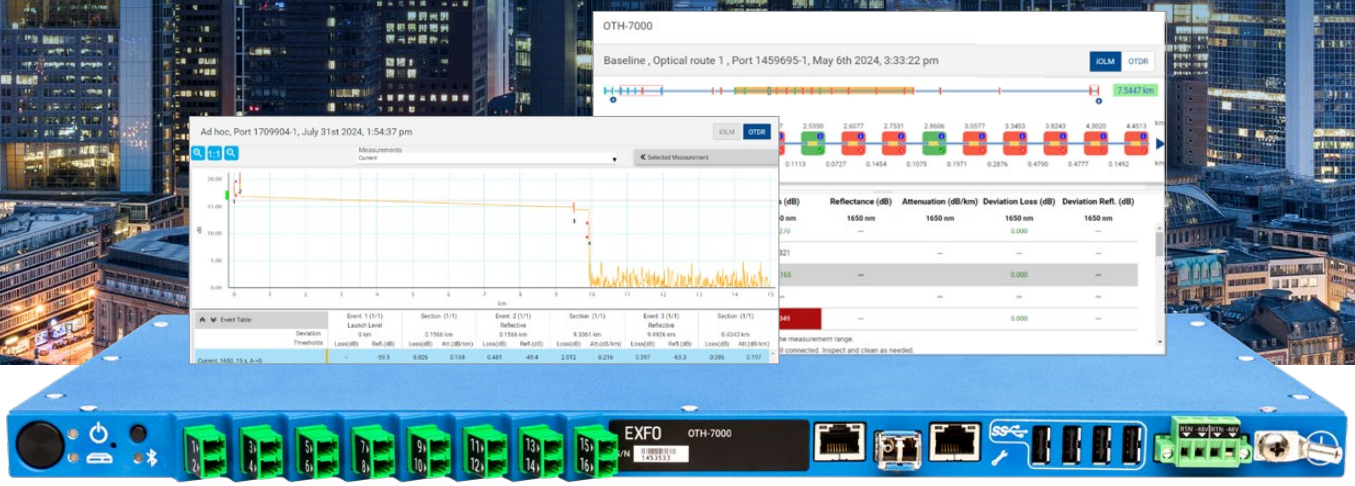
EXFO Remote Fiber Testing and Monitoring (RFTM)

SOLUTION OVERVIEW

SERVERLESS REMOTE OTDRS



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Smarter network in sight™

EXFO

EXFO develops smarter test, monitoring and analytics solutions for the global communications industry.

We are trusted advisers to fixed and mobile network operators, hyperscalers and leaders in the manufacturing, development, and research sector. Our customers count on us to deliver superior visibility and insights into network performance, service reliability and user experience. Building on decades of innovation, EXFO's unique blend of equipment, software and services enable faster, more confident transformations related to 5G, cloud-native and fiber-optic networks.

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1 EXFO REMOTE FIBER TESTING AND MONITORING (RFTM)

The EXFO RFTM solution provides end-to-end link testing, diagnostic and proactive monitoring for any type of fiber network. Its industry-acclaimed OTDR-based technology and automation empowers users to easily and efficiently trigger remote tests.

At the core of this solution is an OTDR engine, which directly influences the accuracy and speed of results. High-quality, reliable results are essential for any system; otherwise, it's simply 'rubbish in, rubbish out.' EXFO is a world leader in OTDR technology, supplying more OTDR technology than all our competitors combined. Over many years, we have tested nearly all major fiber networks worldwide, using that plethora of data to continuously refining our engine, technology, and algorithms.

Whether you operate a small network (e.g., municipality, private network, small MSO, etc.) or a countrywide network, EXFO can help you choose the right type of OTDR-based centralized testing and monitoring to meet your return-on-investment targets.

Looking for the highest performance and density together with the fastest testing? The **RTU-2** powerhouse is designed for you. Prefer an OTDR white box instead? The new **OTH-7000** is exactly that—it gives hyperscalers, NEMs and system integrators great value for the price without any compromise on the OTDR unit's ability to detect and monitor the optical infrastructure's weaknesses and degradations before they become critical and require urgent restoration. All this in a dense, compact form factor down to ½ RU with power consumption as low as 10 W.

EXFO's solutions for remote fiber testing and monitoring deliver key functions and innovative capabilities that are unmatched:

- Automation of OTDR measurements using patented Link-Aware™ (iOLM) technology providing detailed end-to-end (E2E) fiber characterization without requiring effort nor OTDR expertise
- Capability to read and use fiber/cable documentation data, managed externally into alarm workflows
- Fully web-based application, including a GIS function for fault-on-map capability
- Denser solution (up to 1024 ports in 3U) for large FTTH central offices using MPO-type connectors on optical switches
- First and only RFTS solution with phone-home and event-based communication architecture enabling scalability, higher IT security and cloud operability

EXFO can also complement your remote fiber testing solution and boost technician efficiency in the field thanks to a large portfolio of intelligent and connected handheld test instruments.

2 FLEXIBLE DEPLOYMENT TO FIT YOUR IT REQUIREMENTS

From serverless use cases to FMS centralized management, EXFO's RFTM offers flexible solutions for the deployment and operation of our portfolio of remote OTDRS. This document covers serverless scenarios. For more information on FMS centralized management, consult the RFTM technical brochure.

	TEST AGENT 2.0	CONNECTED TEST AGENT (API)	FMS-IN-A-BOX	FMS-AS-A-SERVICE	CUSTOMER MANAGED FMS HOSTING
Highlights	Test head UI accessible locally or remotely (no FMS)	Test heads configured as client API hardware (no FMS)	FMS deployed on pre-installed dedicated server	FMS deployment in the EXFO managed cloud	FMS deployed on-premises or in a customer-managed cloud
Applications supported	P2P ad-hoc test and deviation analysis	P2P ad-hoc test and deviation analysis	P2P test & monitoring	P2P test & monitoring: PON build, connect & assure	P2P test & monitoring: PON build, connect & assure
Key selection driver	Need OTDR capability for reactive maintenance (no monitoring/prevention) No connectivity on RTU site (can operate as a closed system) Low complexity	Need OTDR capability for direct integration with customer OSS (API) Complete end-to-end control Scalability	No connectivity on RTU site (can operate as a closed system) Complete end-to-end control with no IT maintenance Autonomous operation Simpler deployment than on-prem	No IT skills required Free up internal IT resources Faster deployment Scalability FMS integration with existing OSS	Complete end-to-end control Scalability FMS integration with existing OSS Can work in air-gapped environments
IT install skills required	Low (IP address config)	Low (IP address config)	Mid (Linux CLI)	Low	High
Test-acquisition mode	OTDR + iOLM	OTDR + iOLM	iOLM (+ ad hoc OTDR)	iOLM (+ ad hoc OTDR)	iOLM (+ ad hoc OTDR)
Mobile app support	NO	NO	NO	YES	YES
Local switch support	YES	YES	YES	YES	YES
Remote switch support	NO	NO	NO	YES	YES
Multiple test units centralized management	NO (access 1 at a time)	YES – Customer responsibility from their centralized solution	NO (1 per server)	YES (up to 1,000 in FMS)	YES (up to 1,000 in FMS)
Software – commercial model	No software fee	No software fee. API starter pack (for integration)	Perpetual license included	Annual subscription	Perpetual license

3 SERVERLESS APPLICATION: WEBUI WITH LOCAL OTDR TESTS AND SUPPORTED APIS FOR THIRD PARTY INTEGRATION

Instead of being controlled by EXFO FMS, remote test units can be configured to be controlled directly through its WEBUI or by your network management system (NMS) via open REST APIs on the unit.

