

**Anritsu** envision : ensure

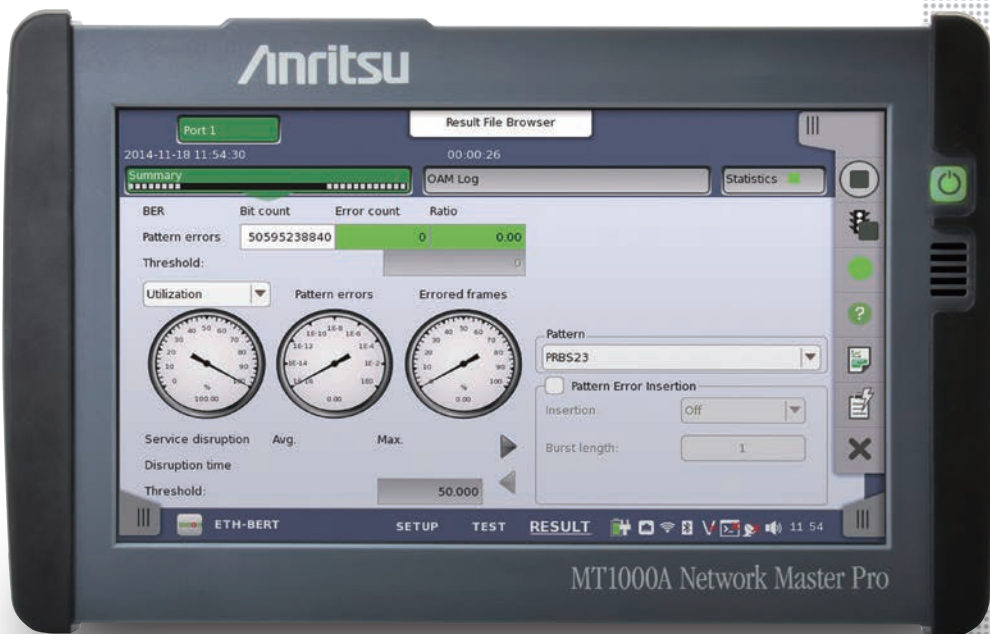
# Network Master™ Series

## Network Master Pro

### MT1000A

### 10G Multirate Module

### MU100010A



# Redefining Transport Testing

Today's communication networks are becoming more and more sophisticated as leading network operators install new technologies like OTN, MPLS-TP and Ethernet in their metro and backhaul networks and CPRI/OBSAI in Mobile Fronthaul networks. In some cases, operators must also support Fibre Channel links, while still keeping legacy technologies like SDH/SONET and PDH/DSn operational. The Network Master Pro MT1000A with 10G Multirate Module MU100010A redefines the direction of future test platforms by bringing these network test requirements to a portable device, making it the ideal tool for field testing.



# 10M/100M/GigE Fibre Channel Ethernet 10 GigE SDH/SONET



**All in One**

**Mobile Backhaul**

**Easy to use**

- **All-in-one transport tester**  
– supports testing from 1.5 Mbps to 10 Gbps
- **Easy and intuitive GUI**
- **Dual port at all rates**
- **WLAN\*/Bluetooth\*/LAN connectivity**
- **PDF, CSV and XML report generation for documenting test results**
- **Remote operation**
- **Remote control (scripting)**
- **Compact, lightweight design for maximum field portability**
- **Modular platform ensuring maximum return on investment**

\*: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

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## Key Applications

### Metro and Core Networks

#### Installation and Maintenance

- OTN up to OTU2 including mapping of Ethernet, CPRI, Fibre Channel, SDH/SONET client signals, multistage mapping and FEC (Forward Error Correction)

#### Carrier Class Ethernet Installation and Troubleshooting

- Ethernet testing up to 10 Gbps including RFC 2544, RFC 6349 and Y.1564
- Ethernet OAM up to 10 Gbps
- MPLS-TP and PBB up to 10 Gbps
- IP Channel Statistics up to 10 Gbps
- Frame capture for advanced troubleshooting

#### Mobile Backhaul Installation and Verification

- Synchronous Ethernet testing up to 10 Gbps
- PTP testing up to 10 Gbps (ITU-T G.826x, ITU-T G.827x and IEEE 1588 v2)

#### Mobile Fronthaul Installation and Verification

- CPRI testing up to 10 Gbps
- OBSAI testing up to 6 Gbps

#### Powerful Storage Area Networking (SAN) Testing

- Fibre Channel up to 10 Gbps

#### Quick and Easy Testing of SDH/SONET and PDH/DSn Networks

- SDH/SONET (STM-1 to 64/OC-3 to 192)
- PDH/DSn (E1, E3, E4, DS1, DS3)

#### Supporting Optical Fiber I&M

- Installing an OTDR Module MU100020A/MU100021A/MU100022A provides the OTDR functions required for optical fiber I&M. Work efficiency is increased by all-in-one support for optical fiber tests and data communications network commissioning.

#### New Method for Remote Radio Head Base Station Installation

- Installing the CPRI RF Module MU100040A supports analysis of IQ signal frequency characteristics included in CPR signals between the RRH and BBU. This can be used for ground-based checks of the RRH installed on a steel tower, etc.



# MT1000A

# Network Master Pro MT1000A Overview

The compact, battery-powered and easy-to-use Anritsu MT1000A with 10G Multirate Module MU100010A has everything in a single, handy tester needed to install and maintain communication networks from 1.5 Mbps to 10 Gbps. This portable, compact, lightweight instrument makes network field testing easy. Service engineers can read and interpret data from the tested network directly on the 9-inch color display with easy-to-understand indications and graphical symbols. And the GUI makes it simple to configure and operate the instrument at its full potential. The MT1000A has been designed for easy expandability, reducing initial costs, and facilitating step-by-step customized investment.

## All-in-one

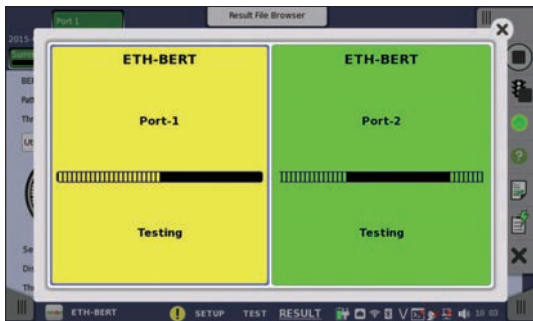
The MT1000A/MU100010A has everything you need to install and maintain communications networks from 1.5 Mbps to 10 Gbps in a single, handy unit. It supports new technologies like OTN, Ethernet, CPRI/OBSAI, MPLS-TP and Fibre Channel, together with legacy SDH/SONET and PDH/DSn technologies.

### • OTN Testing with Client Signals

With the MT1000A/MU100010A you get a powerful and complete tool set for testing OTN signals. You can test all the way to the mapped Ethernet, Fibre Channel and SDH/SONET client signals for quick troubleshooting and testing of in-service OTN systems.

### • Easy-to-Use GUI

The user interface is optimized for troubleshooting by field technicians and to reduce training time. It has a logical structure and self-explanatory graphical symbols. Tests are started by launching an intuitive application, and main results are displayed as GO/NO-GO indications. User-programmed application favorites including all required test parameters make operation fast and easy.



### • Simultaneous Testing and In-band Monitoring with Dual Port

Configuring the MT1000A/MU100010A with two ports at all supported rates reduces test times by completing independent tests simultaneously on two lines using a single tester. Or separate measurement test applications can be run independently at the same time.

Support for dual ports is also important at analysis of in-service lines when analyzing the performance of both line directions simultaneously.

### • Video Inspection Probe Support

Connecting the MT1000A to a Video Inspection Probe (VIP) allows the user to check the fiber end face and confirm that quality practices are being followed, removing a key point in turn-up failure.

### • 9-inch Touch Screen for Easy Viewing and Operation

The large 9-inch, high-resolution, full-color, touch screen is perfect for viewing results. And the touch screen makes instrument operations easy.

### • Fast Measurement Overview

Using the Overall Test Status screen, viewing the test status for all current test applications belonging to one user from a distance is easy. For each test application, the Measurement Summary function allows rapid overview of measurements using GO/NO-GO indications with user-defined thresholds. Statistical histograms facilitate error tracking over time.

### • Flexible Connectivity

WLAN, Bluetooth and LAN connectivity ensure quick and simple tester access in any situation. While remote operation allows an experienced engineer to assist colleagues in the field.

