MU120103A/B 2.5G (1.31) Module
MU120104A/B 2.5G (1.55) Module
MU120105A 10G (1.31) Module
MU120106A 10G (1.55) Module
Operation Manual

19th Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided within the MD1230B Data Quality Analyzer Operation Manual or MP1591A Network Performance Tester Operation Manual. Please also refer to this document before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W1932AE-19.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

DANGER This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.

These indicate that the marked part should be recycled.

MU120103A/B 2.5G (1.31) Module
MU120104A/B 2.5G (1.55) Module
MU120105A 10G (1.31) Module
MU120106A 10G (1.55) Module
Operation Manual

17 September 2001 (First Edition)
1 August 2008 (19th Edition)

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the National Institute of Advanced Industrial Science and Technology, and the National Institute of Information and Communications Technology, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, under the condition that this warranty is void when:

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation shall assume no liability for injury or financial loss of the customer due to the use of or a failure to be able to use this equipment.

Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

Notes On Export Management

This product and its manuals may require an Export License/Approval by the Government of the product's country of origin for re-export from your country.
Before re-exporting the product or manuals, please contact us to confirm whether they are export-controlled items or not.
When you dispose of export-controlled items, the products/manuals needed to be broken/shredded so as not to be unlawfully used for military purpose.

Notice

The following actions are strictly prohibited for all of the software installed in this product or otherwise provided by Anritsu:

1. Copying, except for archival purposes,
2. Transferring to a third party apart from this product,
3. Analyzing the incorporated software including but not limited to modifying, decompiling, disassembling, and reverse engineering.

CE Conformity Marking

Anritsu affixes the CE Conformity marking on the following product (s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

CE

1. Product Model

Plug-in Modules: MU120103A/B 2.5G (1.31) Module,
MU120104A/B 2.5G (1.55) Module,
MU120105A 10G (1.31) Module,
MU120106A 10G (1.55) Module

2. Applied Directive and Standards

When the above modules are installed in the main frame shown below, the applied directive and standards of these modules conform to those of the main frame.

Main frame: MD1230A/B Data Quality Analyzer,
MD1231A/A1 IP Network Analyzer,
MT7407A Multislot Chassis
MP1591A Network Performance Tester

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that the above modules can be used with.

C-tick Conformity Marking

Anritsu affixes the C-tick marking on the following product (s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-tick marking

1. Product Model

Plug-in Modules: MU120103A/B 2.5G (1.31) Module,
MU120104A/B 2.5G (1.55) Module,
MU120105A 10G (1.31) Module,
MU120106A 10G (1.55) Module

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MD1231A/A1 IP Network Analyzer,
MT7407A Multislot Chassis
MP1591A Network Performance Tester

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that the above modules can be used with.

About This Manual

This operation manual is for MD1230 and MP1590 families.