The web interface of the remote test units also allows the local creation of local routes and execution of different tests (baseline, test on-demand and ad hoc) which can be visualized in standard OTDR and in EXFO's proprietary iOLM format. Historical status of the tests and related measurements are kept locally on the remote test units.

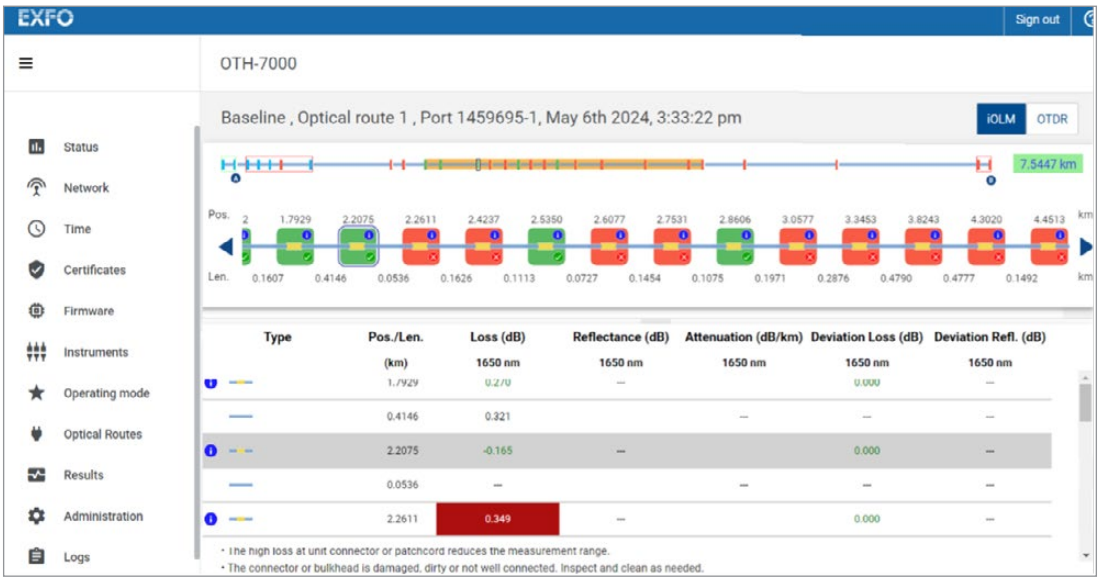


Figure 1. EXFO remote test units WebUI for serverless applications.

Integrate the remote test units client API to your corporate system to store OTDR measurements, perform analysis operations (such as fiber loss calculations) or create configuration files and templates for fiber breaks and degradations. The remote test unit client API removes fiber monitoring EMS requirements and bundles remote equipment control/management into fewer software instances within the corporate network.

Execute tests to detect and precisely locate any deviation from the initial condition with standard OTDR technology (Bellcore .sor). Testing can be programmed or launched on demand from your OSS or SDN controller to get OTDR measurements and perform further analysis. The remote test unit will return the fault status (dB loss and distance) from a simple API call.

Based on a known IP or machine name, you can easily query optical test inventory. For instance, if your NMS or OSS detects a device outage, you can integrate the remote test unit client API to determine if the root cause is related to the fiber, hence reducing mean time to understand (MTTU) when a lack of network communication occurs. This helps to create workflows between transport and test equipment.

The remote test unit as a client can be integrated into your development software through web API calls to test optical routes. This function is crucial for data centers, utility groups, TELCOs, network operators and so on.

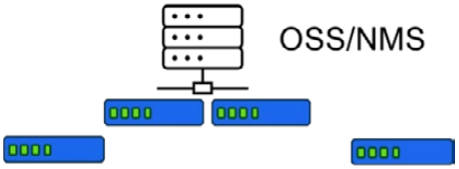
Reduce OPEX/CAPEX with less cost and maintenance fees by using an integrated open API solution for your GIS, NMS, OSS or SDN controller.

4 SERVERLESS USE CASES

4.1 OTDR probes for integrators

The OTH-7000 and RTU-2 units have a documented set of API commands. The device Swagger tool is available for software developers through its WebUI. API are available for the Baseline, Ad Hoc and Test On Demand (TOD), as well as the naming of the optical routes.

The units can be implemented in the customer NMS/OSS to confirm the optical nature (optical fiber break or degradation) of a root cause coming from an NMS/OSS trouble ticket.



4.2 Rack, stack and test

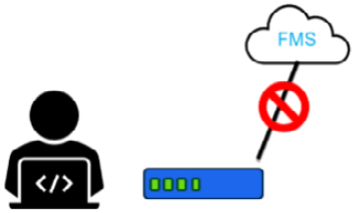
Most initial remote test unit deployments rely on the IT ports and connectivity with the FMS. Now the Field Tech can test the fiber right away without waiting for the FMS connection.

Once the IT connectivity is enabled, the remote test unit will connect directly to the FMS with its "phone home" feature.

4.3 Local/remote OTDR

Verify locally/remotely the state of the fiber (no FMS connectivity)

When the remote OTDR loses connectivity with the centralized FMS solution (if used with this configuration), the user can launch OTDR tests locally (or via the unit's WebUI) to verify the state of the fiber.



5 SERVERLESS OPERATION FEATURE SET (TEST AGENT)

5.1 Testing without optical route definition

5.1.1 Ad hoc testing

You can perform classic OTDR tests from optical ports on the OTH-7000 without creating optical routes. From the Instruments page, select a test port then configure the OTDR test settings manually (duration, pulse, range) or automatically. An ad hoc test will return the typical optical values one can expect from OTDR testing: link length, link loss, link optical return loss (ORL), and for each event its optical loss, reflectance, and distance.

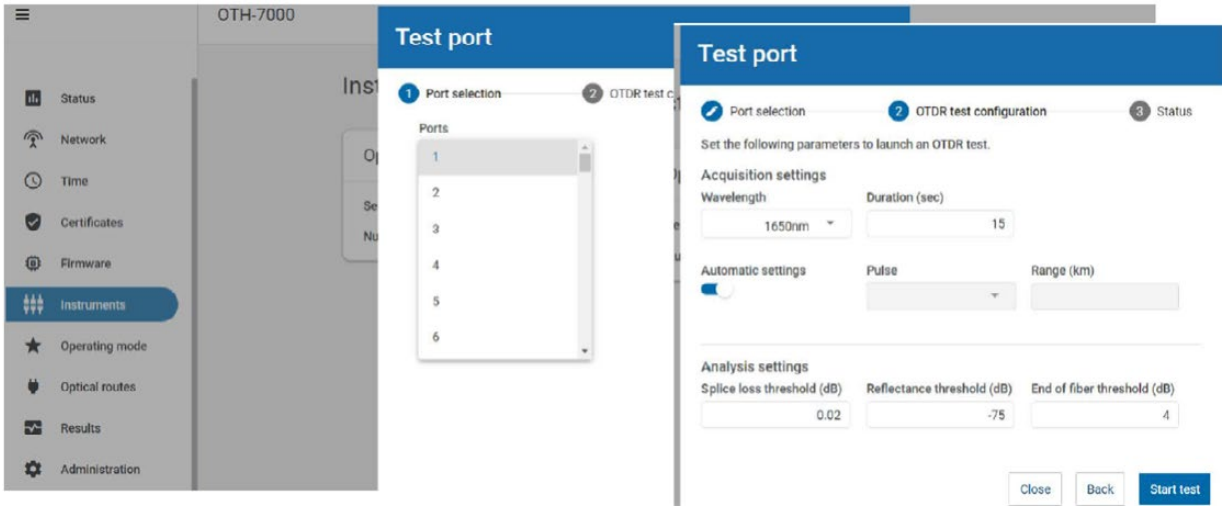


Figure 2. Viewing ad hoc OTDR test result.

