resolution suggestions



Trace test result

Trace test result - zoomed in

Optimized for the data center

Driven by server virtualization and multi-gigabit links between servers, networks and storage, the data center architecture employs more patch cords and dense topology connectors, rendering carrier-class OTDRs with long dead-zones ineffective. OptiFiber Pro not only makes fiber deployment in data centers possible, but provides the highest level of accuracy for quick problem resolution.

Advantages:

- Ultra-short event and attenuation dead-zones precisely locates events and faults on fiber links
- DataCenter OTDR™ mode automatically sets the configuration to quickly test data center fiber
- The EventMap feature depicts fiber events in a way that requires no trace analysis expertise

Unique certification with flexibility and efficiency

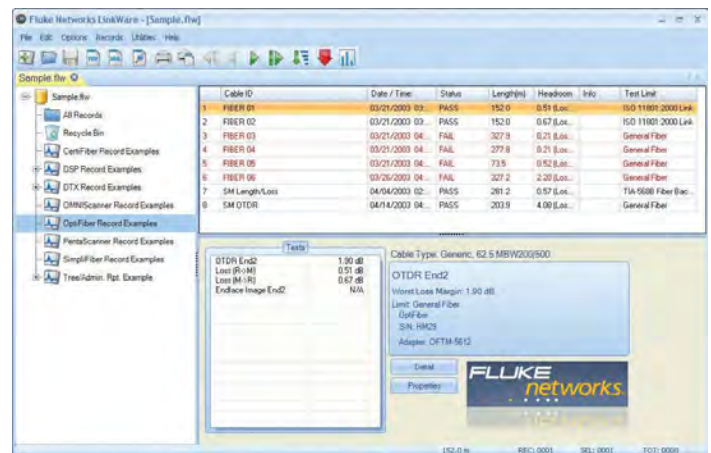
An important aspect in maximizing an OTDR’s value is to properly plan its day-to-day usage. With built-in project management, OptiFiber Pro allows a project manager to define each user’s role, settings and the associated tasks to be performed – transforming the OTDR into an all-in-one fiber testing tool complete with planning, inspection, certification and reporting.

Advantages:

- Full OTDR capability that certifies fiber performance based on industry standards or customer specifications
- Powerful project management facilitates OTDR sharing with clear job assignment for each operator
- Easy monitoring of job progress with pass/fail results
- Built-in Visual Fault Locator (VFL) to facilitate troubleshooting
- On-screen report generation and upload to LinkWare™ application

LinkWare™ management software

Leveraging the popular and multi-featured LinkWare cable test management software application, OptiFiber Pro users can easily access the hassle-free project management, report generation, and software upgrade capabilities to manage workflow and consolidate test results.



LinkWare management software

Key features

Extremely short event and attenuation dead zone

The OptiFiber Pro leverages the most sophisticated optical technology to provide the shortest event dead zone (0.5 m typical for MM) and attenuation dead zone (2.2 m typical for MM and 3.6 m typical for SM) of any OTDR. This technological advancement allows OptiFiber Pro to detect and measure closely spaced faults where no other OTDR can in today's connector-rich data center and storage area environments.

Two second trace per wavelength

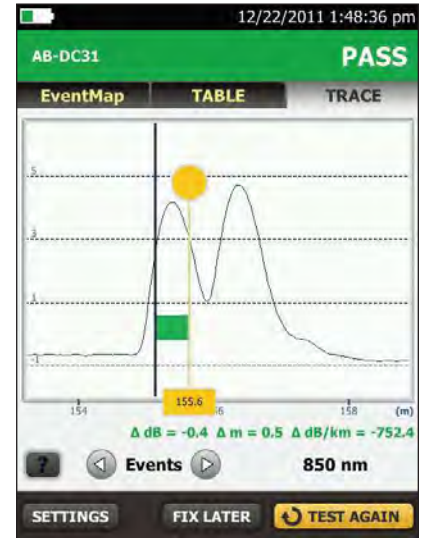
Another breakthrough with OptiFiber Pro is the data acquisition speed. While in Quick Test mode, a complete set of data is acquired in as little as two seconds per wavelength. OptiFiber Pro then analyzes the data and displays it as an EventMap event, Table or Trace. The end result is less time spent testing and more time performing other tasks.

DataCenter OTDR™ mode

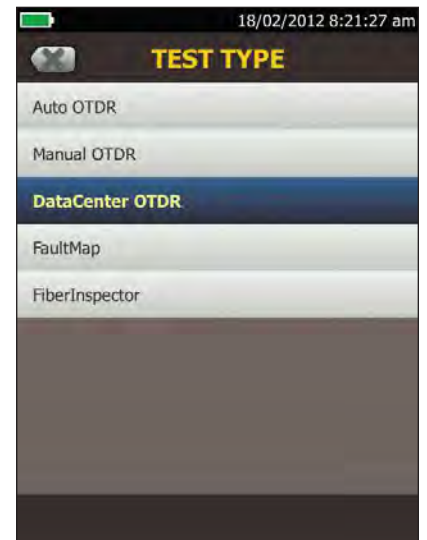
With a simple one-touch selection, users enter DataCenter OTDR mode – without setup time for fine tuning as needed in legacy OTDRs. DataCenter OTDR mode automatically detects OTDR parameters – end-detection algorithms, pulse widths, etc – without getting confused by the short links or number of connectors.

Graphical EventMap™ view

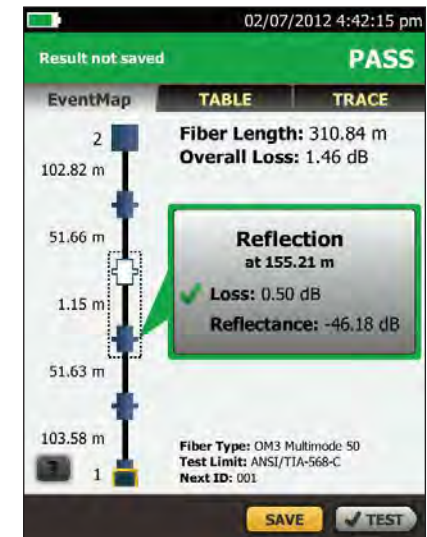
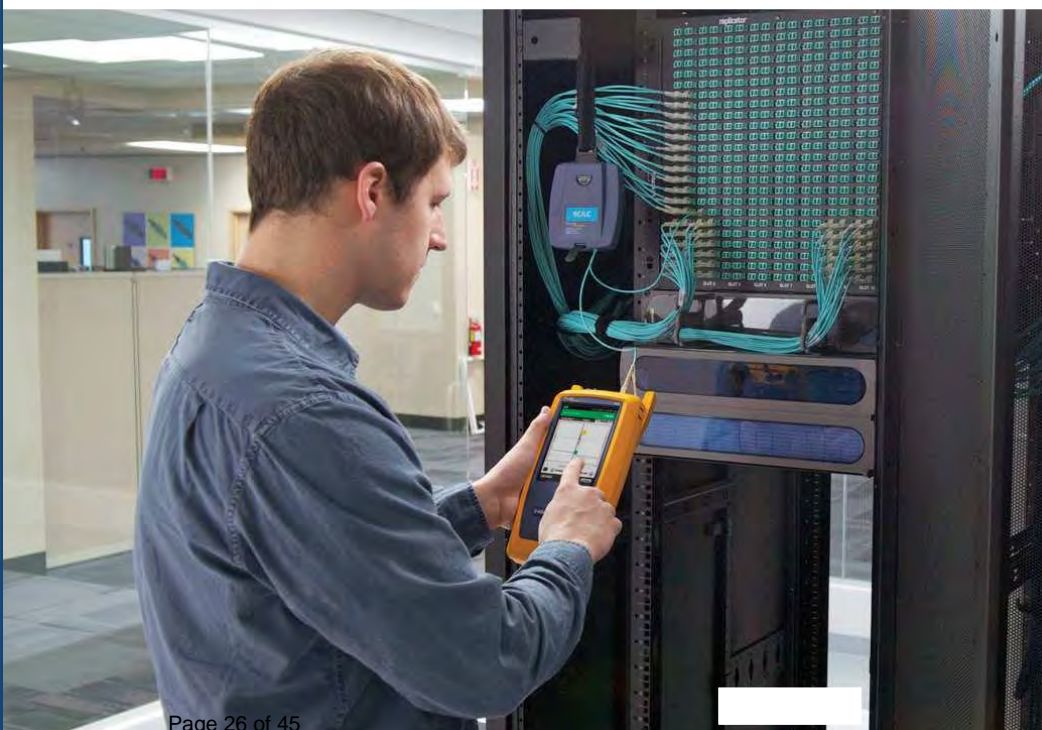
To eliminate the learning curve associated with reading an OTDR trace, OptiFiber Pro's advance logic automatically interprets the information to create a detailed and graphical map of events that includes connectors, splices and anomalies. To accommodate different preferences, users can easily switch between the EventMap, the Event Table and the Trace for test details. Any faulty events will be highlighted with RED icons to facilitate quick troubleshooting.