### • Report Generation

The powerful and flexible report generator creates PDF, CSV or XML files for selected measurements to output results in a professional and attractive looking format. The user can customize the detailed contents of the statistical reports, allowing only the most important information to be included.

### • Remote Operation and Control

Remote operation from a distance is simple using the Remote Operation function, allowing operation as if on-site. A dedicated Remote Control package for the MT1000A also supports file transfer between the instrument and a PC, including download of measurement reports and results files. Upload and download of configuration files as well as remote software upgrade is also supported. In addition, the dedicated Remote Control package offers multi-user access to the MT1000A/MU100010A. Finally, the dedicated Remote Control package MX100001A\* can work stand-alone, allowing users to generate reports and analyze results offline in addition to setting-up files without accessing a MT1000A. The remote scripting function cuts the manual operation time, eliminating human testing errors.

The MT1000A/MU100010A supports Ethernet, WLAN and GPIB for remote scripting.

\*: Supported on Windows 7/8/8.1 (32 bit/64 bit)

### • Portable

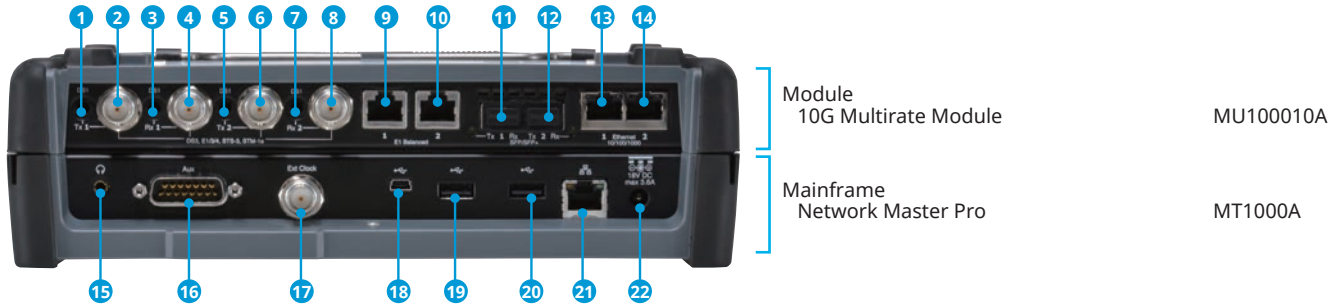
The high portability and robustness of the MT1000A ensure quick location of faults wherever you are. This light, small instrument is just a fraction larger than its 9-inch screen, offering easy access in the tightest locations. The small size coupled with large GUI makes it easy to quickly configure, locate, solve, and report on network issues.

### • Long Battery Life

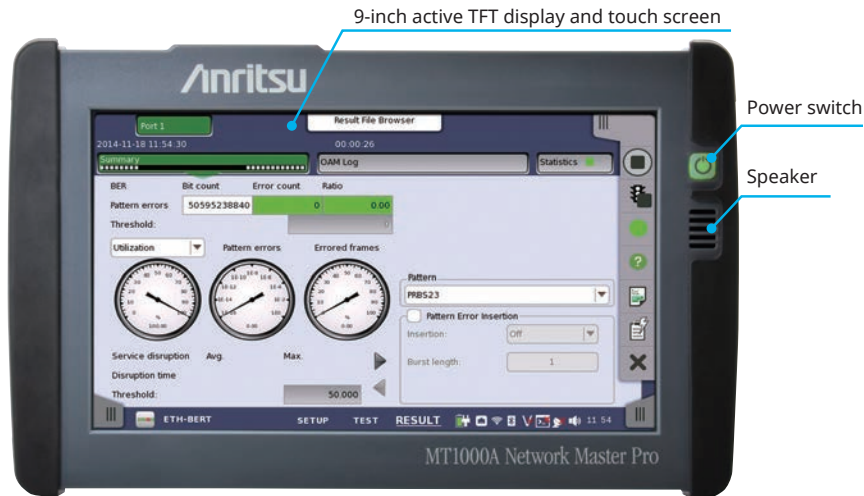
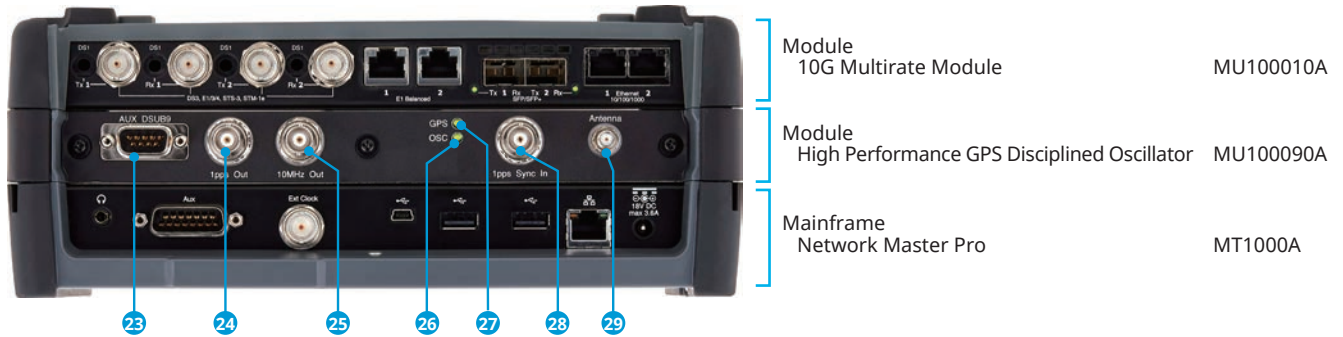
Since AC power is not always available when needed, the MT1000A tester runs for up to 3 hours on a single charge, depending on configuration and setup. Coupled with an optional car cigarette lighter cord, the instrument is always ready whenever and wherever you are.

# Panel Layout

## Standard Configuration



## High Performance GPS Disciplined Oscillator Configuration



Just a fraction larger than 9-inch screen



Rechargeable and replaceable Li-ion battery

- 1 Port 1, Tx Bantam (DS1)
- 2 Port 1, Tx BNC (E1, E3, E4, DS3, STM-1e, STS-3)
- 3 Port 1, Rx Bantam (DS1)
- 4 Port 1, Rx BNC (E1, E3, E4, DS3, STM-1e, STS-3)
- 5 Port 2, Tx Bantam (DS1)
- 6 Port 2, Tx BNC (E1, E3, E4, DS3, STM-1e, STS-3)
- 7 Port 2, Rx Bantam (DS1)
- 8 Port 2, Rx BNC (E1, E3, E4, DS3, STM-1e, STS-3)
- 9 Port 1, Tx/Rx RJ48 (E1 balanced)
- 10 Port 2, Tx/Rx RJ48 (E1 balanced)
- 11 Port 1, Tx/Rx SFP+ (OTN, Ethernet, CPRI/OBSAI, Fibre Channel, SDH/SONET optical)
- 12 Port 2, Tx/Rx SFP+ (OTN, Ethernet, CPRI/OBSAI, Fibre Channel, SDH/SONET optical)
- 13 Port 1, Tx/Rx RJ45 (Ethernet electrical)
- 14 Port 2, Tx/Rx RJ45 (Ethernet electrical)
- 15 Audio (3.5 $\phi$ : CTIA Standard)
- 16 AUX (G0325A/with MT1000A-005, MU100090A)
- 17 Clock Input
- 18 USB Mini-B
- 19 USB A
- 20 USB A
- 21 Ethernet Service Interface
- 22 DC Input (18 Vdc)
- 23 AUX D-SUB 9 pin
- 24 1 pps Output
- 25 10 MHz Output
- 26 GPS received LED
- 27 OCS LED
- 28 1 pps Sync In
- 29 Antenna Input

# OTN Application

## Comprehensive OTN Testing for Metro and Core Networks Installation and Maintenance

OTN carries client signals, but current OTN field testers only support OTN testing at the OTN line rate with bulk test signals. This means that problems in the carried client signals are invisible when testing an in-service OTN system.

Using the MT1000A/MU100010A, OTN lines can be tested at the client signal level with signals like Ethernet, CPRI, Fibre Channel and SDH/SONET, because the OTN mapping function is mandatory for modern OTN transponders. The MT1000A can also test OTN lines at the line rate with bulk signals.