Latest test results on a given port can be reviewed by opening the OTDR trace and displaying the Measurements and Event Table. Summary and Identification of the measurement can also be displayed, and .SOR results can be saved locally or exported for further analysis in a software like EXFO's FastReporter.

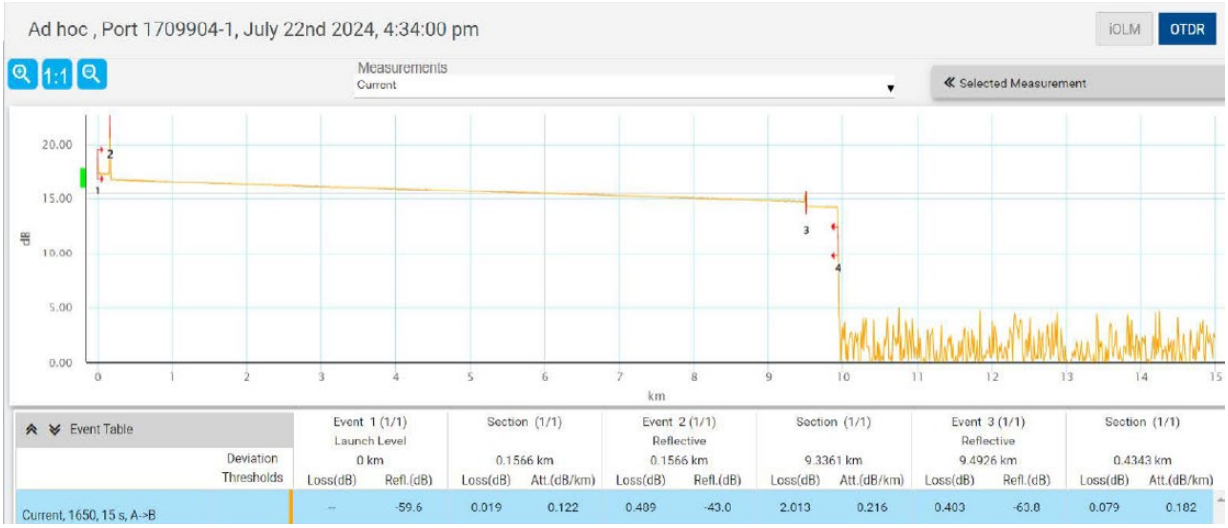


Figure 3. Viewing ad hoc OTDR test result.

5.2 Testing on optical routes

In the context of a remote fiber testing application, an "optical route" refers to the specific path or circuit that an optical signal follows through a fiber optic network from its source to its destination. This route includes all the optical fibers, connectors, and any intermediate devices that the signal encounters along its way.

The optical route is critical for understanding and analyzing the performance of the fiber network, as it impacts signal quality, attenuation, and overall system reliability. When conducting remote fiber tests, various parameters are assessed like signal loss, events reflectance and integrity along this route to ensure that the network is functioning correctly and to diagnose any issues that may arise.

5.2.1 Managing optical routes

You can add optical routes to quickly view results or trigger optical tests. Once routes are created and associated to a port, you can modify their name and description if necessary.

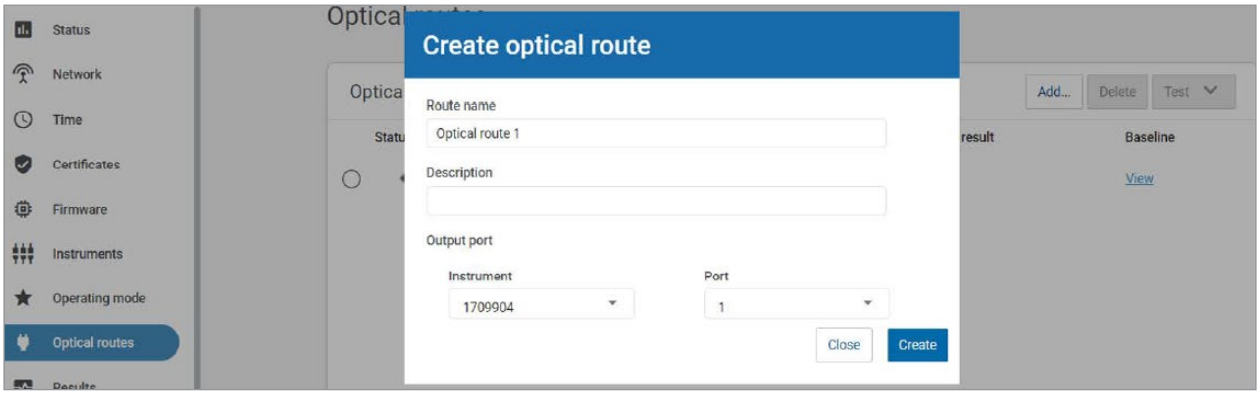


Figure 4. Creating an optical route.

5.2.2 Performing tests on optical routes

You can trigger 3 types of tests: ad hoc testing (simple OTDR test), baseline definition (reference for future deviation analysis) and test on demand (test to identify faults from deviation from baseline)

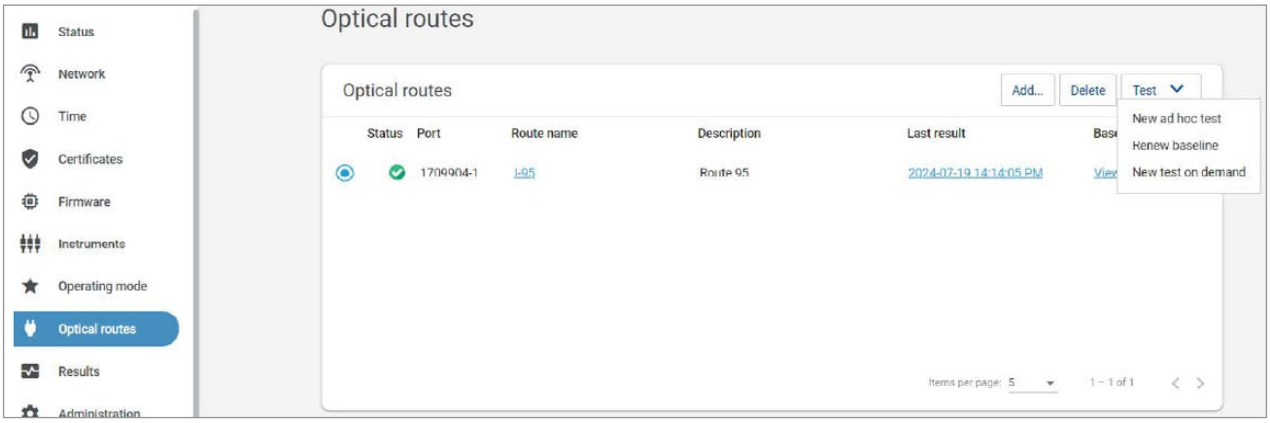


Figure 5. Performing tests on an optical route.