Extremely short event and attenuation dead zone



DataCenter OTDR mode



Graphical EventMap view

Key features (continued)

Dynamic project and user profile management

OptiFiber Pro enhances job efficiency by allowing the workflow planner to create and manage operator and job profiles per project – defined jobs or sets of cable IDs can be assigned to specific operators. The progress and status of each project can also be easily monitored.

On-screen help – corrective action

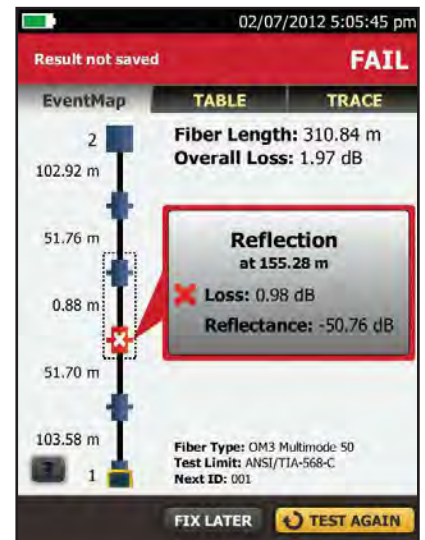
On-screen “help” suggests corrective action(s) for resolving fiber problems during each testing step. The “help” offered is context sensitive which allows users to quickly pinpoint possible resolutions. An easy-to-read, gray icon in the bottom, left-hand corner shows detailed corrective action recommendations.

FiberInspector™ probe

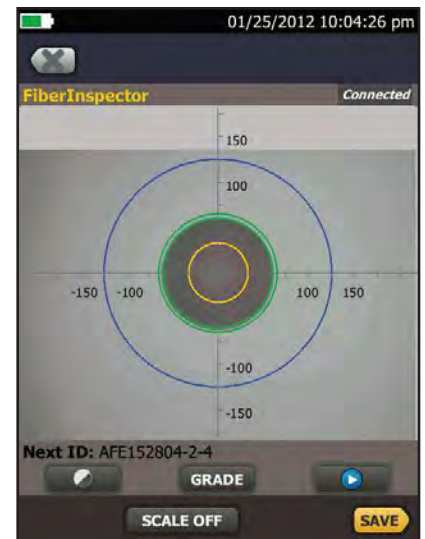
OptiFiber Pro’s video inspection system examines patch cords and patch panel bulkheads to avoid the number one cause of fiber link failure – contamination. Significant time is saved because the probe is inserted directly into the patch panel’s bulkhead to examine installed fiber terminations without disassembling the patch panel. Technicians assign a pass or fail grade to the fiber, append a comment and save it for use in certification reports.



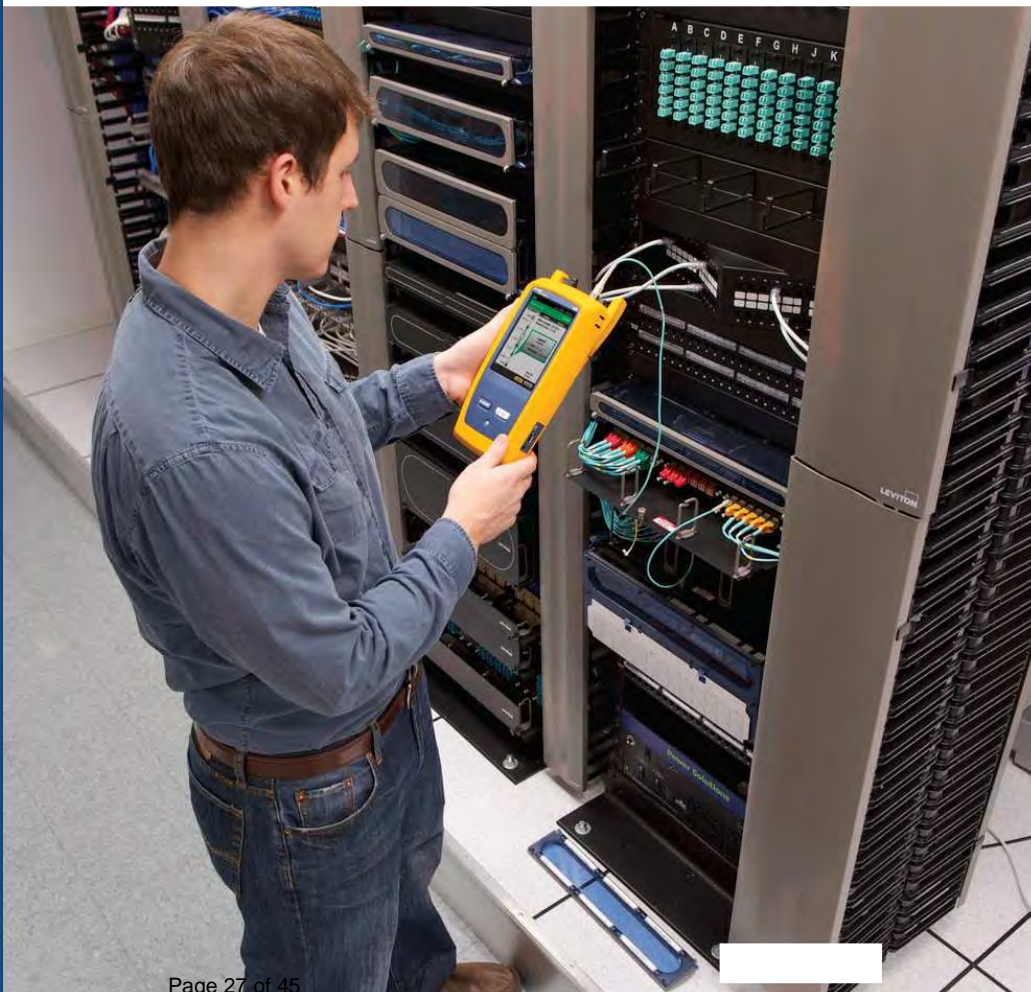
Dynamic project and user profile management