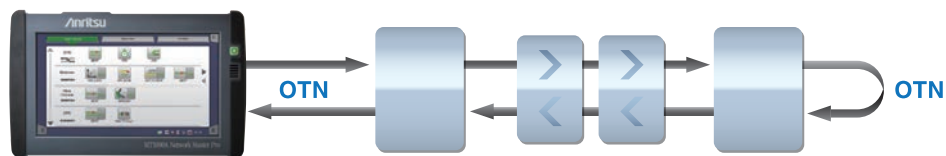
The user can identify problems at all levels in the OTN signal, solving OTN issues efficiently, reducing system downtime, and reducing operating expenses for network operators.

### OTN Testing with Client Signals

The MT1000A/MU100010A is a powerful and full toolset for testing OTN signals. It supports complete Bit Error Rate (BER) tests with bulk signals at the OTN level as well as tests all the way to the Ethernet, Fibre Channel and SDH/SONET client signals mapped onto the OTN signal.

#### OTN tests features include:

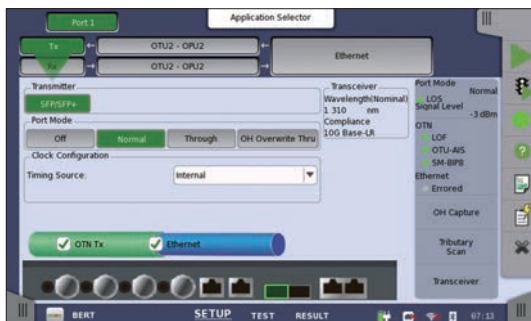
- OTU1, OTU2, OTU1e, OTU2e, OTU1f, OTU2f tests
- ODU0, ODUflex, ODU1 and ODU2 including ODU0 to ODU2 multistage mapping
- OTN tests with bulk signals (PRBS, Null or User pattern) at OTN level
- Comprehensive OTN error and alarm statistics
- OTN error performance measurement in accordance with G.8201 or M.2401
- ITU-T O.182-compliant FEC test
- Test of Ethernet, CPRI, Fibre Channel or SDH/SONET client signals mapped onto OTN signal
- Delay measurement
- OTN header edit and capture
- OTN TCM monitoring and generation
- Service disruption analysis using APS application
- OTN tributary scan
- Full flexibility to monitor insert/overwrite client overhead and payload within OTN signal



Looping-back test signal from MT1000A at far end supports easy OTN line quality tests

### Out-of-service OTN Error and Alarm Statistics

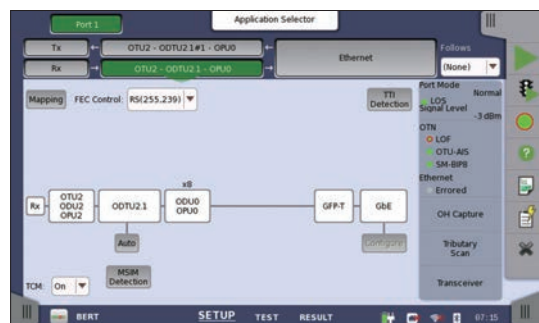
The MT1000A/MU100010A supports powerful statistical measurements for BER tests as well as OTN level alarms and errors for installing/commissioning and troubleshooting out-of-service OTN lines. G.8201 or M.2401 error-performance parameters are calculated during measurement. Stress testing of network elements is supported by inserting errors and alarms, and adjusting overhead bytes in the signal transmitted by the instrument.



### Testing Ethernet, CPRI, Fibre Channel, or SDH/SONET Client Signals Mapped onto OTN Signal (Part of ODU Multiplexing Option)

The MT1000A/MU100010A tests OTN links carrying Ethernet, CPRI, Fibre Channel or SDH/SONET client signals, allowing the operator to test embedded client signals.

For example, an RFC 2544 or Y.1564 test can be performed with an Ethernet signal carried over the OTN signal, allowing the service engineer to run tests emulating the real-world requirements of end users.

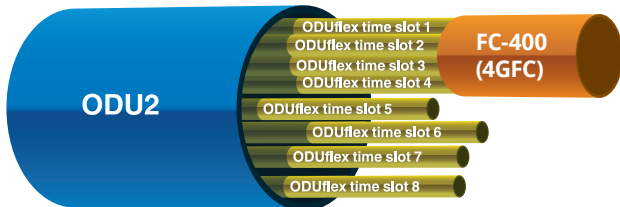


# OTN Application

## Comprehensive OTN Testing for Metro and Core Networks Installation and Maintenance

### ODUflex Test (with ODU Flex Option)

ODUflex is a new feature of OTN supporting flexible allocation of client-signal bandwidth to make best use of OTN capacity. The MT1000A/MU100010A with ODU Flex option supports ODUflex tests, allowing operators to verify this new technology on their networks.



ODU Flex Option divides capacity of ODU2 into eight 1.25G ODUflex time slots. In the above example, an FC-400 (4GFC) Fibre Channel signal occupies four ODUflex time slots.

### ITU-T O.182-compliant FEC Test

Anritsu proposed the FEC performance tests using Poisson-distributed random errors adopted by ITU-T Recommendation O.182. This method supports reproducible and accurate FEC error correction tests by generating truly random signal errors. High-speed networks cannot be tested accurately without using the ITU-T O.182 Poisson error distribution.



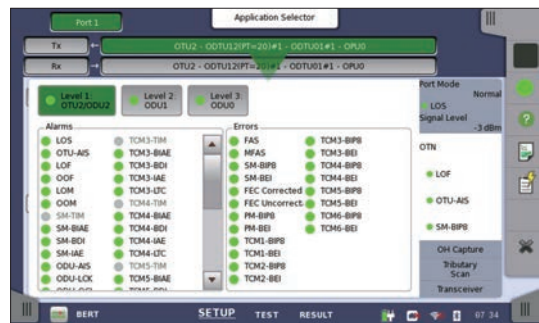
OTN Statistics Summary

### OTN Tributary Scan

The tributary scan feature supports quick inspection of the OTN signal by examining it for major problems and highlighting them in an easy-to-understand manner.



OTU Level Statistics



OTU Alarms and Errors View

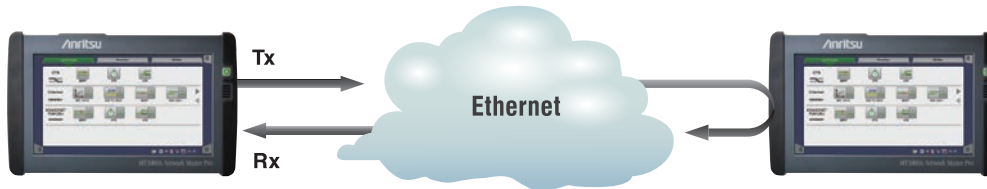


OTU Header Capture

# Ethernet Application

## Carrier Ethernet Installation and Troubleshooting

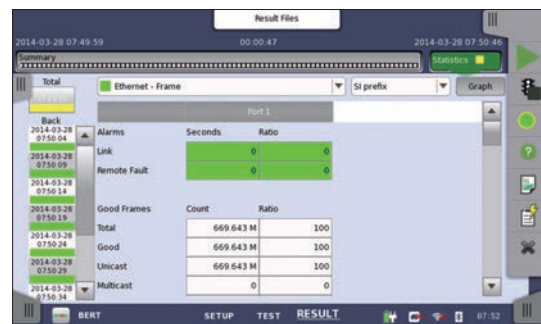
Ethernet technology is used by many applications today, including Carrier Class Ethernet, VLAN, Q-in-Q, Ethernet OAM and MPLS and, recently, PBB and MPLS-TP. Network operators must handle all these technologies, leading to long and complex test procedures. The MT1000A/MU100010A with Ethernet option is a comprehensive solution for easy testing, installing, and faster troubleshooting of Ethernet lines up to 10 Gbps using functions for verifying bandwidth, and testing connectivity, Quality of Service (QoS), and service availability, cutting additional truck rolls, tech support calls, and customer churn to improve operating expenses.