5.2.2.1 Ad hoc testing

An ad hoc test will return the typical optical values one can expect from OTDR testing: link length, link loss, link optical return loss (ORL), and for each event its optical loss, reflectance, and distance.

Ad hoc testing on optical routes is performed using a classic single pulse OTDR approach with automated parameters or user-defined parameters (pulse, duration, range).

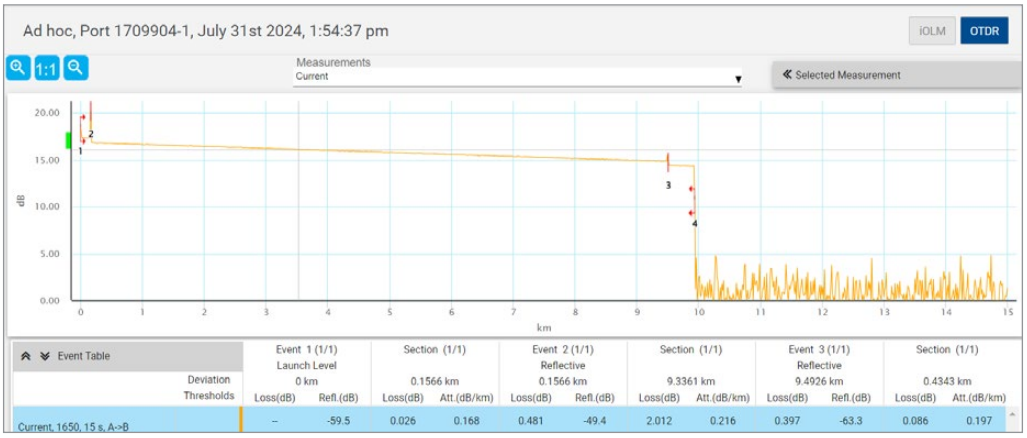


Figure 6. Ad hoc test result on an optical route.

5.2.2.2 Baseline definition (new or renew)

A baseline is an iOLM test used as a reference measurement taken under standard or normal operating conditions. The test will return the typical optical values one can expect from OTDR testing: link length, link loss, link optical return loss (ORL), and for each event its optical loss, reflectance, and distance. The result analysis is based on “absolute” values that can be compared to a set of predefined thresholds for quality and fault assessment.

This benchmark will serve as a standard for comparison when assessing the performance of a given optical route. By comparing current test results against this baseline, deviations or anomalies will be able to be identified, allowing for the detection of potential issues such as increased signal attenuation or performance degradation within the network. A new baseline of an optical route is performed at first deployment of the remote test unit on this link. It can be renewed later on to account for accepted changes in the optical route. This typically happens after a repair on the link changes the link conditions (e.g., overall length, shifted positions, updated reference loss where the fiber was repaired).

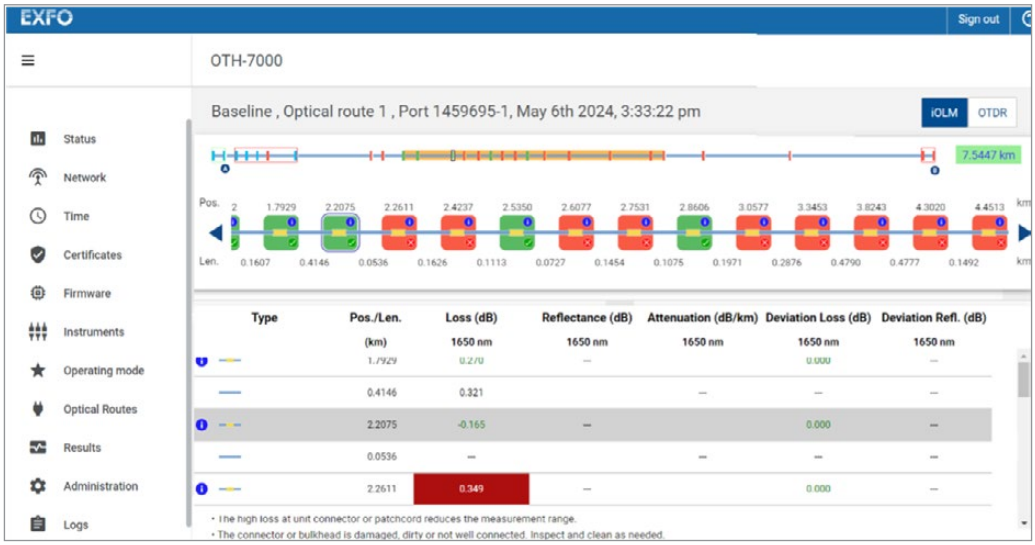


Figure 7. An example of baseline test results.

5.2.2.3 Test on demand (TOD)

A TOD is an iOLM test to identify faults by analyzing deviation from a baseline (or reference). It also provides absolute optical values of the fiber link under test and those are compared to the historical data from the baseline. Hence a relative analysis is performed to identify and quantify deviations, and those deviations are compared to a set of predefined thresholds.

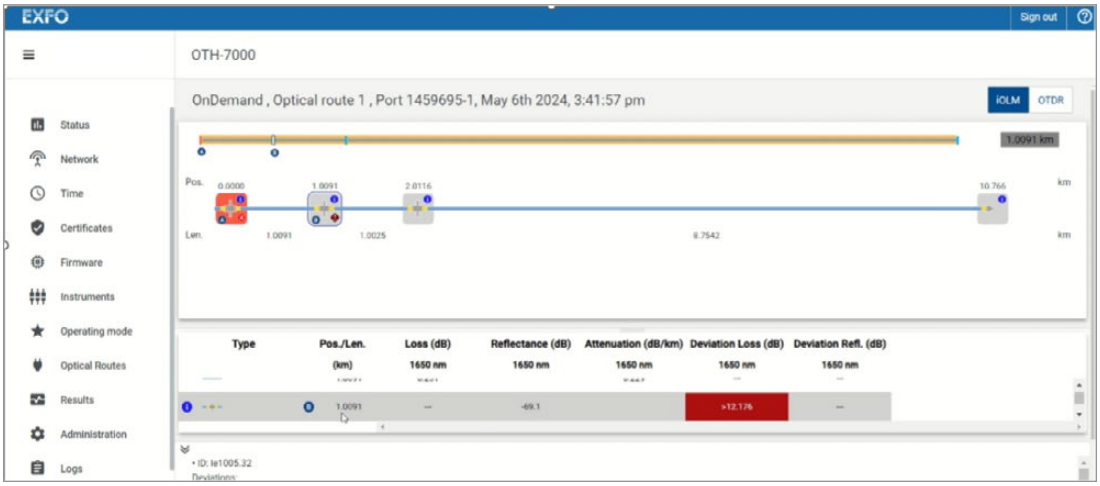


Figure 8. An example of a test-on-demand result.

5.3 Working with results

5.3.1 Viewing the results locally

The results browser will show past results by date, route name, port as well as the deviation loss (dB) and deviation position (km) if any. A clear icon is presented to display the results status.