EventMap view with on-screen help



FiberInspector probe





Key OTDR specifications

	Multimode module	Singlemode module	Quad module
Wavelengths	850 nm +/- 10 nm 1300 nm +35/-15 nm	1310 nm +/- 25 nm 1550 nm +/- 30 nm	850 nm +/- 10 nm 1300 nm +35/-15 nm 1310 nm +/- 25 nm 1550 nm +/- 30 nm
Compatible fiber types	50/125 μm 62.5/125 μm	Singlemode	50/125 μm 62.5/125 μm Singlemode
Event dead zone ¹	850 nm: 0.5 m (typical) 1300 nm: 0.7 m (typical)	1310 nm: 0.6 m (typical) 1550 nm: 0.6 m (typical)	850 nm: 0.5 m (typical) 1300 nm: 0.7 m (typical) 1310 nm: 0.6 m (typical) 1550 nm: 0.6 m (typical)
Attenuation dead zone ²	850 nm: 2.2 m (typical) 1300 nm: 4.5 m (typical)	1310 nm: 3.6 m (typical) 1550 nm: 3.7 m (typical)	850 nm: 2.2 m (typical) 1300 nm: 4.5 m (typical) 1310 nm: 3.6 m (typical) 1550 nm: 3.7 m (typical)
Dynamic range ^{3, 5, 6}	850 nm: 28 dB (typical) 1300 nm: 30 dB (typical)	1310 nm: 32 dB (typical) 1550 nm: 30 dB (typical)	850 nm: 28 dB (typical) 1300 nm: 30 dB (typical) 1310 nm: 32 dB (typical) 1550 nm: 30 dB (typical)
Max distance range setting	40 km	130 km	MM: 40 km SM: 130 km
Distance measurement range ^{4, 5, 7, 8, 9, 10}	850 nm: 9 km 1300 nm: 35 km	1310 nm: 80 km 1550 nm: 130 km	850 nm: 9 km 1300 nm: 35 km 1310 nm: 80 km 1550 nm: 130 km
Reflectance range ^{4, 5}	850 nm: -14 dB to -57 dB (typical) 1300 nm: -14 dB to -62 dB (typical)	1310 nm: -14 dB to -65 dB (typical) 1550 nm: -14 dB to -65 dB (typical)	850 nm: -14 dB to -57 dB (typical) 1300 nm: -14 dB to -62 dB (typical) 1310 nm: -14 dB to -65 dB (typical) 1550 nm: -14 dB to -65 dB (typical)
Sample resolution	3 cm to 400 cm	3 cm to 400 cm	3 cm to 400 cm
Pulse widths (nominal)	850 nm: 3, 5, 20, 40, 200 ns 1300 nm: 3, 5, 20, 40, 200, 1000 ns	3, 10, 30, 100, 300, 1000, 3000, 10000, 20000 ns	850 nm: 3, 5, 20, 40, 200 ns 1300 nm: 3, 5, 20, 40, 200, 1000 ns 1310/1550 nm: 3, 10, 30, 100, 300, 1000, 3000, 10000, 20000 ns
Test time (per wavelength)	Auto setting: 5 sec (typical)	Auto setting: 10 sec (typical)	Auto setting: MM - 5 sec (typical) SM - 10 sec (typical)
	Quick test setting: 2 sec (typical)	Quick test setting: 5 sec (typical)	Quick test setting: MM - 2 sec (typical) SM - 5 sec (typical)
	Best resolution setting: 2 to 180 sec	Best resolution setting: 5 to 180 sec	Best resolution setting: MM - 2 to 180 sec SM - 5 to 180 sec
	FaultMap setting: 2 sec (typical), 180 sec (max)	FaultMap setting: 10 sec (typical), 180 sec (max)	FaultMap setting: MM - 2 sec (typical) MM - 180 sec (max) SM - 10 sec (typical) SM - 180 sec (max)
	DataCenter OTDR setting: 1 sec (typical at 850 nm), 7 sec (max)	DataCenter OTDR setting: 20 sec (typical), 40 sec (max)	DataCenter OTDR setting: MM - 1 sec (typical at 850 nm) MM - 7 sec (max) SM - 20 sec (typical) SM - 40 sec (max)
	Manual setting: 3, 5, 10, 20, 40, 60, 90, 120, 180 sec	Manual setting: 3, 5, 10, 20, 40, 60, 90, 120, 180 sec	Manual setting: MM - 3, 5, 10, 20, 40, 60, 90, 120, 180 sec SM - 3, 5, 10, 20, 40, 60, 90, 120, 180 sec

1. Measured at 1.5 dB below non-saturating reflection peak with the shortest pulse width. Reflection peak < -40 dB for multimode and < -50 dB for singlemode.
2. Measured at +/- 0.5 dB deviation from backscatter with the shortest pulse width. Reflection peak < -40 dB for multimode and < -50 dB for singlemode.
3. For typical backscatter coefficient for OM1 fiber: 850: -65 dB, 1300: -72 dB.
4. Typical backscatter and attenuation coefficients for OM2-OM4 fiber: 850 nm: -68 dB; 2.3 dB/km; 1300 nm: -76 dB; 0.6 dB/km.
5. Typical backscatter and attenuation coefficients for OS1-OS2 fiber: 1310nm : -79 dB; 0.32 dB/km; 1550 nm: -82 dB; 0.19 dB/km.
6. SNR=1 method, 3 minute averaging, widest pulse width.
7. 850 = 9 km typical to find the end or 7 km typical to find a 0.1 dB event (with a maximum of 18 dB attenuation prior to the event).
8. 1300 = 35 km typical to find the end or 30 km typical to find a 0.1 dB event (with a maximum of 18 dB attenuation prior to the event).
9. 1310 = 80 km typical to find the end or 60km typical to find a 0.1 dB event (with a maximum of 20 dB attenuation prior to the event).
10. 1550 = 130 km typical to find the end or 90 km typical to find a 0.1 dB event (with a maximum of 18 dB attenuation prior to the event).
11. Does not include index of refraction error and does not include automatic event location error.
12. dB variation per 1 dB step.
13. Applies along the trace backscatter within the distance range in which the OTDR can find a 0.1 dB event.



Additional key specifications

FiberInspector probe specification	
Magnification	~ 200X with OptiFiber Pro Display
Light source	Blue LED
Power source	TFS mainframe
Field of View (FOV)	Horizontal: 425 μm Vertical: 320 μm
Minimum detectable particle size	0.5 μm
Dimensions	Approximately 6.75 in x 1.5 in (1175 mm x 35 mm) without adapter tip
Weight	200 g
Temperature range	Operating: 32°F to 122°F (0 °C to +50 °C) Storage: -4°F to +158°F (20°C to +70°C)
Certifications	CE (when used with the mainframe)

VFL specifications	
On/Off control	Mechanical switch and a button on the touch screen
Output power	316 μW (-5 dBm) ≤ peak power ≤ 1.0 mW (0 dBm)
Operating wavelength	650 nm nominal
Spectral width (RMS)	±3 nm
Output modes	Continuous wave Pulsed mode (2 Hz to 3 Hz blink frequency)
Connector adapter	2.5 mm universal
Laser safety (classification)	Class II CDRH Complies to EN 60825-2