Single-end test using MT1000A as Ethernet reflector

### Ethernet test features include:

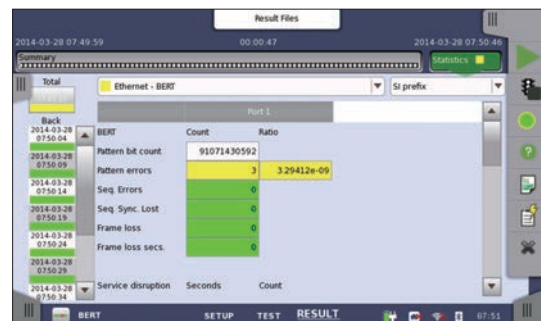
- Ethernet tests at 10 Gbps, 1 Gbps, 100 Mbps and 10 Mbps
- Traffic generation up to full line rate
- Support for IPv4 and IPv6
- Ethernet Service Activation Test (Y.1564)
- Automated RFC 2544 tests of Throughput, Frame Loss, Latency or Packet Jitter, Burstability
- TCP Throughput option (RFC 6349, iPerf)
- BER tests – include Frame Loss and Sequence Error tests
- Service disruption measurements
- Comprehensive statistics
- Filters – to extract relevant parts of traffic
- Thresholds – to highlight abnormalities
- Simultaneous monitoring in both line directions
- IP Channel Statistics to identify error streams, top talkers, network attacks
- Ethernet OAM tests
- 10G WAN-PHY tests
- Synchronous Ethernet test (ITU-T G.826x and IEEE 1588 v2)
- IEEE 1588 v2 Phase/Time synchronization test (For optical GigE/10 GigE)
- Ethernet Multistream
- Stacked VLAN (Q-in-Q)
- MPLS tests
- MPLS-TP and PBB tests
- Ping
- Traceroute
- Frame capture for protocol analysis with Wireshark
- Electrical cable tests and optical signal level displays



Ethernet Statistics



Ethernet BER Tests Statistics Summary



Ethernet BER Tests Results

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# Ethernet Application

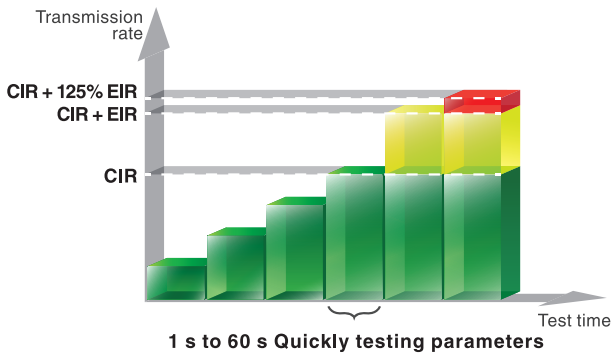
## Carrier Ethernet Installation and Troubleshooting

### Ethernet Service Activation Test (Y.1564)

With the ability to simultaneously test multiple traffic streams, ITU-T Y.1564 is a new test methodology when deploying Ethernet networks. Today's common RFC 2544 standard completes tests one at the time and does not run all traffic streams simultaneously. ITU-T Y.1564 has the following two test phases.

- **Service Configuration Test:**

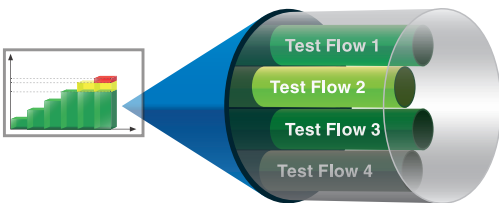
This section is completed quickly, within seconds per stream. It confirms the end-to-end configuration while quickly checking the Information Rate (IR), Frame Transfer Delay (FTD), Frame Delay Variation (FDV), Frame Loss Ratio (FLR), Committed Burst Size (CBS) and Excess Burst Size (EBS) sequentially for all configured traffic streams.



Y.1564 Service Configuration Test

- **Service Performance Test:**

This section is completed based on the M.2110 standard for 15 minutes, 2 hours, 24 hours, or a user-selectable period. It transmits all configured traffic streams simultaneously at the CIR, confirming that all traffic can traverse the network under full load while checking IR, FTD, FDV, FLR and Availability (AVAIL).



Y.1564 Service Performance Test

Simultaneous testing in the Service Performance Test section greatly reduces the total test time compared to RFC 2544.

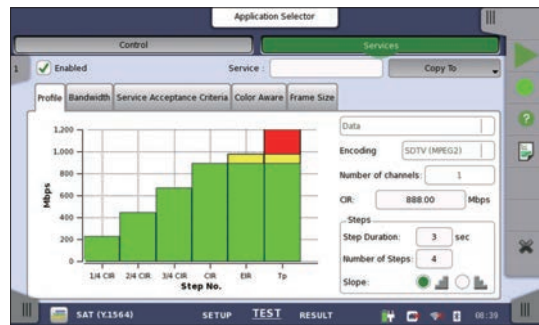
### Ethernet end-to-end Testing

The MT1000A/MU100010A Ethernet Service Activation Test application supports user tests in accordance with Y.1564 for up to 8 services. Testing is typically performed with two testers running the Service Activation Test in a local-remote setup. However, it can be run using one tester and a far-end loopback device.



Running Service Activation Test in local - remote configuration using two MT1000A testers

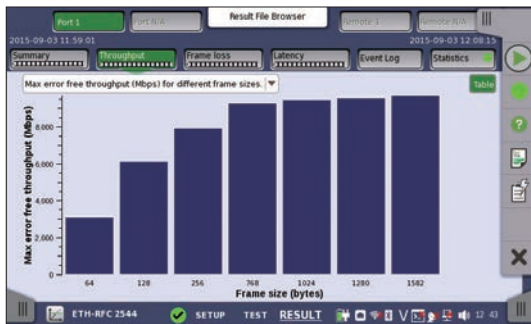
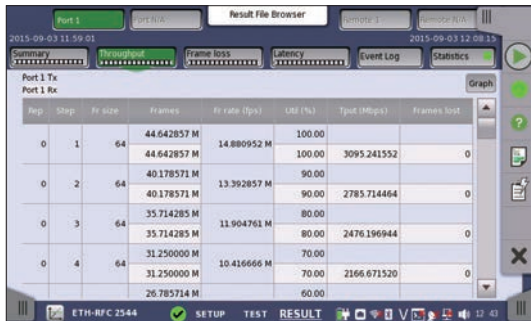
Running the Service Activation Test in a local-remote configuration with two MT1000A testers supports control from the local instrument. Relevant data is transferred to the remote and results from both testers are displayed on the local instrument after the test is completed. Easy-to-understand graphics show passed and failed tests. When further analysis is required, the display can be expanded to show all test details. For measurements of Frame Transfer Delay (FTD) between two MT1000A testers, the GPS option provides synchronization for true one-way FTD measurement.



## Carrier Ethernet Installation and Troubleshooting

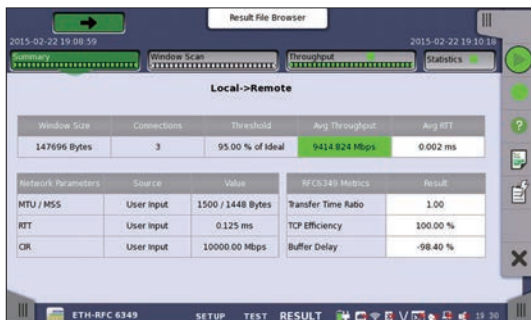
### RFC 2544 Test

RFC 2544 testing of Throughput, Frame Loss, Latency, Packet Jitter and Burstability is straightforward with the MT1000A/MU100010A. It automates the procedure while still allowing thorough test configuration. For full information on performance at both line sides, the end-to-end test mode allows two MT1000A testers to work together in a local-remote configuration where the user controls both testers and reads results from both locally. Easy to understand tabular screens and bar graph presentations simplifies reading of results. Attractive looking reports can be generated for presentation to end-customers.



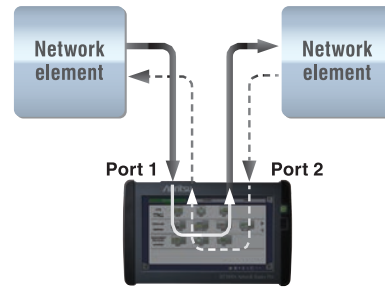
### TCP Throughput Option (RFC 6349, iPerf)

Optimizing performance is essential in modern communication networks. In IP networks, operators can test based on IETF RFC 2544 and ITU-T Y.1564, but even if they find that their networks are working fine using these tests, customers may complain that the achieved throughput is below their agreement with the operator. This may be caused by a non-optimum configuration of the Transmission Control Protocol (TCP) providing higher layer connections through the network. RFC 6349 is a test methodology that operators can use to optimize TCP throughput. The MT1000A/MU100010A with TCP Throughput option is ideally suited to supporting TCP throughput optimization based on RFC 6349. iPerf client for TCP throughput is also supported.