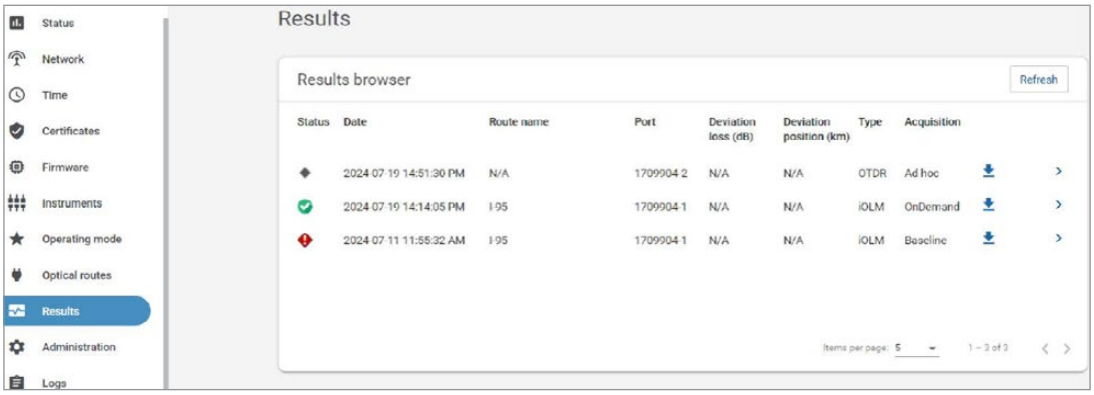


Figure 9. Results browser tab.

5.3.2 Exporting the results

Any result saved on the remote test unit can be exported to the computer connected to the remote test unit, either manually through the Web UI or through API calls. Classic OTDR tests (i.e., ad hoc OTDR testing) are exported in .SOR format while iOLM tests (i.e., baseline, TOD) are exported in .iOLM format. .SOR and . iOLM file formats can be opened and further analyzed if needed in a post-processing software like EXFO's FastReporter available at:

www.EXFO.com/en/products/field-network-testing/otdr-iolm/fastreporter-3

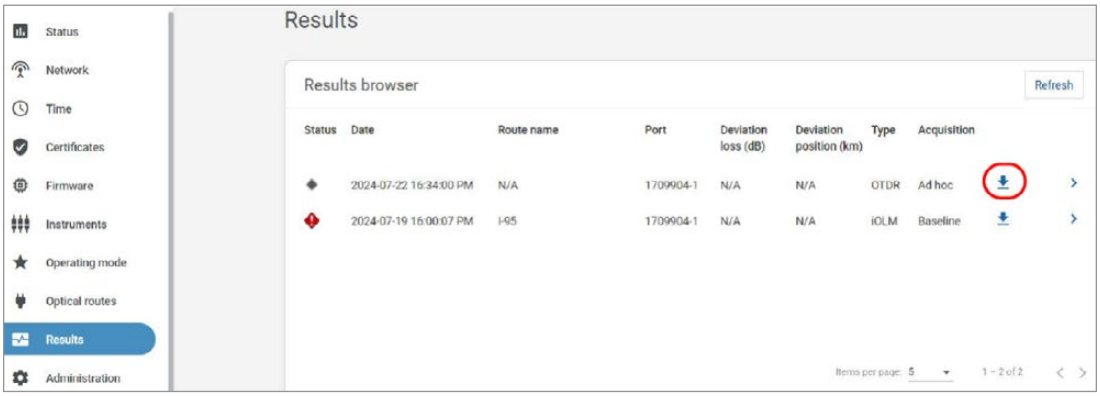


Figure 10. Manually exporting results from results browser tab.

5.4 Remote test unit management

5.4.1 User local access

EXFO's remote test units can be accessed locally by connecting a computer to the unit RJ45 management port and opening a web browser page pointing to the unit address (169.254.10.10). A default username and password are defined and can be modified.

Figure 11. OTH-7000 management Ethernet port (10/100/1000 Base-T) for local access.

5.4.2 User remote access

By default, the management of EXFO's remote test units is done locally by connecting a laptop to the unit. However, if you prefer to be able to manage your unit remotely (via LAN or WAN) after the first connection, you can enable a feature allowing you to do so. The remote test unit will then need to be connected to the LAN or WAN from its RJ45 LAN/WAN connection port or from the SFP port.

Once enabled, if the unit is reachable by your computer, its IP address can be type in a web browser to access the unit WebUI.

5.4.3 Operation through APIs

You can configure and operate your remote test unit using an API available on the LAN/WAN interface(s). A complete list of commands allowing you to remotely control your unit is available from the remote test unit or upon demand. It details the commands with examples and appropriate syntax.

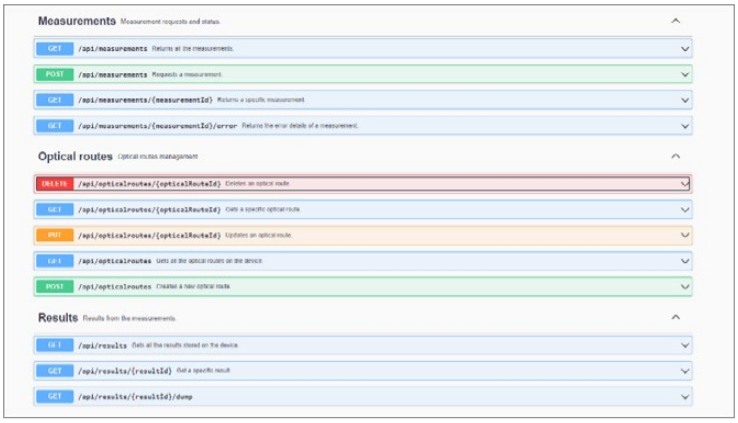


Figure 12. Examples of APIs available.

The main tasks that can be performed through APIs are:

- Remote test unit remote management: certificate management, NTP server settings, IP settings, software updates, etc.
- Remote test unit firmware management: checking and installing updates
- Associate a port to an optical route name
- Performing OTDR tests: perform ad hoc, baseline and test-on-demand (TOD), check their status, retrieve test results
- Troubleshooting the remote test unit: retrieve log files and set log verbosity

5.4.4 Software updates

EXFO's remote test unit allows you to check for updates, download these updates (internet connection required) and install them. This task can be performed through either local or remote access by a user on the Web UI or through API calls. Additionally, the updates can be uploaded from a local computer through the WebUI

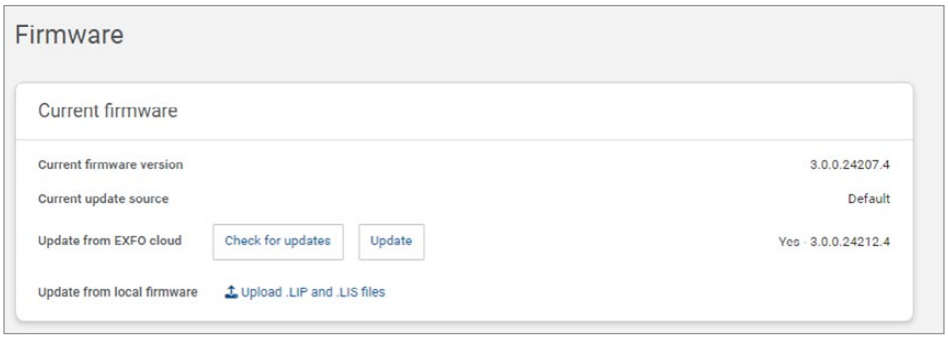


Figure 13. Firmware update through WebUI.