For complete kit configurations, please visit www.flukenetworks.com/orderopro

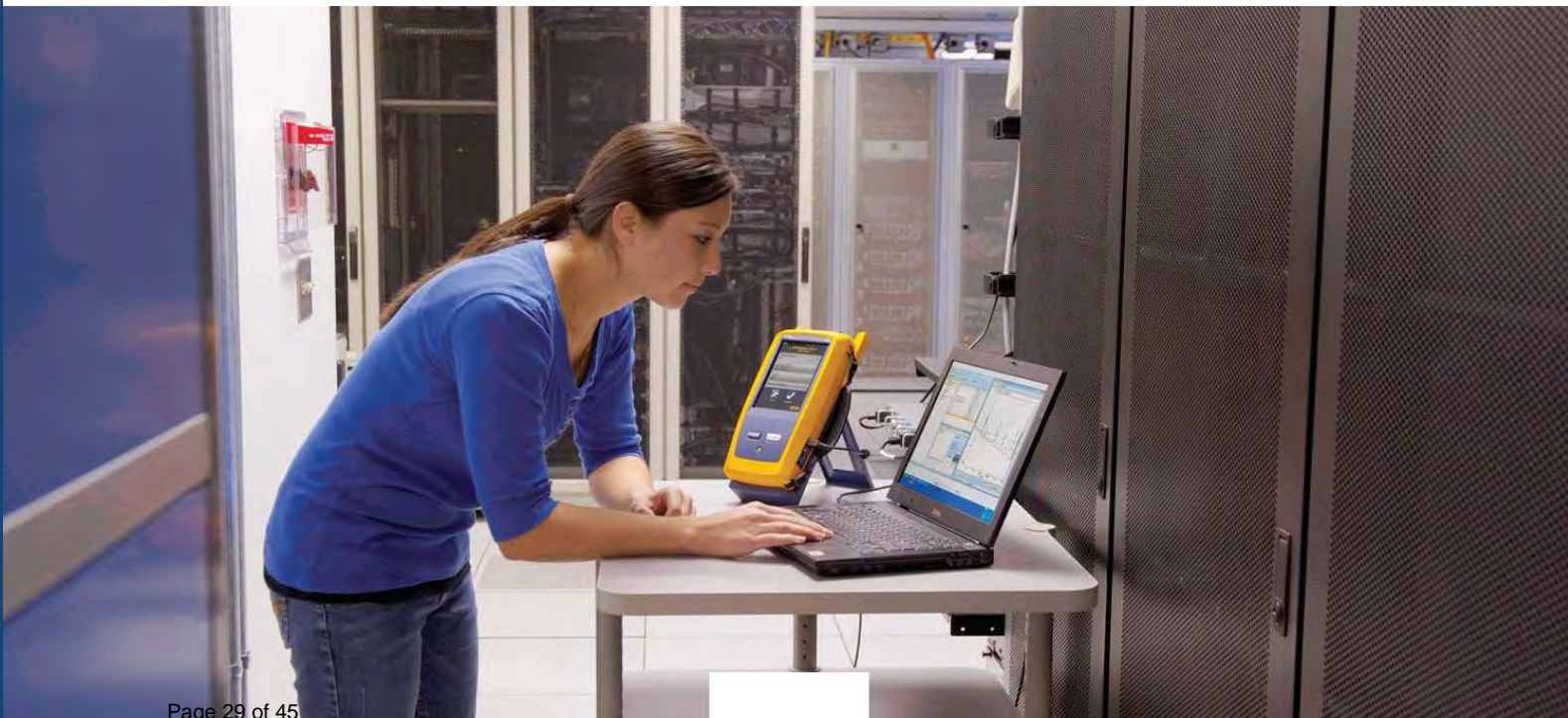
Technical specifications

General specifications	
Weight	Mainframe with module and battery: 3 lbs, 5 oz (1.28 kg)
Dimensions	Mainframe with module and battery: 2.625 in x 5.25 in x 11.0 in (6.67 cm x 13.33 cm x 27.94 cm)
Battery	Lithium ion battery pack, 7.2 volts
Battery life	Four hours to charge from 10% capacity to 90% capacity with tester off

Environmental specifications	
Operating temperature*	-18 C to 45 C
Non-operating temperature	-30 C to 60 C
Operating altitude	4,000 m (13,123 ft) 3,200 m (10,500 ft) with AC adapter
Storage altitude	12,000 m
EMC	EN 61326-1

* Using battery power. With AC power: 0 C to 45 C. Real Time Trace function used for no more than 5 minutes in a 15-minute period. Maximum ambient temperature is 35 C for continuous use of the Real Time Trace function.

* Do not keep battery at temperatures below -20°C (-4°F) or above 50°C (122°F) for periods longer than one week to maintain battery capacity.





OptiFiber Pro ordering information

Model	Description
OFF-100-M	OptiFiber Pro Multimode OTDR kit
OFF-100-MI	OptiFiber Pro Multimode OTDR with inspection kit
OFF-100-S	OptiFiber Pro Singlemode OTDR kit
OFF-100-SI	OptiFiber Pro Singlemode OTDR with inspection kit
OFF-100-Q	OptiFiber Pro Quad OTDR kit
OFF-100-QI	OptiFiber Pro Quad OTDR with inspection kit
OFF-MM	OptiFiber Pro Multimode OTDR module
OFF-SM	OptiFiber Pro Singlemode OTDR module
OFF-QUAD	OptiFiber Pro Quad OTDR module
OFF-FI	DI-1000 Inspector with selective bulkhead and video probe tip set FI1000-TIP-KIT
TFS	TFS mainframe with battery

Accessories	Description
MMC-50-SCSC	Multimode launch cable 50µm SC/SC
MMC-50-SCLC	Multimode launch cable 50µm SC/LC
MMC-50-SCST	Multimode launch cable 50µm SC/ST
MMC-50-SCFC	Multimode launch cable 50µm SC/FC
MMC-50-SCE2K	Multimode launch cable 50µm SC/E2K
MMC-62-SCSC	Multimode launch cable 62.5µm SC/SC
MMC-62-SCLC	Multimode launch cable 62.5µm SC/LC
MMC-62-SCST	Multimode launch cable 62.5µm SC/ST
MMC-62-SCFC	Multimode launch cable 62.5µm SC/FC
SMC-9-SCSC	Singlemode launch cable 9µm SC/SC
SMC-9-SCLC	Singlemode launch cable 9µm SC/LC
SMC-9-SCST	Singlemode launch cable 9µm SC/ST
SMC-9-SCFC	Singlemode launch cable 9µm SC/FC
SMC-9-SCE2KAPC	Singlemode launch cable 9µm SC/E2000 APC
PA-SC	OTDR source port interchangeable SC adapter
PA-LC	OTDR source port interchangeable LC adapter
PA-ST	OTDR source port interchangeable ST adapter
PA-FC	OTDR source port interchangeable FC adapter
TFS-BAT	TFS battery
TFS-CHGR	TFS AC adapter/charger, international
TFS-KIT-CASE	OFF soft case
TFS-HSTRAP	TFS hand strap
TFS-USB-CBL	USB interface cable standard A to micro B

FiberInspector probe models and accessories

Model	Description
FI1000	DI-1000 FiberInspector USB video probe for OptiFiber Pro
FI1000-SCFC-TIP	SC and FC bulkhead video probe tip
FI1000-TIP-KIT	LC, FC/SC Bulkhead, 1.25 and 2.5 mm universal tips in a box
FI1000-LC-TIP	LC bulkhead video probe tip
FI1000-ST-TIP	ST bulkhead video probe tip
FI1000-MU-TIP	MU bulkhead video probe tip
FI1000-E2KAPC-TIP	E2000/APC bulkhead video probe tip
FI1000-SCAPC-TIP	SC/APC bulkhead video probe tip
FI1000-E2K-TIP	E2000 bulkhead video probe tip
FI1000-LCAPC-TIP	LC/APC bulkhead video probe tip
FI1000-2.5-UTIP	2.5mm universal video probe tip for patch cords
FI1000-1.25-UTIP	1.25mm universal video probe tip for patch cords
FI1000-2.5APC-UTIP	2.5mm APC universal video probe tip for patch cords
FI1000-MPO-UTIP	MPO/MTP probe tip and translator knob for patch cords and bulkheads
FI1000-MPOAPC-UTIP	MPO/APC probe tip and translator knob for patch cords and bulkheads
FI1000-1.25APC-TIP	1.25mm APC universal video probe tip for patch cords



For a complete listing of OptiFiber Pro models and accessories, visit www.flukenetworks.com/OPRO

Fluke 1623-2 and 1625-2

GEO Earth Ground Testers

Technical Data

The new Fluke 1623-2 and 1625-2 GEO Earth Ground Testers offer data storage and download capabilities via USB port. World class accessories will simplify and speed up testing time.