### Pass-through Mode

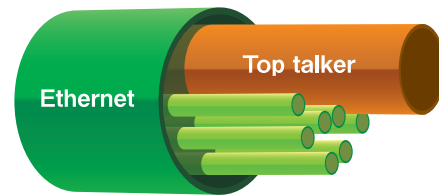
Configuring the MT1000A/MU100010A to Pass-through mode supports detailed troubleshooting, especially in bi-directional networks requiring traffic monitoring from both ends.



Pass-through monitoring by inserting MT1000A/MU100010A in network

### IP Channel Statistics – Multiflow Counters

Up to 230 flows can be selected and filtered by MAC and IP Source/Destination addresses, VLAN and MPLS to monitor selected streams and display detailed information. This allows the user to identify error streams, top talkers, and network attacks, as well as troubleshoot network issues more deeply.



### Ethernet OAM

To improve the performance of Ethernet-based networks and provide Carrier Class service, many network providers have enhanced their systems with Ethernet OAM (Operation, Administration and Maintenance), supporting the ability to detect network faults and measure performance. Ethernet OAM is defined by three standards covering different network sections. The ITU-T Y.1731 and IEEE 802.1ag standards are similar and support end-to-end network functionality, while the IEEE 802.3 (previously IEEE 802.3ah) standard supports first (or last) mile functionality. The MT1000A/MU100010A tests the network using all supported OAM functions.

### Ethernet Multistream

The MT1000A/MU100010A Ethernet Multistream function allows simulation and testing of a congested network's ability to prioritize high-priority traffic over low-priority traffic. The user can set different priorities for up to 16 streams per port to measure how frame loss affects network performance. The Multistream function displays clear information on Packet Jitter and Latency per stream, helping troubleshoot problematic issues for VoIP services, etc.



# Ethernet/Fibre Channel Application

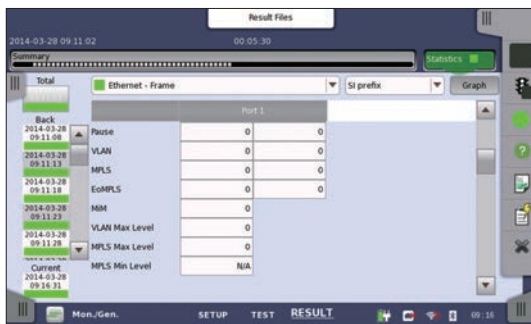
## Carrier Ethernet Installation and Troubleshooting

### Stacked VLAN

Stacked VLAN (Q-in-Q) is used increasingly by several types of Ethernet-based networks, allowing operators to split traffic from different customers on one line or to shape traffic by priority. The MT1000A/MU100010A supports up to 8 levels of VLAN tags, offering a powerful network test tool.

### MPLS and MPLS-TP

Multi-Protocol Label Switching (MPLS) supports efficient traffic routing on packet-based networks. MPLS – Transport Profile (MPLS-TP) technology is based on standard MPLS and aims to give service providers reliable connection-oriented packet-based transport over the network. MPLS-TP offers service providers QoS, end-to-end Carrier Class OAM, and protection switching. With its ability to insert up to 8 levels of MPLS labels, the MT1000A/MU100010A is a powerful tool for testing MPLS and MPLS-TP networks including OAM functions.



### PBB

The Provider Backbone Bridge (PBB) technology is designed to provide Carrier Class division of the networks at layer 2 often referenced as MAC-in-MAC. Allowing multiple provider bridge networks to be interconnected without VLAN addresses conflict.

### Protocol Analysis

For advanced Ethernet troubleshooting the MT1000A/MU100010A supports a frame capture function for capturing frames of live traffic on the monitored line. Captured frames are analyzed using the Wireshark protocol analysis software.

## Powerful Storage Area Networking (SAN) Testing

Many operators need to support Fibre Channel links in Storage Area Networks (SAN) together with other transport technologies like OTN, Ethernet, and SDH/SONET. Having one tool for all technologies is important for efficient testing. The multi-protocol MT1000A/MU100010A with Fibre Channel option is the perfect tool for deploying Fibre Channel with support for testing links at rates up to 10 Gbps and it also supports other technologies like OTN, Ethernet, CPRI/OBSAI, SDH/SONET and PDH/DSn. The all-in-one MT1000A gives the user less equipment to maintain and learn, helping reduce operating expenses.

### Fibre Channel test features include:

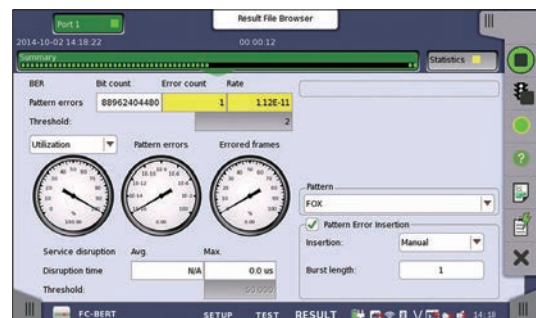
- 1GFC, 2GFC, 4GFC, 8GFC, and 10GFC tests
- Optional mapping to OTN
- Latency measurement
- BER tests including service disruption measurement
- Line alarm and error monitor
- Normal or Reflector mode

### Latency

High latency is a problem for many applications, including SAN, and network operators and service providers urgently need a tool like the MT1000A/MU100010A with Fibre Channel option to test latency on Fibre Channel lines and equipment.

### Fibre Channel BER Tests

The MT1000A/MU100010A with Fibre Channel option supports BER tests to measure the performance of Fibre Channel lines and equipment. Service disruption measurement is also supported.



# Mobile Backhaul/Mobile Fronthaul Application

## Mobile Backhaul Installation and Verification

SyncE and IEEE 1588 v2 are network synchronization technologies used by mobile backhaul networks. Since the base station generates wireless signals based on the synchronization signal distributed by the mobile backhaul, synchronization faults in the mobile backhaul have far-reaching deleterious effects on mobile communications performance. As a result, mobile operators must confirm that the SyncE and IEEE 1588 v2 functions are normal. The MT1000A/MU100010A support SyncE (ITU-T G.826x) and IEEE 1588 v2 (G.8265.1 and G.8275.1) protocol tests and analyses for monitoring SSM messages, and effectively troubleshooting and analyzing network faults, such as interoperability issues caused by abnormal vendor clock devices.

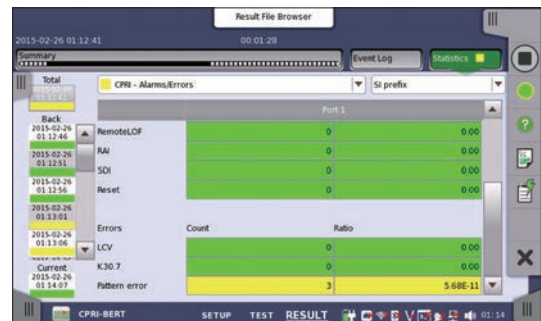
Moreover, the increasingly widespread deployment of LTE-Advanced is leading to configuration of time and phase synchronized mobile backhaul networks using IEEE 1588 v2 (G.8275.1). The MU100090A option supports high-accuracy measurements of max|TE|, cTE, and dTE metrics used to measure time and phase synchronization. Installing the MU100090A in the MT1000A/MU100010A enables easy Pass/Fail evaluations when installing and commissioning time and phase synchronous networks.



## Mobile Fronthaul Installation and Verification

Operators are supporting the explosive spread of smartphones and tablets by increasing the bandwidth of mobile communications networks, in turn driving a complete change in mobile communications systems, typified by adoption of Centralized-Radio Access Networks (C-RAN). Using C-RAN, the mobile fronthaul is configured from centralized Base Band Units (BBU) and multiple Remote Radio Head (RRH) units connected via general-purpose interfaces, such as the Common Public Radio Interface (CPRI) or Open Base Station Architecture Initiative (OBSAI). Support from CPRI interface rate option 1 (614.4 Mbit/s) to option 8 (10.1376 Gbit/s) ensures testing of all current and future requirements. Combining testing at any rate with the ability to exercise the BBU or RRH up to the Passive link state (as per the latest CPRI standard) or in pass-through mode supports a complete solution for detailed installation and maintenance testing. Checking for and inserting of Layer-2 Alarms and Errors between the BBU and RRH ensures that engineers can complete advanced fault finding and evaluate the root cause of any issue. Furthermore, we are also examining arranging the C-RAN as a ring along with incorporation of the CPRI network fault auto-switching function.