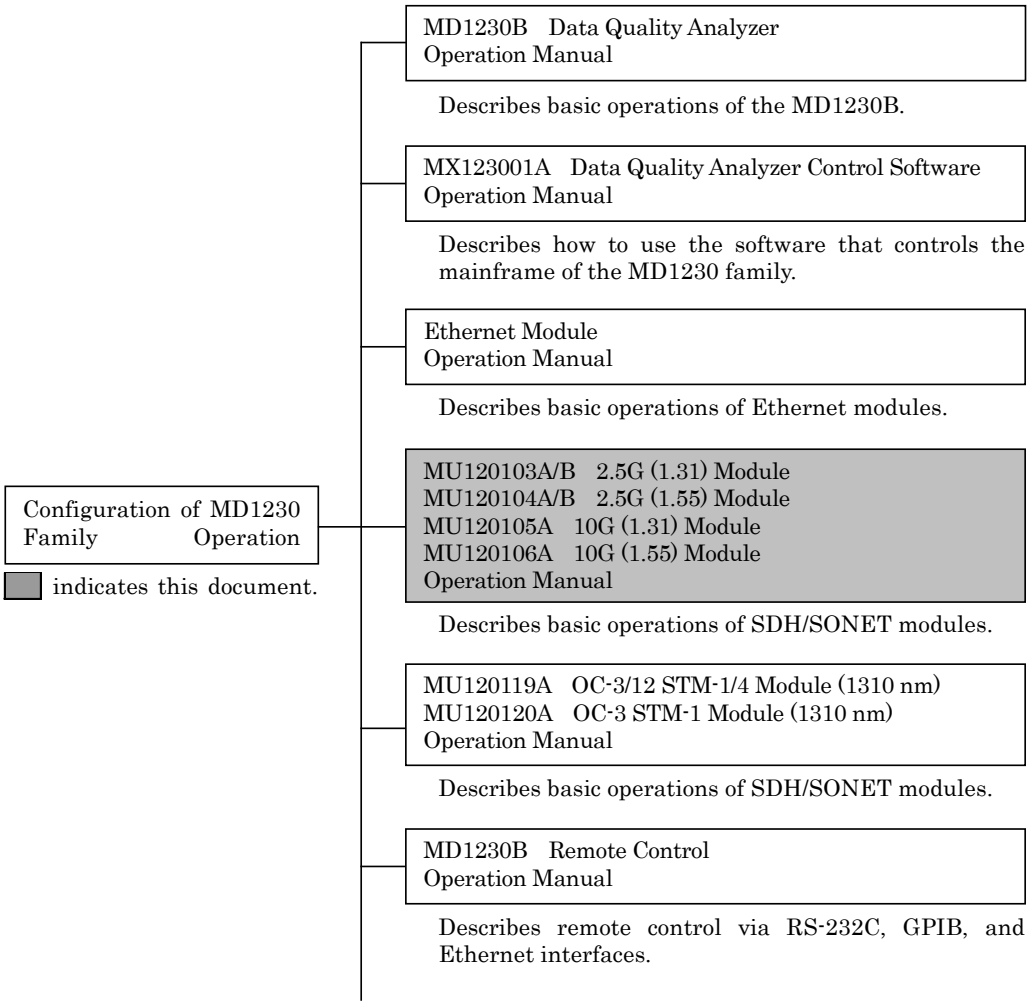
Note:

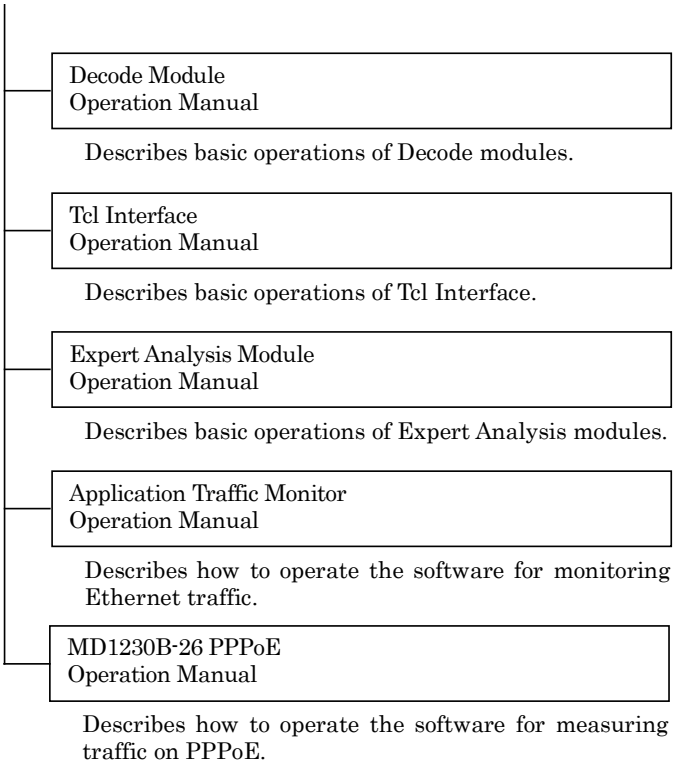
MD1230 family is a general name for the MD1230A/B Data Quality Analyzer, the MD1231A/A1 IP Network Analyzer, and the MT7407A Multislot Chassis.

The MP1590 family is a general name for the MP1590B Network Performance Tester and the MP1591A Network Performance Tester.