Product features:

- 3- and 4-pole Fall of Potential, earth resistance loop testing
- 4-pole Soil Resistivity testing
- Selective earth ground rod testing using 1 clamp
- Stakeless earth ground rod testing using 2 clamps
- IP56 rated for outdoor use
- Professional carrying case
- USB data storage and transfer

In addition, the Fluke 1625-2 offers these advanced features:

- Automatic Frequency Control (AFC)—identifies existing interference and chooses a measurement frequency to minimize its effect, providing more accurate earth ground value
- R* measurement—calculates earth ground impedance at 55 Hz to more accurately reflect the earth ground resistance that a fault-to-earth ground would see
- Adjustable limits—for quicker testing

Stakeless testing

The Fluke 1623-2 and 1625-2 earth ground testers are able to measure earth ground loop resistances using only clamps. With this test method, two clamps are placed around the earth ground



rod and each are connected to the tester. No earth ground stakes are used at all. A known, fixed voltage is induced by one clamp and the current is measured using the second clamp. Then the tester automatically determines the resistance of the earth ground rod.

This test method only works if a bonded earth ground system exists for the building or structure under test, but most are. If there is only one path to ground, like at many residential applications, the Stakeless method will not provide an acceptable value and the Fall of Potential test method must be used.

With Stakeless testing, the earth ground rod does not need to be disconnected—leaving the bonded earth ground system intact during test. Gone are the days of spending time placing and connecting stakes for each earth ground rod on your system—a major time saver. You can also perform earth ground tests in places you've not considered before: inside buildings, power pylons, or anywhere you don't have access to soil.

The most complete testers

The Fluke 1623-2 and 1625-2 are distinctive earth ground testers that can perform all four types of earth ground measurement:

- 3- and 4-Pole Fall of Potential (using stakes)
- 4-Pole Soil Resistivity testing (using stakes)
- Selective testing (using 1 clamp and stakes)
- Stakeless testing (using 2 clamps only)

The testers are also easy to use. For each test, the testers inform you which stakes or clamps need to be connected and the large rotary switch can be used even with a gloved hand.

The complete model kit comes with the 1623-2 or 1625-2 tester, test leads, 4 earth ground stakes, 3 cable reels with wire, 2 clamps, batteries, and manual—all inside a professional Fluke carrying case.

1623-2 Specifications

General

Display: 1999 digit LCD	Display with special symbols, digit height 25 mm
User interface	Instant measurement through TURN and START one button concept. The only operating elements are rotary switch and START button
Robust, water and dust resistant	Instrument is designed for tough environmental conditions (rubber protective cover, IP56)
Memory	Internal memory storage up to 1500 records accessible via USB port

Temperature ranges

Operating temperature	-10 °C to 50 °C (14 °F to 122 °F)
Storage temperature	-30 °C to +60 °C (-22 °F to +140 °F)

Temperature coefficient	± 0.1 % of reading/°C <18 °C >28 °C
Intrinsic error	Refers to the reference temperature range and is guaranteed for 1 year
Operating error	Refers to the operating temperature range and is guaranteed for 1 year
Climatic class	C1 (IEC 654-1), -5 °C to +45 °C (23° to +115° F), 5 % to 95 % RH
Protective type	IP56 for case, IP40 for battery door according to EN60529
Safety	Protection by double and/or reinforced insulation. max. 50 V to earth. IEC61010-1: CAT none, Pollution degree 2
EMC (Emission Immunity)	IEC61326-1: Portable
Quality system	Developed, designed and manufactured according to DIN ISO 9001
External voltage	V ext, max = 24 V (dc, ac < 400 Hz), measurement inhibited for higher values
V ext rejection	> 120 dB (16 ² /3, 50, 60, 400 Hz)
Measuring time	Typical 6 sec.
Max. overload	250 V rms (pertains to misuse)
Auxiliary power	6 x 1.5 V alkaline (type AA LR6)
Battery life span	Typical > 3,000 measurements
Dimensions (WxHxD)	250 mm x 133 mm x 187 mm (9.75 in x 5.25 in x 7.35 in)
Weight	1.1 kg (2.43 lb) including batteries 7.6 kg (16.8 lb) including accessories and batteries in carrying case

RA 3-pole ground resistance measurement (IEC 1557-5)

Switch position	Resolution	Measuring range	Accuracy	Operating error
R _A 3-pole	0.001 Ω to 10 Ω	0.020 Ω to 19.99 kΩ	± (2 % rdg + 3 d)	± (5 % rdg + 3 d)

For 2-pole measurements connect terminals H and S with the supplied connector cable.

Measuring principle: Current and voltage measurement

Measuring voltage	$V_m = 48 \text{ V ac}$
Short-circuit current	$> 50 \text{ mA}$
Measure frequency	128 Hz
Probe resistance (R_G)	Max 100 k Ω
Auxiliary earth electrode resistance (R_H)	Max. 100 k Ω
Additional error from R_H and R_S	$R_H[\text{k}\Omega] \cdot R_S[\text{k}\Omega] / R_A[\Omega] \cdot 0.2 \%$
Monitoring of R_S and R_H with error indicator	
Automatic range selection	
Measurement is not performed if the current through the current clamp is too low	

R_A 4-pole ground resistance measurement (IEC 1557-5)

Switch position	Resolution	Measuring range	Accuracy	Operating error
R_A 4-pole	0.001 Ω to 10 Ω	0.020 Ω to 19.99 k Ω	$\pm (2 \% \text{ rdg} + 3 \text{ d})$	$\pm (5 \% \text{ rdg} + 3 \text{ d})$

Measuring principle: Current/voltage measurement

Measuring voltage	$V_m = 48 \text{ V ac}$
Short-circuit current	$> 50 \text{ mA}$
Measuring frequency	128 Hz
Probe resistance ($R_S + R_{ES}$)	Max. 100 k Ω
Auxiliary earth electrode resistance (R_H)	Max. 100 k Ω
Additional error from R_H and R_S	$R_H[\text{k}\Omega] \cdot R_S[\text{k}\Omega] / R_A[\Omega] \cdot 0.2 \%$
Monitoring of R_S and R_H with error indicator	
Automatic range selection	

R_A 3-pole selective ground resistance measurement with current clamp ($R_A \text{ } \text{⌂}$)

Switch position	Resolution	Measuring range	Accuracy	Operating error
R_A 3-pole ⌂	0.001 Ω to 10 Ω	0.020 Ω to 19.99 k Ω	$\pm (7 \% \text{ rdg} + 3 \text{ d})$	$\pm (10 \% \text{ rdg} + 5 \text{ d})$

Measuring principle: Current/voltage measurement (with external current clamp)

Measuring voltage	$V_m = 48 \text{ V ac}$
Short-circuit current	$> 50 \text{ mA}$
Measuring frequency	128 Hz
Probe resistance (R_S)	Max. 100 k Ω
Auxiliary earth electrode resistance (R_H)	Max. 100 k Ω
Monitoring of R_S and R_H with error indicator	
Automatic range selection	
Measurement is not performed if the current through the current clamp is too low	

R_A 4-pole selective ground resistance measurement with current clamp ($R_A \text{ } \text{⌂}$)

Switch position	Resolution	Measuring range	Accuracy	Operating error
R_A 4-pole ⌂	0.001 Ω to 10 Ω	0.020 Ω to 19.99 k Ω	$\pm (7 \% \text{ rdg} + 3 \text{ d})$	$\pm (10 \% \text{ rdg} + 5 \text{ d})$

Measuring principle: Current/voltage measurement (with external current clamp)

Measuring voltage	$V_m = 48 \text{ V ac}$
Short-circuit current	$> 50 \text{ mA}$
Measuring frequency	128 Hz
Probe resistance (R_s)	Max. 100 k Ω
Auxiliary earth electrode resistance (R_H)	Max. 100 k Ω
Monitoring of R_s and R_H with error indicator	
Automatic range selection	
Measurement is not performed if the current through the current clamp is too low	

Stakeless ground loop measurement (Ⓢ)

Switch position	Resolution	Measuring range	Accuracy	Operating error
R_A 4-pole Ⓢ	0.001 Ω to 0.1 Ω	0.020 Ω to 199.9 Ω	$\pm (7 \% \text{ rdg} + 3 \text{ d})$	$\pm (10 \% \text{ rdg} + 5 \text{ d})$