The MT1000A/MU100010A has a built-in CPRI/OBSAI interface and can perform BER tests, various error and alarm tests, and Return Time Delay (RTD) tests, as well as display the Link status using BBU/RRH emulation, and perform pass-through monitoring and CPRI-APS measurements. In addition, the CPRI can be tested as a client signal mapped to OTN.



# SDH/SONET, PDH/DSn Application

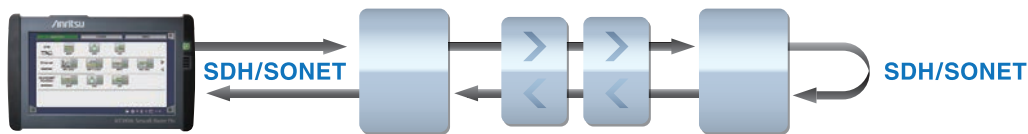
## Quick and Easy Tests of SDH/SONET and PDH/DSn Networks

Legacy technologies in transport networks can't just be eliminated because of the huge capital investment, but keeping legacy technologies operational can require several testers.

With its SDH/SONET and PDH/DSn test options, the MT1000A/MU100010A is a powerful and easy-to-use tool for testing SDH/SONET up to STM-64/OC-192. PDH/DSn systems (E1, E3, E4, DS1 and DS3) can be tested directly or embedded into SDH/SONET. The MT1000A can support new and legacy technologies, leaving the user less equipment to maintain and learn, and reducing operating expenses.

### SDH/SONET and PDH/DSn test features include:

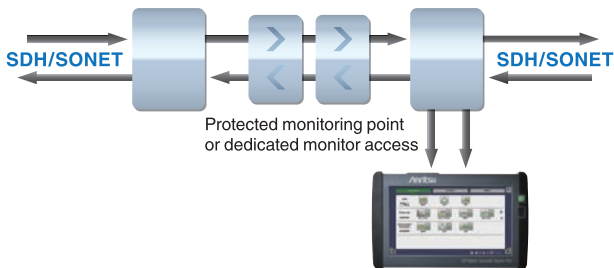
- Powerful testing of SDH (STM-64, STM-16, STM-4, STM-1), SONET (OC-192, OC-48, OC-12, OC-3, STS-3) systems and embedded PDH (E1, E3, E4) and DSn (DS1, DS3) systems
- Powerful testing of PDH (E1, E3, E4) and DSn (DS1, DS3) systems
- Simultaneous bi-directional monitoring of SDH/SONET and PDH/DSn lines
- SDH/SONET mapping and de-mapping of PDH/DSn signals
- Comprehensive error and alarm statistics
- SDH/SONET overhead byte testing and monitoring
- SDH/SONET tributary scan
- SDH/SONET pointer event generation and monitoring
- SDH/SONET and PDH/DSn delay measurements
- Analysis of service disruption with APS application



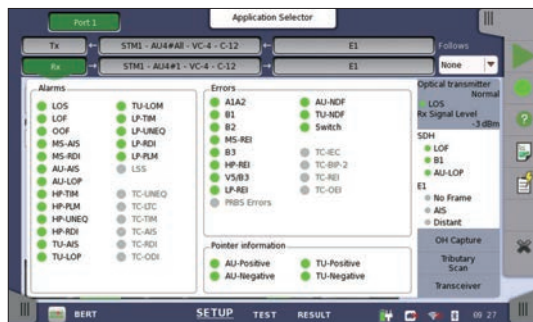
Looping-back test signal from MT1000A at far end supports SDH/SONET line quality tests

### SDH/SONET Installing and Commissioning Testing

The MT1000A/MU100010A has powerful statistical measurements for BER testing at installing/commissioning and troubleshooting out-of-service SDH/SONET lines. Statistics are also collected for in-service analysis of line transmission-error performance together with information on pointer operations. G.826, G.828, G.829, or M.2100 error-performance parameters are calculated and the measurement result is highlighted by easy-to-understand color coding. Errors, alarms, pointer operations and overhead byte changes can be inserted into the transmitted signal for stress testing.



Bi-directional in-service monitoring of SDH/SONET lines



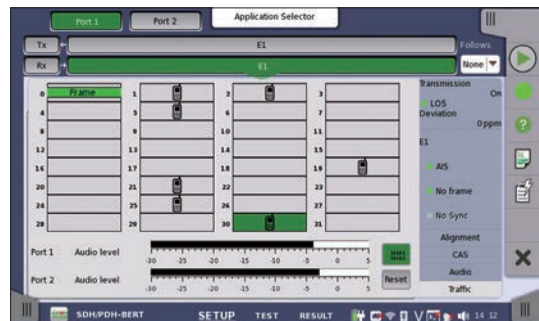
Quick overview of errors and alarms for both sides of SDH/SONET line

### Speeds-up SDH/SONET Troubleshooting

The MT1000A/MU100010A monitor function speeds-up troubleshooting by providing key information on the monitored system, including line alarms and errors, input frequency and deviation, optical input level and overhead bytes. Information is also available on embedded PDH/DSn signals.

### PDH (E1, E3, E4) and DSn (DS1, DS3) Testing

The MT1000A/MU100010A has powerful statistical measurements for BER testing at installing/commissioning and troubleshooting out-of-service PDH/DSn lines. Statistics are also collected for in-service analysis of line transmission-error performance of PDH/DSn lines, and G.826 or M.2100 error-performance parameters are calculated. Furthermore, PDH/DSn signals can be mapped to the SDH/SONET signal.



Monitor 64 kbps traffic channels on bidirectional E1 line with MT1000A/MU100010A traffic display

# Optical Modules Selection Guide

Optical interface tests can be run using the MT1000A/MU100010A just by inserting an optical module supporting the relevant standard into the SFP/SFP+ slot.

The following table lists the lineup of SFP/SFP+ application parts, and the corresponding standards.

Model/Order No.	Description (Approx. Distance)	Max. Input Power	Input Sensitivity	Input Wavelength	Output Power	Output Wavelength	Loop Back
G0332A 100M FX 1310 nm MM SFP	100BASE - FX 1310 nm multi mode (2 km)	-14 dBm	-31 dBm	1270 nm to 1600 nm	-20 to -15 dBm	1280 nm to 1380 nm	OK
G0329A 10G LR 1310 nm SFP+	10GBASE - LR 1310 nm single mode (10 km)	+0.5 dBm	-14 dBm	1260 nm to 1355 nm	-8.2 to +0.5 dBm	1260 nm to 1355 nm	OK
G0315A 10G LR/LW 1310 nm SFP+	10GBASE - LR 1310 nm single mode (10 km)	+0.5 dBm	-14.4 dBm	1260 nm to 1565 nm	-6 to -1 dBm	1290 nm to 1330 nm	OK
G0316A 10G ER/EW 1550 nm 40 km SFP+	10GBASE - ER 1550 nm single mode (40 km)	-1 dBm	-15.8 dBm	1260 nm to 1565 nm	-3 to +3 dBm	1530 nm to 1560 nm	>4 dB ATT
G0318A 10G ZR/ZW 1550 nm 80 km SFP+	10GBASE - ER 1550 nm single mode (80 km)	-8 dBm	-22 dBm	1260 nm to 1565 nm	0 to +5 dBm	1525 nm to 1565 nm	>13 dB ATT
G0319A Up to 2.7G 1310 nm 15 km SFP	STM-1/4/16 short haul 1310 nm single mode (15 km)	0 dBm	-18 dBm	1270 nm to 1580 nm	-5 to 0 dBm	1260 nm to 1360 nm	OK
G0320A Up to 2.7G 1310 nm 40 km SFP	STM-1/4/16 long haul 1310 nm single mode (40 km)	-9 dBm	-27 dBm	1270 nm to 1580 nm	-2 to +3 dBm	1280 nm to 1335 nm	>12 dB ATT
G0321A Up to 2.7G 1550 nm 80 km SFP	STM-1/4/16 long haul 1550 nm single mode (80 km)	-9 dBm	-28 dBm	1270 nm to 1580 nm	-2 to +3 dBm	1500 nm to 1580 nm	>12 dB ATT
G0328A 1G/2G/4G FC 850 nm SFP	1GFC, 2GFC, 4GFC 850 nm multi mode (0.5 km)	-3 dBm	-15 dBm	830 nm to 860 nm	-9 to 0 dBm	830 nm to 860 nm	>3 dB ATT
G0322A 1G/2G/4G FC 1310 nm SFP	1GFC, 2GFC, 4GFC 1310 nm single mode (10 km)	-3 dBm	-18 dBm	1260 nm to 1360 nm	-8 to 0 dBm	1260 nm to 1360 nm	>3 dB ATT
G0323A 1G/2G/4G FC 1550 nm SFP	1GFC, 2GFC, 4GFC 1550 nm single mode (40 km)	-3 dBm	-18 dBm	1470 nm to 1600 nm	0 to +5 dBm	1510 nm to 1590 nm	>8 dB ATT
G0356A 8G FC/10G SR 850 nm SFP+	8GFC, 10GFC, 10GBASE - SR 850 nm multi mode (0.3 km)	-1 dBm	-11.1 dBm	840 nm to 860 nm	-7.3 to -1.0 dBm	840 nm to 860 nm	OK