5.4.5 Security

5.4.5.1 Credentials

A login and password are required to access the remote test unit WebUI. The account will be temporarily locked after certain number of unsuccessful connection attempts. The waiting time starts increasing after the fifth unsuccessful connection attempt up to a maximum of fifteen minutes.

The administrator password can be updated through either local or remote access and is required to include minimum of eight characters and include characters from at least three of the following categories:

- Lowercase letters ("a" - "z")
- Uppercase letters ("A" - "Z")
- Numbers (0 - 9)
- Special characters

5.4.5.2 Local certificate

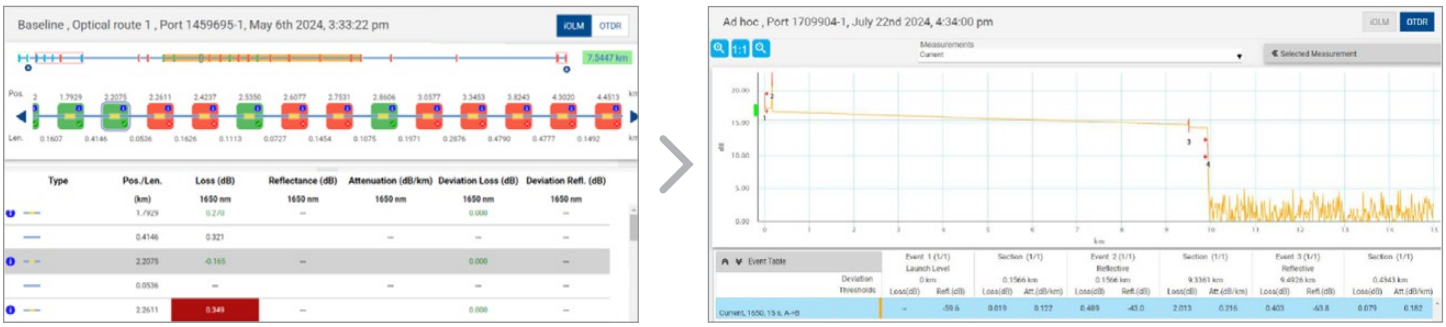
Remote test units use a self-signed certificate.

6 iOLM TECHNOLOGY – AUTOMATION AND ADVANCED ACCURACY

iOLM is an innovative OTDR-based application that uses multipulse acquisitions and advanced algorithms to deliver information on every element in the link with the following advantages:

- **Dynamic multipulse acquisition:** Adjusts test parameters dynamically for ANY link under test using a mix of short, medium and long pulses. This allows the solution to scale easily by automating the definition of the best acquisitions for every link; whereas alternative solutions on the market requires users to define and fine tune acquisition parameter for every link to achieve acceptable accuracy.
- **Automation:** iOLM enables further automation in testing and monitoring for touchless operations compatible with a machine-to-machine environment.
- **Intelligent trace analysis:** Based on the multiple acquisitions and with the help of advanced algorithms, iOLM can detect more events with maximum resolution.
- **All results in a single view:** Results are displayed in an icon-based fiber-link view to quickly assess an event's pass/fail status per standard selected, removing risk of misinterpretation.
- **Comprehensive diagnosis:** Delivers an analysis of failed events and suggests solutions; guides the technicians in fixing the fault quickly and successfully

At any time, users can switch from the comprehensive iOLM view to an OTDR view displaying a golden acquisition.



7 REMOTE TEST UNITS AND ACCESSORIES

Remote test units are OTDR-based test heads. Combined with local or remote switches, they scale up for testing from a few ports to thousands. OTH-7000 and RTU-2 units run EXFO's patented Link-Aware™ technology and are thus referred to as iOLM test units.

7.1 OTH-7000

The OTH-7000 is only ½ U in rack height. Combined with an external high-density optical switching unit that is also ½ U in rack height, one can provision up to 256 optical testing and/or monitoring ports in only 1U of space with fanless operation, low-power consumption and all-in-front access.

Figure 14. OTH-7000

The OTH-7000 is shipped with a standard test agent configuration, i.e., connectable through RESTful APIs to the client management tool as a multiple-port OTDR unit. Within minutes, OTDR testing capability can be added to the client software or management suite at a very competitive price compared to all the low-end OTDRs for remote troubleshooting. It can easily scale from the 4-port typical configuration (2 west and 2 east live fibers) to larger fiber nodes typically found in metro and access networks. The unit can test dark or live fibers through a high-performance OTDR and provides a dynamic range of 42 dB, meeting all core-to-access network requirements based on P2P-type links.

In-service testing and monitoring of P2P is possible thanks to a filtered OTDR port at 1650 nm coupled with a compact test access module coupler (up to 64 ports per ½ U rackmount space).

OTH-7000 is available with a choice of 1, 4, 16, 32 or 64 ports. OTH-7000 family is expanding with the UBRD model featuring narrower laser and filtering, optimal on P2P live networks when the upper L Band is used by traffic or supervisory.

GENERAL SPECIFICATIONS

Operating system		Linux
USB interfaces		USB 2.0 (4)
Wired network interfaces		2x 10/100/1000 Base-T Ethernet IP-V4 and V6 (network and management interfaces), 1x SFP (network interface)
Unit status front LEDs		Power, system status and Bluetooth LEDs
Storage		16 GB
Dual feed power supply		–48VDC 2A (ordering option: external AC-DC adapter for AC operation)
Power consumption		10 W (typical), over entire operating temperature range
Dimensions (for 19 in or ETSI racks) (H × W × D)		22 mm (1 1/2 U) × 440 mm × 220 mm (7/8 in × 17 5/16 in × 8 11/16 in) Compatible with ETSI 300 mm deep racks
Weight (includes brackets)		1.4 kg (3.1 lb)
Temperature	Operating Storage	0 °C to 55 °C (32 °F to 131 °F) –40 °C to 70 °C (–40 °F to 158 °F)
Relative humidity		< 95 % non-condensing
Heat management		No fan

Complete and latest specifications available at:
www.EXFO.com/en/resources/technical-documentation/spec-sheets/oth-7000

7.2 RTU-2

The RTU-2 is a 1U-rack-size remote test unit. It is modular (two module slots) and compatible with EXFO's FTBx modules used in portable and manufacturing test applications. The unit provides fast on-board analysis and large local storage. The unit can also support up to four RTUe-9120s switches, scaling the number of test ports up to 1024. An optional junction panel is available so that all connections are available at the front of the unit (see Figure 10 with the ½ U shelf underneath the RTU-2 unit).

The unit can be connected to P2P links (either backhaul or access type) to provide both build and connect testing, as well as 24/7 monitoring. With the FTBx-750C-SM3, a 3-wavelength OTDR module for dark fiber characterization and monitoring, RTU-2 can test links ranging from short to long haul owing to its 45 dB dynamic range.