Measuring principle: Stakeless measurement of resistance in closed loops using two current transformers

Measuring voltage	$V_m = 48 \text{ V ac (primary)}$
Measuring frequency	128 Hz
Noise current (I_{EXT})	Max. $I_{EXT} = 10 \text{ A (ac)}$ ($R_A < 20 \Omega$)
	Max. $I_{EXT} = 2 \text{ A (ac)}$ ($R_A > 20 \Omega$)

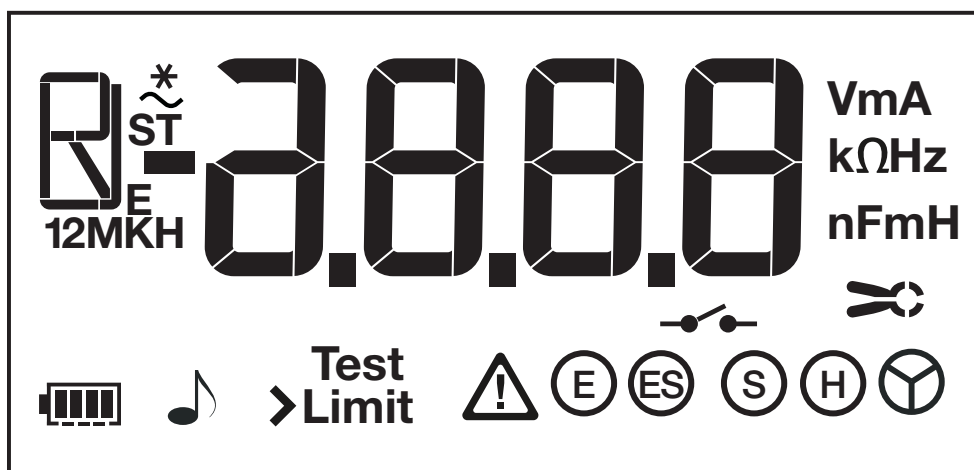
Automatic range selection

The information regarding stakeless ground loop measurements is only valid when used in conjunction with the recommended current clamps at the minimum distance specified.

1625-2 Specifications

General

Memory	Internal memory storage up to 1500 records accessible via USB port
Measuring function	Interference voltage and frequency, earthing resistance 3- and 4-pole with/without clip-on current transformer, resistance 2-pole with ac, 2- and 4-pole with dc
Display	4 digit (2999 Digit) - 7 segment liquid crystal display, with improved visibility
Operation	Central rotary switch and function keys



Temperature ranges

Operating temperature range	-10 °C to 50 °C (14° F to 122° F)
Storage temperature range	-30 °C to 60 °C (-22° F to 140° F)

Temperature coefficient	± 0.1 % of range/± 0.1 % of reading/°C <18 °C >28 °C
--------------------------------	--

Type of protection	IP56 for case, IP40 for battery door according to EN60529
Max voltage	<p>⚠ socket to socket </p> <p>$U_{ms} = 0 V$</p> <p>Sockets " " to each other in any combination, max. $U_{ms} = 250 V$ (pertains to misuse)</p>
Safety:	Protection by double and/or reinforced insulation. Max. 50 V to earth per IEC61010-1. CAT none, Pollution degree 2
EMC (Emission Immunity)	IEC61326-1: Portable
Quality standard	Developed, designed and manufactured to comply with DIN ISO 9001
External field influence	Complies with DIN 43780 (8/76)
Auxiliary power	6 x 1.5 V alkaline (IEC LR6 or type AA)
Battery life span	<p>With IEC LR6/type AA: typ. 3,000 measurements ($R_E + R_H \leq 1 k\Omega$)</p> <p>With IEC LR6/type AA : typ. 6,000 measurements ($R_E + R_H > 10 k\Omega$)</p>
Dimensions (WxHxD)	250 mm x 133 mm x 187 mm (9.75 in x 5.25 in x 7.35 in)
Weight	<p>≤ 1.1 kg (2.43 lb) without accessories</p> <p>7.6 kg (16.8 lb) including accessories and batteries in carrying case</p>
Case material	Polyester

Measurement of interference voltage dc + ac (U_{ST})

Measuring Limits of error: method		Fullwave rectification		
Measuring Range	Display Range	Resolution	Frequency Range	Limits of Error
1 V to 50 V	0.0 V to 50 V	0.1 V	dc/ac 45 Hz to 400 Hz sine	± (5 % of rdg + 5 digit)
Measuring sequence	approx. 4 measurements/s			
Internal resistance	approx. 1.5 MΩ			
Max. overload	$U_{rms} = 250 V$			

Measurement of interference frequency (F)

Measuring method	Measurement of oscillation period of the interference voltage			
Measuring Range	Display Range	Resolution	Range	Accuracy
6.0 Hz to 400 Hz	16.0 Hz to 299.9 Hz to 999 Hz	0.1 Hz to 1 Hz	1 V to 50 V	± (1 % of rdg + 2 digit)

Earthing resistance (R_E)

Measuring method	Current and voltage measurement with probe as IEC61557-5
Open circuit voltage	20/48 V, ac
Short circuit current	250 mA ac
Measuring frequency	94, 105, 111, 128 Hz selected manually or automatic. (AFC) 55 Hz in function R*
Noise rejection	120 dB ($16^2/3$, 50, 60, 400 Hz)
Max. overload	$U_{rms} = 250 V$

Electrical measurement specifications

Intrinsic error or influence quantity	Reference conditions or specified operating range	Designation code	Requirements or test in accordance with the relevant parts of IEC 1557	Type of test
Intrinsic error	Reference conditions	A	Part 5, 6.1	R
Position	Reference position ± 90°	E1	Part 1, 4.2	R
Supply voltage	At the limits stated by the manufacturer	E2	Part 1, 4.2, 4.3	R
Temperature	0 °C and 35 °C	E3	Part 1, 4.2	T
Series interference voltage	See 4.2 and 4.3	E4	Part 5, 4.2, 4.3	T
Resistance of the probes and auxiliary earth electrodes	0 to 100 x R_A but ≤ 50 kΩ	E5	Part 5, 4.3	T
System frequency	99 % to 101 % of the nominal frequency	E7	Part 5, 4.3	T
System voltage	85 % to 110 % of the nominal voltage	E8	Part 5, 4.3	T
Operating error	$B = \pm(A + 1,15\sqrt{E_1^2 E_2^2 E_3^2 E_4^2 E_5^2 E_6^2 E_7^2 E_8^2})$		Part 5, 4.3	R
A = intrinsic error En = variations R = routine test T = type test		$B[\%] = \pm \frac{B}{\text{fiducial value}} \times 100 \%$		

Measuring Range	Display Range	Resolution	Accuracy	Operating Error
0.020 Ω to 300 kΩ	0.001 Ω to 2.999 Ω	0.001 Ω	± (2 % of rdg + 2 digit)	± (5 % of rdg + 5 digit)
	3.00 Ω to 29.99 Ω	0.01 Ω		
	30.0 Ω to 299.9 Ω	0.1 Ω		
	0.300 kΩ to 2.999 kΩ	1 Ω		
	3.00 kΩ to 29.99 kΩ	10 Ω		
	30.0 kΩ to 299.9 kΩ	100 Ω		

Measuring time	typ. 8 sec. with a fixed frequency 30 sec. max. with AFC and complete cycle of all measuring frequencies
Additional error because of probe-and auxiliary earth electrode resistance	$\frac{R_H (R_S + 2000 \Omega)}{R_E} \times 1.25 \times 10^{-6} \% + 5 \text{ digits}$
Measuring error of RH and RS	typ. 10 % of $R_E + R_S + R_H$
Max. probe resistance	≤ 1 MΩ
Max. auxiliary earth electrode resistance	≤ 1 MΩ

Automatic check if error is kept within the limits required by IEC61557-5.