Model/Order No.	Name	Form Factor	100 Meg Ethernet	156 Meg STM-1	614 Meg CPRI	622 Meg STM-4	768 Meg OBSAI	1 Gig FC	1.23 Gig CPRI	1.25 Gig Ethernet	1.54 Gig OBSAI	2 Gig FC	2.46 Gig CPRI	2.488 Gig STM-16	2.67 Gig OTU1	3.07 Gig CPRI OBSAI	4 Gig FC	4.92 Gig CPRI	6.14 Gig CPRI OBSAI	8 Gig FC	9.83 Gig CPRI	9.95 Gig STM-64	10.1 Gig CPRI	10.3 Gig Ethernet	10.5 Gig FC	10.7 Gig OTU2	11.05 Gig OTU1e	11.09 Gig OTU2e	11.27 Gig OTU1f	11.3 Gig OTU2f	
G0332A	100M FX 1310 nm MM SFP	SFP	1310 nm, MM, 2 km																												
G0329A	10G LR 1310 nm SFP+	SFP+																						1310 nm, SM, 10 km							
G0315A	10G LR/LW 1310 nm SFP+	SFP+																						1310 nm, SM, 10 km							
G0316A	10G ER/EW 1550 nm 40 km SFP+	SFP+																							1550 nm, SM, 40 km						
G0318A	10G ZR/ZW 1550 nm 80 km SFP+	SFP+																							1550 nm, SM, 80 km						
G0319A	Up to 2.7G 1310 nm 15 km SFP	SFP							1310 nm, SM, 15 km																						
G0320A	Up to 2.7G 1310 nm 40 km SFP	SFP							1310 nm, SM, 40 km																						
G0321A	Up to 2.7G 1550 nm 80 km SFP	SFP							1550 nm, SM, 80 km																						
G0328A	1G/2G/4G FC 850 nm SFP	SFP							850 nm, MM, 0.5 km																						
G0322A	1G/2G/4G FC 1310 nm SFP	SFP							1310 nm, SM, 10 km																						
G0323A	1G/2G/4G FC 1550 nm SFP	SFP							1550 nm, SM, 40 km																						
G0356A	8G FC/10G SR 850 nm SFP+	SFP+																			850 nm, MM, 0.3 km										

# Network Master Pro MT1000A Mainframe Specifications

User Interfaces	
Display	9-inch active TFT display (800 × 480 pixels) and touch screen
Supported Languages	English, Chinese, Japanese, French, Russian, Spanish

Service Interfaces	
USB Data Interface	MT1000A operates as host: USB 2.0 type A (2 ports) MT1000A operates as device: USB 2.0 type Mini-B (1 port)
Ethernet Interface	Ethernet 10M/100M/1000M, Connector: RJ45
WLAN Interface*	IEEE 802.11 b/g/n
Bluetooth Interface*	Bluetooth 2.1 +EDR

\*: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.

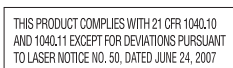
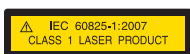
Other Interfaces	
Audio Interface	For connection of CTIA Standard head set Connector: 3.5-mm diameter jack
AUX Connector	For connection of optional G0325A GPS receiver With MT1000A-005: For connection of Optional MU100090A
Built-in Loudspeaker	Monitors speech of voice channel Output level: user-controlled from user Interface
Ext. Clock Input	For connection of external clock signals: SETS (E1: 2.048 Mbps), BITS (DS1: 1.544 Mbps) or 2.048 MHz TTL signal in accordance with ITU-T G.703, 10 MHz Connector: BNC (50Ω)

Miscellaneous	
Battery	10.8 V rechargeable and replaceable intelligent Li-ion battery Operating time: 4 hours (typ.) Charging time: 3 to 6 hours (typ.) Remaining capacity indication: %
Mains Adapter	Input: 100 V(ac) to 240 V(ac), 50 Hz/60 Hz Output: 18 V(dc), 3.62 A (max.) Power Consumption: ≤65 W
Dimensions and Mass	257 (W) × 164 (H) × 77 (D) mm ≤2.7 kg (including MT1000A, MU100010A and battery)
Environmental	Temperature Operating : 0° to +50°C (non-condensing) Charging: 0° to +40°C (non-condensing) Storage: -30° to +60°C (non-condensing, without battery or AC adapter) -20° to +50°C (non-condensing, with battery and AC adapter) Humidity Operating: ≤85% RH (non-condensing) Storage and Transportation: ≤90% RH (non-condensing)
EMC	EN61326-1, EN61000-3-2
LVD	EN61010-1
Laser Safety*2	IEC 60825-1: 2007 CLASS 1, 21CFR1040.10 and 1040.11*1: MU100010A with optical modules

\*1: Excludes deviations caused by conformance to Laser Notice No. 50 dated June 24, 2007

\*2: Safety measures for laser products

This product complies with optical safety standards in 21CFR1040.10, 1040.11 and IEC 60825-1; the following descriptive labels are affixed to the product.



# Ordering Information

Please specify the model/order number, name and quantity when ordering.  
The names listed in the table below are Order Names. The actual name of the item may differ from the Order Name.

## Mainframe

Model/Order No.	Name
MT1000A	Network Master Pro
<b>Standard Accessories</b>	
	Line Code*1: 1 pc
B0690A	Softbag: 1 pc
B0728A*2	Rear Panel kit: 1 pc
G0309A	AC Adapter: 1 pc
G0310A	Li-ion Battery: 1 pc
Z1746A	Stylus: 1 pc
Z1747A*3	Carrying Strap: 1 pc
Z1748A*4	Handle: 1 pc
Z1817A*5	Utilities ROM: 1 pc
<b>Options</b>	
MT1000A-003*6	Connectivity for WLAN/Bluetooth
MT1000A-005*7	AUX I/O

- \*1: One line cord is attached to the area to shipment.
- \*2: Set of B0720A (Rear Panel) and B0732A (Screw Set).
- \*3: Shoulder strap for MT1000A.
- \*4: Hand strap for MT1000A.
- \*5: DVD ROM containing operation manual, remote script instruction manual, etc.
- \*6: Available for certified countries and regions including USA, Canada, Japan and EU countries. Please visit the Anritsu web site for updated information.
- \*7: Required to carry MU100090A. MT1000A-205 is a retrofit option.

## Measurement Module

Model/Order No.	Name
MU100010A	10G Multirate Module
<b>Standard accessories</b>	
W3681AE	MT1000A/MU100010A Quick Reference Guide
B0692A*8	ESD Box (for optical modules)

- \*8: Up to four SFP+/SFPs can be stored.