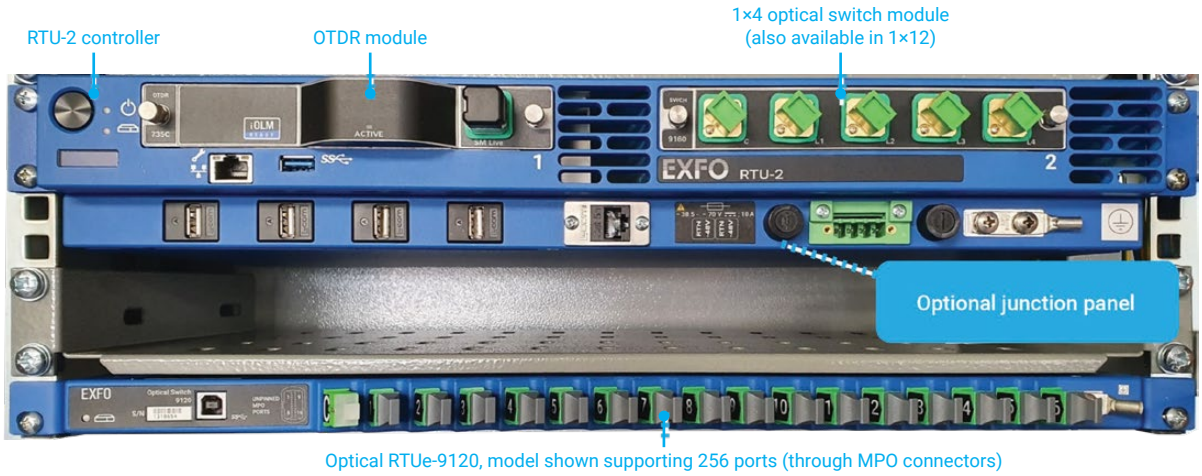


Figure 15. RTU-2 with OTDR module, first stage 1x4 switch and optional junction panel and second stage switch to support 256 ports.

PLATFORM SPECIFICATIONS

Mainframe		Quad-core Intel i7 processor / 8 GB / Linux embedded
Front interfaces		RJ45 10/100/1000 Mbit/s (management port), USB 3.0
Rear interfaces		RJ45 10/100/1000 Mbit/s (management + Ethernet ports) (2), USB 3.0 (5), relay contact: 3 (power, system and user configurable)
Storage		128 GB SSD internal memory
Power supply		–48VDC DC, 10A (ordering option: external AC-DC adapter for AC operation)
Power consumption	Idle state OTDR measuring	25 W 40 W (typical)
Dimensions (H × W × D) (includes brackets)		44 mm (1U) × 482 mm × 262 mm (1 ¾ in × 19 in × 10 5/16 in)
Weight (includes brackets)		5.1 kg (11.2 lb)
Temperature	Operating Storage	–5 °C to 50 °C (23 °F to 122 °F) –40 °C to 70 °C (–40 °F to 158 °F)
Relative humidity		< 95 % non-condensing

Complete and latest specifications available at:
www.EXFO.com/en/resources/technical-documentation/spec-sheets/rftm-rtu2

7.3 RTUe switches

Based on reliable and cost-effective MEMS technology, the RTUe-9120 units are external optical switches for connecting an OTH-7000 or an RTU-2 to large quantity of fibers terminating in the same hub. It features low power consumption (typically 1W per unit) and is very dense (up to 1×256 in ½ U). It uses MPO connectors to interface with the fiber route to be tested/monitored. Models are available in 1×32, 1×64, 1×128 and 1×256 fitting most OLT port configurations, both being based on multiples of 16. Each MPO connector based on standard MPO 24-fiber ferrule, exits 16 ports (2×8 on the middle rows) and is therefore compatible with most MPO cleaning and inspection tools.

Figure 16. MPO-24 port configuration with 16

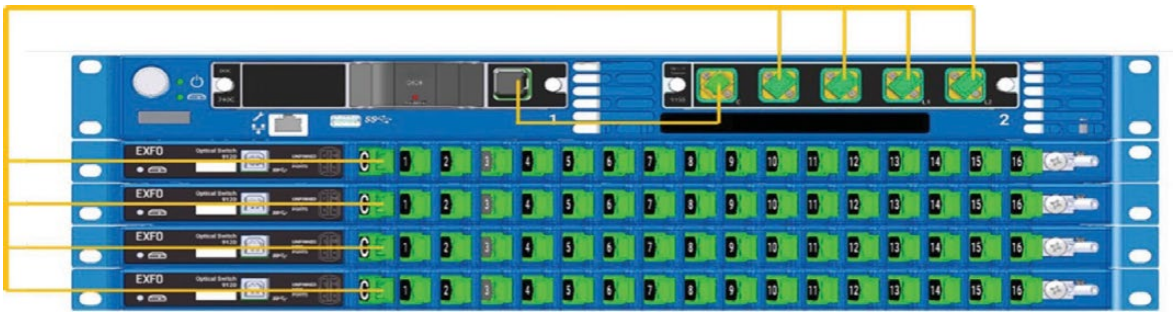


Figure 17. Four MPO-based RTUe-9120s with 256 test ports each in ½ U size for 1024 ports in 2 U height. First stage 1×4 optical switch connects to the 1×256 external optical switch. Excess loss caused by first and second level optical switching is typically 3 dB. Each unit is powered and controlled from the RTU-2 or OTH-7000 chassis (no need for more DC circuits).

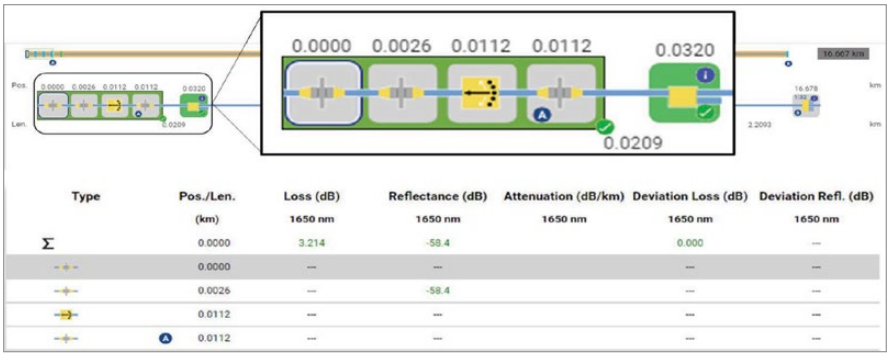


Figure 18. Thanks to iOLM's patented multipulse technology, even on a 17-km PON with high loss, last stage optical switch port on the front end is properly detected, allowing to set link start accordingly (A) at the output of the last connector, part of the injection.

ELECTRICAL SPECIFICATIONS

Latching type	Non-latching
Supply type	USB 2.0
Operating power consumption	~1 W

GENERAL SPECIFICATIONS

Chassis size		½ U, rackmount chassis (19")
Size (H x W x D)		22 mm x 440 mm x 220 mm (7/8 in x 17 5/16 in x 8 11/16 in)
Weight		1.2 kg (2.6 lb)
Temperature	Operating Storage	–5 °C to 50 °C (23 °F to 122 °F) –40 °C to 70 °C (–40 °F to 158 °F)
Optical connector location		Front panel

Complete and latest specifications available at:
www.EXFO.com/en/resources/technical-documentation/spec-sheets/rtue-9120

7.4 Test access module kits and FWDMs for testing on live fibers

When testing on a live fiber link, the OTDR signals needs to be injected with live traffic and then extracted on its way back. For that, the OTDR uses an out-of-band wavelength which is multiplexed with the traffic wavelength(s). The multiplexing, as seen in Figure 31, is handled by a test access module kit (TAMK), offered in ½ U or 1U full-wide rack units. Typical out-of-band wavelength(s) used for OTDR in this implementation are 1610 nm, 1625 nm or 1650 nm (depending on applications). EXFO's RFTM offers a wide variety of configurations from single path WDM with SC/FC connectors to 128 WDMs in a 1U rack space. The 1U TAMKs use a mix of LC connectors and MPO 24f ferrules where 16 or 24 ports can be quickly connected to EXFO's RTUe-9120 units and to line (Tx/Rx or OLT) as illustrated.