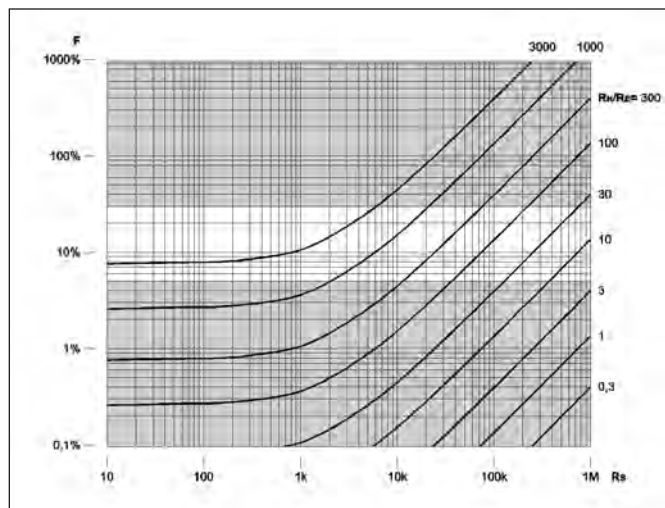
If after a measurement of probe-, auxiliary earth electrode- and earthing resistance, a measurement error of higher than 30 % is assumed because of the influencing conditions (see diagram), the display shows a warning symbol Δ and a notice that R_S or R_H are too high.

Automatic switchover of measuring resolution in dependence to auxiliary earth electrode resistance R_H

RH with $U_{meas} = 48 \text{ V}$	RH with $U_{meas} = 20 \text{ V}$	Resolution
< 300 Ω	< 250 Ω	1 mΩ
< 6 kΩ	< 2.5 kΩ	10 mΩ
< 60 kΩ	< 25 kΩ	100 mΩ
< 600 kΩ	< 250 kΩ	1 Ω

Selective measurement of the earthing resistance ($R_x \gg C$)

Measuring method	Current and voltage measurement with probe as per EN61557-5 and current measurement in the individual branch with additional current transformer (patent applied for).
Open circuit voltage	20/48 V ac
Short circuit current	250 mA ac
Measuring frequency	94, 105, 111, 128 Hz selected manually or automatically (AFC), 55 Hz (R^*)
Noise rejection	120 dB ($16^{2/3}$, 50, 60, 400 Hz)
Max. overload	Max. $U_{rms} = 250 \text{ V}$ (measurement will not be started)



Measuring Range	Display range	Resolution	Intrinsic error*	Operating error*
0.020 Ω to 30 kΩ	0.001 to 2.999 Ω	0.001 Ω	± (7 % of rdg + 2 digit)	± (10 % of rdg + 5 digit)
	3.00 to 29.99 Ω	0.01 Ω		
	30.0 to 299.9 Ω	0.1 Ω		
	0.300 to 2.999 kΩ	1 Ω		
	3.00 to 29.99 kΩ	10 Ω		

* With recommended current clamps/transformers.

Additional error because of probe- and auxiliary earth typ. electrode resistance	$\frac{R_H (R_S + 2000 \Omega)}{R_{TOTAL}} \times 1.25 \times 10^{-6} \% + 5 \text{ digits}$	
Measuring error of R_H and R_S	Typ. of 10 % of $R_{TOTAL} + R_S + R_H$	
Measuring time	Typ. 8 sec. with a fixed frequency 30 sec. max. with AFC and complete cycle of all measuring frequencies	
Minimal current in single branch to be measured	0.5 mA	With transformer (1000:1)
	0.1 mA	With transformer (200:1)
Max. interference current through transformer	3 A	With a transformer (1000:1)

Resistance measurement (R~)

Measuring method	Current and voltage measurement
Measuring voltage	20 V ac, square pulse
Short circuit current	> 250 mA ac
Measuring frequency	94, 105, 111, 128 Hz selected manually or automatically (AFC)

Measuring range	Display range	Resolution	Accuracy	Operating errors
0.020 Ω to 300 kΩ	0.001 Ω to 2.999 Ω	0.001 Ω	± (2 % of rdg + 2 digit)	± (5 % of rdg + 5 digit)
	3.0 Ω to 29.99 Ω	0.01 Ω		
	30 Ω to 299.9 Ω	0.1 Ω		
	300 Ω to 2999 Ω	1 Ω		
	3.0 kΩ to 29.99 kΩ	10 Ω		
	30.0 kΩ to 299.9 kΩ	100 Ω		

Measuring time	typ. 6 sec.
Max. interference voltage	24 V, with higher voltages measurement will not be started
Max overload	U_{rms} max. = 250 V

Resistance measurement (R---)

Measuring method	current- voltage measurement as per IEC61557-4 possible
Open circuit voltage	20 V dc
Short circuit current	200 mA dc
Formation of measured value	with 4-pole measurement wires on H, S, ES can be extended without additional error. Resistances > 1 Ω in wire E can cause additional error of 5m Ω/Ω.

Measuring range	Display range	Resolution	Accuracy	Operating error
0.020 Ω to 3 kΩ	0.001 Ω to 2.999 Ω	0.001 Ω	± (2 % of rdg + 2 digit)	± (5 % of rdg + 5 digit)
	3.0 Ω to 29.99 Ω	0.01 Ω		
	30.0 Ω to 299.9 Ω	0.1 Ω		
	300 Ω to 2999 Ω	1 Ω		

Measuring sequence	Approx. 2 measurements/s
Measuring time	Typ. 4 sec. incl. reversal of polarity (2-pole or 4-pole)
Max. interference voltage	≤ 3 V ac or dc, with higher voltages measurement will not be started
Max inductivity	2 Henry
Max. overload	$U_{rms} = 250 V$

Compensation of lead resistance (R_k)

Compensation of lead resistance (R_k) can be switched on in functions R_E 3-pole, R_E 4-pole ➤C , R_{\sim} , and R_{\equiv} 2-pole	
Formation of measured value	$R_{display} = R_{measured} - R_{compensated}^*$

* Value of setpoint entry $R_k = 0.000 \Omega$, variable from 0.000 to 29.99 Ω by means of measuring adjustment.

Stakeless ground loop measurement (Ⓢ)

Switch position	Resolution	Measuring range	Accuracy	Operating error
R_A 4-pole	0.001 Ω to 0.1 Ω	0.02 Ω to 199.9 Ω	$\pm (7 \% \text{ rdg} + 3 \text{ d})$	$\pm (10 \% \text{ rdg} + 5 \text{ d})$

Measuring principle: Stakeless measurement of resistance in closed loops using two current transformers

Measuring voltage	$V_m = 48 \text{ V ac (primary)}$
Measuring frequency	128 Hz
Noise current (I_{EXT})	Max. $I_{EXT} = 10 \text{ A (ac)}$ ($R_A < 20 \Omega$)
	Max. $I_{EXT} = 2 \text{ A (ac)}$ ($R_A > 20 \Omega$)

Automatic range selection

The information regarding stakeless ground loop measurements is only valid when used in conjunction with the recommended current clamps at the minimum distance specified.