## Options\*9

Model/Order No.	Name
<b>Low Rate</b>	
MU100010A-001*10	Up to 2.7G Dual Channel
<b>Ethernet</b>	
MU100010A-011*11	Ethernet 10G Single Channel
MU100010A-012*11	Ethernet 10G Dual Channel
MU100010A-020*12	TCP Throughput
<b>OTN</b>	
MU100010A-051*13	OTN 10G Single Channel
MU100010A-052*13	OTN 10G Dual Channel
MU100010A-061*14	ODU Multiplexing
MU100010A-062*15	ODU Flex
<b>CPRI/OBSAI</b>	
MU100010A-071	CPRI/OBSAI Up to 5G Dual Channel
MU100010A-072*16	CPRI/OBSAI 6G to 10G Single Channel
MU100010A-073*16	CPRI/OBSAI 6G to 10G Dual Channel
<b>SDH/SONET</b>	
MU100010A-081*17	STM-64 OC-192 Single Channel
MU100010A-082*17	STM-64 OC-192 Dual Channel
<b>Fibre Channel</b>	
MU100010A-002	FC 1G 2G 4G Dual Channel
MU100010A-091*18	FC 8G 10G Single Channel
MU100010A-092*18	FC 8G 10G Dual Channel

- \*9: These options can be retrofitted.  
The Model/Order No. of retrofit options is "-3\*\*".  
Example  
MU100010A-001 Up to 2.7G Dual Channel becomes MU100010A-301 Up to 2.7G Dual Channel Retrofit.  
In addition, specify one of the following media along with the required option.  
Z1849A: DVD-ROM for Retrofit Options  
Z1850A: USB Stick for Retrofit Options
- \*10: Includes OTN (OTU1), Ethernet (10 Mbps, 100 Mbps, 1 Gbps), SDH up to STM-16, SONET up to OC-48, PDH (E1, E3, E4), and DSn (DS1, DS3)
- \*11: MU100010A-011, MU100010A-012: Only one of these options can be installed.
- \*12: MU100010A-020: Requires that at least one of the following options is installed: MU100010A-001, MU100010A-011, MU100010A-012
- \*13: MU100010A-051, MU100010A-052: Only one of these options can be installed.
- \*14: MU100010A-061: Requires that at least one of the following options is installed: MU100010A-001, MU100010A-051, MU100010A-052
- \*15: MU100010A-062: Requires that at least one of the following options is installed: MU100010A-001, MU100010A-051, MU100010A-052
- \*16: MU100010A-072, MU100010A-073: Only one of these options can be installed.
- \*17: MU100010A-081, MU100010A-082: Only one of these options can be installed.
- \*18: MU100010A-091, MU100010A-092: Only one of these options can be installed.

## GPS Disciplined Oscillator

Model/Order No.	Name
MU100090A*19	High Performance GPS Disciplined Oscillator
<b>Standard accessories</b>	
J1705A	AUX Conversion Adaptor
J1706A	GPS Antenna
J1710A	BNC Cable (20 cm) × 2

- \*19: Excellent Eco Product non-compliant.  
The MT1000A-005 option is required to install the MU100090A in the MT1000A.



# Ordering Information

## Optional Accessories

Model/Order No.	Name
<b>Main Unit Accessories</b>	
B0691B*20	Hard Case
B0733A*21	Hard Case
G0306A	Video Inspection Probe
G0324A	Battery Charger
G0325A	GPS Receiver
J1569A	Car 12 Vdc Adapter
J1570A	Head Set
J1667A*22	GPIB-USB Converter
<b>Operation Manuals</b>	
W3682AE	MT1000A/MU100010A Operation Manual
Z1821A*23	Utilities in USB Stick
<b>Optical Module</b>	
G0332A	100M FX 1310 nm MM SFP
G0356A	8G FC/10G SR 850 nm SFP+
G0329A	10G LR 1310 nm SFP+
G0315A	10G LR/LW 1310 nm SFP+
G0316A	10G ER/EW 1550 nm 40 km SFP+
G0318A	10G ZR/ZW 1550 nm 80 km SFP+
G0319A	Up to 2.7G 1310 nm 15 km SFP
G0320A	Up to 2.7G 1310 nm 40 km SFP
G0321A	Up to 2.7G 1550 nm 80 km SFP
G0328A	1G/2G/4G FC 850 nm SFP
G0322A	1G/2G/4G FC 1310 nm SFP
G0323A	1G/2G/4G FC 1550 nm SFP
<b>Cables</b>	
J1571A	Optical Cable SM LC/PC to SC/PC 3 m
J1575A	Optical Cable SM LC/PC to FC/PC 3 m
J1579A	Optical Cable SM LC/PC to LC/PC 3 m
J1581A	Optical Cable MM LC/PC to LC/PC 3 m
J1583A	Optical Attenuator 10 dB LC/PC to LC/PC
J1584A	RJ45 Cable 3 m
J1585A*24	RJ48 to Crocodile Clips Cable 3 m
J1586A*24	RJ48 to Crocodile Clips Cable 20 dB ATT 3 m
J1588A*25	BNC Cable 2.5 m
J1589A*25	BNC to 1.6/5.6 Cable 2.5 m
J1591A*24	RJ48 to Two 3-pin Banana Plug Cable 2.5 m
J1597A*24	RJ48 Balanced PDH Cable Crossed 3 m
J1598A*26	Bantam Cable 3 m
J1710A*27	BNC Cable 0.2 m
J0127B*27	COAXIAL CORD, 2.0 M
<b>Module Connection Parts</b>	
B0720A	Rear Panel
B0728A*28	Rear Panel Kit
B0729A*29	Screw 1U
B0730A*29	Screw 2U
B0731A*29	Screw 3U
B0732A*30	Screw Kit

- \*20: Can use module 1 to 2 in combination
- \*21: Can use module 1 to 3 in combination
- \*22: J1667A is required for SCPI remote control via GPIB
- \*23: Include MT1000A Operation Manual and the Remote Script Manual.
- \*24: E1 interface cable.
- \*25: E1, E3, E4, DS3, STM-1e, STS-3 interface cable. Impedance: 75Ω
- \*26: DS1 interface cable.
- \*27: 50Ω impedance cable for MU100090A and main-frame external clock input connector
- \*28: Includes B0720B and B0732A
- \*29: Includes 4 bolts of same length
- \*30: Four bolts of each length for 12 bolts total

## Maintenance Service

Model/Order No.	Name
MT1000A-ES210	2 Years Extended Warranty Service
MT1000A-ES310	3 Years Extended Warranty Service
MT1000A-ES510	5 Years Extended Warranty Service
MU100010A-ES210	2 Years Extended Warranty Service
MU100010A-ES310	3 Years Extended Warranty Service
MU100010A-ES510	5 Years Extended Warranty Service
MU100090A-ES210	2 Years Extended Warranty Service
MU100090A-ES310	3 Years Extended Warranty Service
MU100090A-ES510	5 Years Extended Warranty Service



Standard Softbag B0690A

The standard accessory softbag accommodates the MT1000A with MU100010A and accessories.



Hard Case B0691B



Hard Case B0733A

# Network Master Pro MT1000A

## Related Products

### Network Master Pro MT1000A

**OTDR Module 1310/1550 nm SMF** MU100020A  
**OTDR Module 1310/1550/850/1300 nm SMF/MMF** MU100021A  
**OTDR Module 1310/1550/1625 nm SMF** MU100022A

Installing an OTDR Module MU100020A/MU100021A provides the OTDR functions required for optical fiber I&M. Work efficiency is increased by all-in-one support for optical fiber tests and data communications network commissioning.

I&M tests of 1.5-Mbps to 10-Gbps communications networks can be executed by simultaneously installing the MU100010A. In addition to supporting Ethernet, OTN, etc., networks, Mobile base station CPRI and OBSAI, as well as SyncE protocols are also supported.

**CPRI RF Module** MU100040A

Installing the CPRI RF Module MU100040A in the MT1000A supports analysis of IQ signal frequency characteristics included in CPR signals between the LTE base station RRH and BBU. This can be used to check operation of the RRH after installation.



### Network Master Flex MT1100A

All-in-one, up to 4-port transport tester supporting from 1.5 Mbps to 100 Gbps including OTN, Ethernet, CPRI/OBSAI, Fibre Channel, SDH/SONET and PDH/DSn.



### MT9090A Series

**μOTDR Module** MU909014/15

Compact OTDR for full automatic verification of optical networks, FTTH-PON, Metro and Core.



**Optical Channel Analyzer Module** MU909020A

Compact CWDM channel analyzer to verify power levels, drift and channel presence of CWDM networks.



**Gigabit Ethernet Module** MU909060A

Dedicated field test solution for installation and troubleshooting Ethernet links in access networks.



### CMA5 Series

**Light Source/Optical Power Meter**

For optical fiber installation and maintenance.



### MT9083 Series

**ACCESS Master Mini-OTDR**

All-in-one test tool for fiber construction and maintenance.



**Note:**

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