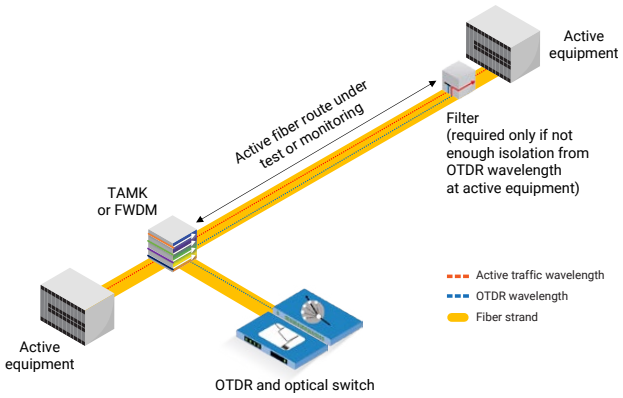


Figure 19. Use of a test access module kit and a blocking filter on a P2P schematic example.

Optical transport equipment from network equipment manufacturers (NEMs) now often integrate an OTDR port. Although great in theory, these ports have to let the entire OTDR emitting power pass through and must present high-enough directivity, low reflectance (APC recommended) and enough isolation so that the return loss from the fiber and connectors hit by a strong OTDR signal are filtered out by the WDMs before they could reach a receiver. In comparison, EXFO WDMs typically provide:

- Low loss for traffic and OTDR—less than
- 0.8 dB for the device itself
- Isolation larger than 30 dB on the line port at the OTDR wavelength
- Directivity larger than 50 dB
- Various cut-off wavelengths between traffic and OTDR to ensure specifications are optimized for the application

7.4.1 Test access module kit (TAMK)

A TAMK is ½ U or 1U full-size rack, in typical configurations of 12, 24, 32, 48, 64, 96 and 128 WDMs. Low-density units are ideal for use with FG-750 or OTH-7000 equipped with more than 12 ports while denser units such as 48, 64 and above are preferred for use with RTU-2 or OTH-7000 combined with RTUe-9120s.

Figure 20. TAMK: ½ U, 64 WDMs all in front.

Low-density units are ideal for use with FG-750 equipped with more than 12 ports while denser units such as 48, 64 and above are preferred for use with RTU-2/RTUe-9120s. Different types are available upon request with volume pricing available.

Models

TAMK-WDM-GA-24-XX	1U, 24 WDMs SC-APC for line and common (front) with 3-m pigtails (different connectors) for the OTDR (rear)
TAMK-WDM-GA-48-MPOC-104	1U, 48 WDMs LC-APC for line and common (front) with MPO-24/16f (3) for OTDR (rear)
TAMK-NS3089	1U, 128 WDMs LC-APC common ports (front) with MPO-24/16f (8) for OTDR and MPO-24/16f (8) for line (rear)
TAMK-WDM-GA-64-MPO16-104	½ U, 64 WDMs all in front. LC-APC ports for common, MPO-24/16f (4) ports for line and 1.5m pigtails MPO-24/16f (4) terminated for OTDR

7.4.2 FWDM: Single fiber

LGX compatible modules and rack-mounting kits are also available and are ideal for the 2- and 4-fiber configurations that need to be connected to testing and monitoring equipment. In these models, the front SC or FC connectors are removable from the front, giving access to the ferrule for ease of inspection and safe cleaning.

Figure 21. FWDM

Models

FWDM-234	Regular 1310-1550 nm with 1625 nm for the OTDR
FWDM-NS2065	1310-1550 nm with 1650 nm for the OTDR

7.4.3 FWDM: Bypass assembly – single path

To enable the OTDR signal to bypass or jump over an active equipment (e.g., a traffic re-gen) or an optical add-drop multiplexer (OADM) site, EXFO offers a similar FWDM configuration but with the monitor ports of two WDMs spliced together so that it bypasses a transmission gear, an amplification equipment, or an OADM with minimal loss added to the link.

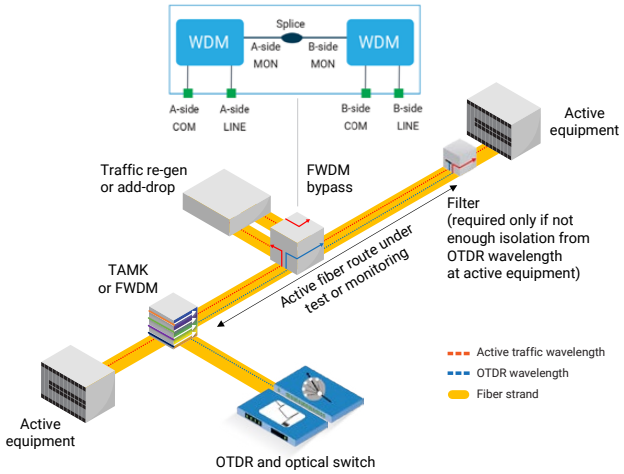


Figure 22. Schematic example using an FWDM bypass to monitor a fiber route including traffic regen or add/drop module.

7.4.4 Low-density FWDM cassettes

Ideal companion for OTH-7000, for EAST-WEST TX/RX live fiber monitoring

FWDM-NS3191	1/2 U cassette, all ports in front. 4 WDMs for the monitoring of up to 4 live fibers. 2x duplex LC/UPC connector for "line" ports, 2x duplex LC/UPC connector for "common" ports, 2x duplex LC/UPC connector for "monitor" ports.
RMK-NS3115	1/2 U holder module hosting up to 3x FWDM cassettes.

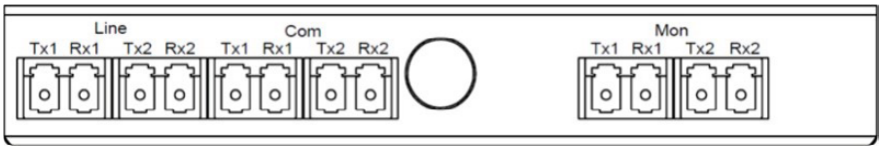


Figure 23. FWDM-NS3191

7.4.5 High-density FWDM cassettes

MPO 24f APC ferrules are used to terminate more fiber ports into high-density fiber racks. These cassettes can replace single-fiber connector patch panels already used to link up OLTs to ODFs, while offering an OTDR test access without a larger footprint.

Figure 24. MPO-based high-density FWDMs.

Models	
FWDM-NS2919	48 WDMs, all in front MPOs, maximum 288 WDMs per 1U in scaling steps of 48x
FWDM-NS2944	16 WDMs, front/rear MPOs, maximum 96 WDMs per 1U in scaling steps of 16x
Rack-NS2919	1U size, 6-slot chassis for holding up to six (6) high-density FWDMs

7.4.6 Other passives

- Rejection filters for P2P fibers in jumpers or bulkhead adapters
- WDM in small and ruggedized package with various jumper lengths and connector types

Additional references

OTH-7000 spec sheet

RTU-2 spec sheet

RTUe-9120 spec sheet

Assuring data center interconnectivity with the OTH-7000 use case

5G and fronthaul monitoring with the OTH-7000 use case

RFTM technical brochure

CONTACT AND MORE INFORMATION

Useful links

EXFO.com

Contact a sales representative

Schedule a demo

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Support services and SLAs

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