Selection guide by user

	Field Service Technician	Industrial Maintenance Technician	Power Utilities and Telecom
Fluke 1623-2	•	•	
Fluke 1625-2		•	•

Standard earth ground test methods

	Fall of Potential		Selective	Stakeless
	3-pole	4-pole/soil	1 clamp	2 clamps
Fluke 1623-2	•	•	•	•
Fluke 1625-2	•	•	•	•

Ordering information

Fluke-1623-2 Kit Basic GEO Earth Ground Tester Kit
 Fluke-1623-2 Basic GEO Earth Ground Tester
 EI-1623 Selective/Stakeless Clamp Set for 1623
 Fluke-1625-2 Kit Advanced GEO Earth Ground Tester Kit
 Fluke-1625-2 Advanced GEO Earth Ground Tester
 EI-1625 Selective/Stakeless Clamp Set for 1625

Optional accessories

ES-162P3-2 Stake Set for 3-Pole Measurement
 ES-162P4-2 Stake Set for 4-Pole Measurement
 EARTH STAKE Ground/Earth Stake
 CABLE REEL 25M BL Ground/Earth Cable Reel 25 m (81.25 ft)
 CABLE REEL 25M GR Ground/Earth Cable Reel 25 m (81.25 ft)
 CABLE REEL 50M RD Ground/Earth Cable Reel 50 m (162.5 ft)
 EI-162BN 320 mm (12.6 in) Split Core Transformer
 EI-162X Clip-on Current Transformer (Sensing) with Shielded Cable Set
 EI-162AC Clip-on Current Transformer (Inducing)



Fluke. Keeping your world up and running.®

Fluke Corporation
 PO Box 9090, Everett, WA 98206 U.S.A.

Fluke Europe B.V.
 PO Box 1186, 5602 BD Eindhoven, The Netherlands

For more information call:
 In the U.S.A. (800) 443-5853 or Fax (425) 446-5116
 In Europe/M-East/Africa +31 (0)40 267 5100 or Fax +31 (0)40 267 5222
 In Canada (800)-36-FLUKE or Fax (905) 890-6866
 From other countries +1 (425) 446-5500 or Fax +1 (425) 446-5116
 Web access: <http://www.fluke.com>

©2013, 2017 Fluke Corporation.
 Specifications subject to change without notice.
 Printed in U.S.A. 3/2017 2634980d-en

Modification of this document is not permitted without written permission from Fluke Corporation.

Appendix B

Certificates of Calibration

SAMPLE



Certificate of Calibration

ISO 9001:2015 (10100/2)

Everett Service Center

Certificate Number: EVL732642

Data Type: Found-Left
Result Summary: In Tolerance

Calibration Date: 16-Aug-2021

Calibration Due: 16-Aug-2022

Manufacturer: Fluke Networks

Certificate Date: 16-Aug-2021

Model: DSX-8000

Temperature: 23.9 °C

Serial Number: 1731041

Humidity: 45.7 %

Description: Cable Analyzer

Procedure: TFS TEST

Revision: 20190227

Customer: DECKER ELECTRIC

City: WICHITA

Country: US

State: KS

Purchase Order: GOLD 56210015

RMA: 32256520

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), radiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Revision 124 and/or Fluke 17025 Quality Manual QSD 111.41 Revision 007.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.



Calibrated **FLUKE**

Cert # : EVL732642
 Cal Date: 16-Aug-2021
 Due Date: 16-Aug-2022
 S/N : 1731041
 www.fluke.com

Thien, Bao Trinh
THIEN TRINH
Issued By



Certificate of Calibration

Everett Service Center

ISO 9001:2015 (10100/2)

Certificate Number: EVL732643

Data Type: Found-Left

Result Summary: In Tolerance

Manufacturer: Fluke Networks

Model: DSX-8000

Serial Number: 1731064

Description: Cable Analyzer

Calibration Date: 16-Aug-2021

Calibration Due: 16-Aug-2022

Certificate Date: 16-Aug-2021

Temperature: 23.9 °C

Humidity: 45.7 %

Procedure: TFS TEST

Revision: 20190227

Customer: DECKER ELECTRIC

City: WICHITA

Country: US

State: KS

Purchase Order: GOLD 56210015

RMA: 32256520

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), radiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Revision 124 and/or Fluke 17025 Quality Manual QSD 111.41 Revision 007.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.



Calibrated **FLUKE**

Cert #: EVL732643
 Cal Date: 16-Aug-2021
 Due Date: 16-Aug-2022
 S/N: 1731064
www.fluke.com

Thien, Bao Trinh
 THIEN TRINH
 Issued By



Certificate of Calibration

ISO 9001:2015 (10100/2)

Everett Service Center

Certificate Number:	EVL695765	Calibration Date:	13-Mar-2021
Data Type:	As-Left	Calibration Due:	13-Mar-2022
Result Summary:	In Tolerance	Certificate Date:	13-Mar-2021
Manufacturer:	Fluke Networks	Temperature:	22.6 °C
Model:	OFP-QUAD	Humidity:	24.0 %
Serial Number:	2897509		
Description:	OptiFiber Pro Quad OTDR Module		

Procedure:	OptiFiber Pro QUAD OTDR Test	Revision:	1.2.1.0
Customer:	DECKER ELECTRIC	Country:	US
City:	WICHITA		
State:	KS		
Purchase Order:	GOLD 56210015	RMA:	32151165

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), radiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Revision 124 and/or Fluke 17025 Quality Manual QSD 111.41 Revision 007.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.



<p>Calibrated</p> <p>FLUKE</p> <p>Cert # : EVL695765 Cal Date: 13-Mar-2021 Due Date: 13-Mar-2022 S/N : 2897509 www.fluke.com</p>	<p>Cert # : EVL695765 Date: 13-Mar-2021 Due: 13-Mar-2022 www.fluke.com</p>
---	--

Ed Mills
 ED MILLS
 Issued By

Certificate of Calibration

Everett Service Center

Certificate Number: EVL742110			
Data Type: Found-Left		Calibration Date: 28-Sep-2021	
Result Summary: In Tolerance		Calibration Due: 28-Sep-2022	
Manufacturer: Fluke		Certificate Date: 28-Sep-2021	
Model: 1623-2		Temperature: 23.8 °C	
Serial Number: ST203611473B2		Humidity: 35.3 %	
Description: EARTH /GROUND TESTER GEO			

Procedure: Fluke 1623-2: (1 year) ZCAL VER /5320+VLC		Revision: 1.0
Customer: TENAX TECHNOLOGIES		
City: WICHITA		Country: US
State: KS		
Purchase Order: CCS CHARLES HOFFMAN		RMA: 32284616

This calibration is traceable to the International System of Units (SI), through National Metrology Institutes (NIST, PTB, NRC, NPL, etc.), radiometric techniques, or natural physical constants. This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. Calibration certificates without signature are not valid. The calibration has been completed in accordance with Fluke Electronics Corporation Quality System Document 111.0 Revision 124 and/or Fluke 17025 Quality Manual QSD 111.41 Revision 007.

The Data Type found in this certificate must be interpreted as:

- As - Found Calibration data collected before the unit is adjusted and / or repaired.
- As - Left Calibration data collected after the unit has been adjusted and / or repaired.
- Found-Left Calibration data collected without any adjustment and / or repair performed.

This calibration conforms to the requirements of ANSI/NCSL Z540-1-1994 (R2002).

In the attached measurement results, deviation may be expressed with units, Measured Value (MV) - Nominal Value (NV) or as a proportion of the nominal value ((MV-NV)/NV), expressed without units with a scalar multiplier such as % (0.01), or as a ratio of the units (mA/A, μ V/V, etc.) Descriptions such as μ A/A, μ V/V, and others, where used to annotate results or column headings are the preferred replacements for what was historically labeled as "ppm" or parts-per-million and described the results in that column, unless otherwise noted by units symbols.

Where applicable, the expanded uncertainty of measurement at the time of test is given in the following pages. They are calculated in accordance with the method described in the ISO Guide to the Expression of Uncertainty in Measurement (GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, such that the confidence level approximates 95%.

Where applicable, the Test Uncertainty Ratio (TUR) is provided in the following pages. Unless otherwise stated, the TUR for a given measurement result is 4:1 or greater.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications.

Measurement results greater than limits of error are indicated by '!'.



Z540-1:1994

Cert # :	EVL742110	www.fluke.com
Cal Date:	28-Sep-2021	
Due Date:	28-Sep-2022	
S/N :	ST203611473B2	
www.fluke.com		

ROBERT LEVER
 Issued By