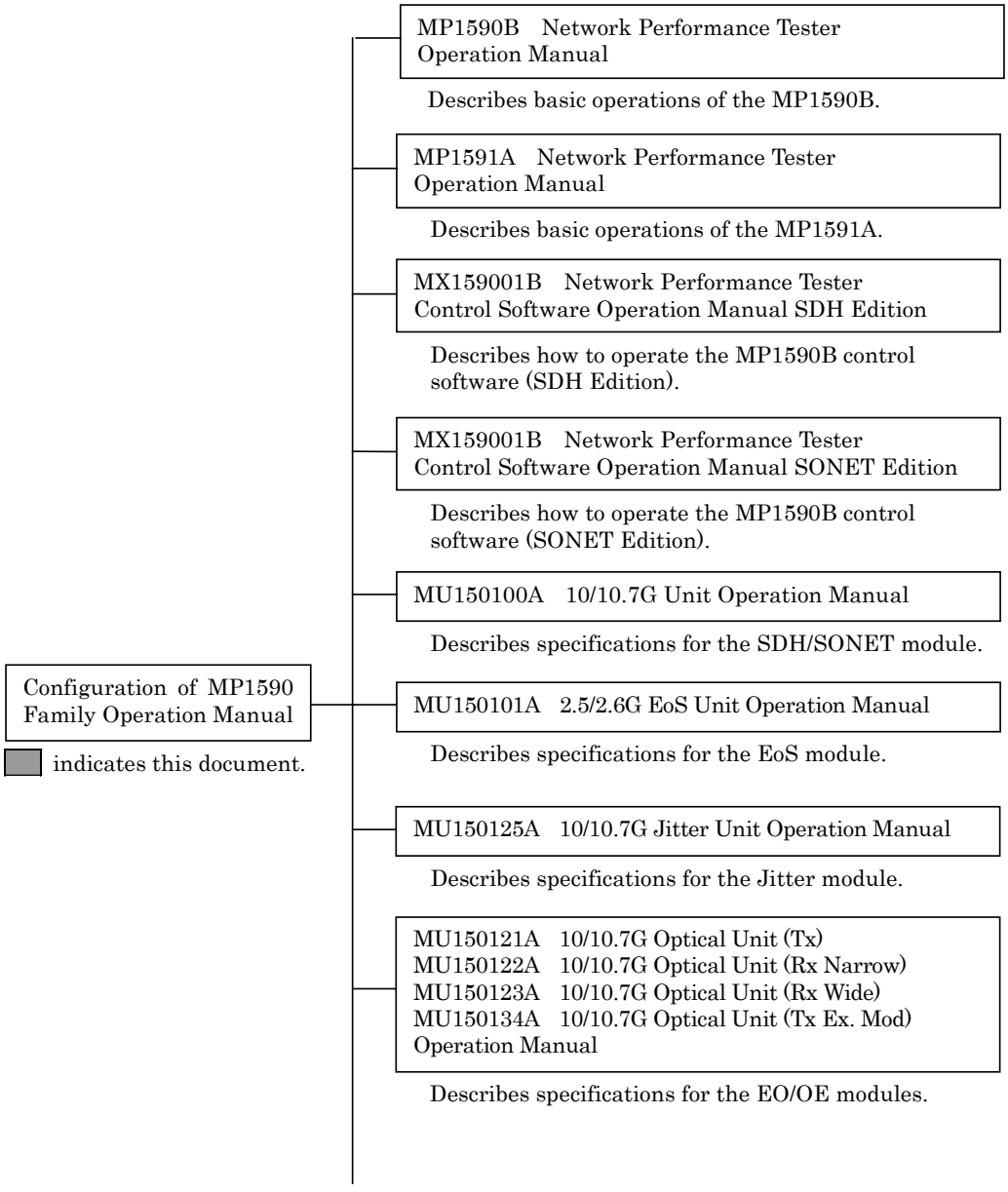
Note that the MD1230A, MD1231A/A1, and MT7407A are not supported in Ver. 7.0 and above.

The MD1230 family operation manuals consist of separate documents for the main unit, control software, module(s), remote control operation, and options, as shown below.




Decode Module
Operation Manual
Describes basic operations of Decode modules.
Tcl Interface
Operation Manual
Describes basic operations of Tcl Interface.
Expert Analysis Module
Operation Manual
Describes basic operations of Expert Analysis modules.
Application Traffic Monitor
Operation Manual
Describes how to operate the software for monitoring Ethernet traffic.
MD1230B-26 PPPoE
Operation Manual
Describes how to operate the software for measuring traffic on PPPoE.

The MP1590 family operation manuals consist of separate documents for the mainframe, module(s), control software, remote control operation, and options, as shown below.



MU150121B 10/10.7G Optical/Electrical Unit (Tx)
MU150123B 10/10.7G Optical/Electrical Unit (Rx Wide)
Operation Manual

Describes specifications for the MU150121B/23B.

MU150124B 10.3G Optical/Electrical Unit (Rx Wide)
Operation Manual

Describes specifications for the MU150124B.

Ethernet Module
Operation Manual

Describes basic operations of Ethernet modules.

MU120103A/B 2.5G (1.31) Module
MU120104A/B 2.5G (1.55) Module
MU120105A 10G (1.31) Module
MU120106A 10G (1.55) Module
Operation Manual

Describes basic operations of SDH/SONET modules.

MU120119A OC-3/12 STM-1/4 Module (1310 nm)
MU120120A OC-3 STM-1 Module (1310 nm)
Operation Manual

MP1590B/MP1591A Network Performance Tester
Remote Control Operation Manual

Describes remote control via RS-232C, GPIB, and Ethernet Interfaces.

MP1590A/B-30 High Precision Jitter Analysis
Operation Manual

Describes specifications for the MP1590A/B-30.

Application Traffic Monitor
Operation Manual

Describes how to operate the software for monitoring Ethernet traffic.

This manual uses the following notations.

(1) Notation on equipment name

This manual uses the following abbreviations on equipment name.

Full Name	Abbreviated Name
MD1230B Data Quality Analyzer	MD1230B
MP1591A Network Performance Tester	MP1591A
MU120103A/B 2.5G (1.31) Module MU120104A/B 2.5G (1.55) Module MU120105A 10G (1.31) Module MU120106A 10G (1.55) Module	2.5G/10G Module
MU120103A/B 2.5G (1.31) Module MU120104A/B 2.5G (1.55) Module	2.5G Module
MU120105A 10G (1.31) Module MU120106A 10G (1.55) Module	10G Module

(2) Notation on reference page

This manual indicates a related page, as below.

☞ For the details of specification and function, refer to Appendix A “Specifications.”

Table of Contents

Section 1 Overview

This section describes an overview of 2.5G/10G module functions.


For specifications, refer to Appendix “Specifications.”

1.1 Product Outline

The MD1230B equipped with the 2.5G/10G modules can test switches and routers in conformance with the SDH/SONET specifications, and capture or monitor the data that flows between switches.

The 2.5G/10G module measures Packets over SONET network. The function for sending/receiving frames encapsulated for PPP or HDLC allows for evaluation of POS systems or networks. In addition, the capture and thru-monitoring functions can be used for network monitoring or fault analysis.

(1) Available interfaces

The modules and their available interfaces are given below.

Modules	Available interfaces (wave-length band)
MU120103A/B	OC-48/STM-16, 2.5G, 1310 nm, single mode
MU120104A/B	OC-48/STM-16, 2.5G, 1550 nm, single mode
MU120105A	OC-192/STM-64, 10G, 1310 nm, single mode
MU120106A	OC-192/STM-64, 10G, 1550 nm, single mode

(2) Number of ports

Each 2.5G/10G module has a 1-port interface. Since a maximum of five 2.5G/10G modules can be mounted on one MD1230B unit, simultaneous tests on five independent ports are enabled (except for the traffic map and monitoring functions). In addition, daisy-chain connection of a maximum of eight MD1230B units enables the control of a maximum of 40 ports.

Modules	Number of ports/ module	Max. number of modules/ unit	Max. number of ports/unit	Max. number of ports for 8-unit connection
MU120103A/B	1	5	5	40
MU120104A/B	1	5	5	40
MU120105A	1	5	5	40
MU120106A	1	5	5	40

(3) Strong stream generation function and data analysis function

(a) Enables generating of up to 256 types of streams at full wire rate, and selecting increment, decrement, or random for the frame length of each stream.

(b) Enables selecting of any inter-frame gap between frames, and random generation of inter-frame gap.

(c) Enables generating of the stream for throughput, latency, frame-loss rate, back-to-back, system recovery, and reset tests (automatic test), required for the performance test of network equipment which are specified by RFC1242 and RFC2544.

(d) Enables counting of various frames such as: No. of sent/received frames, No. of sent/received bytes, SDH/SONET errors or alarms, FCS errors, under size, over size, IP checksum errors, TCP/UDP checksum errors, No. of QoS packets for each of eight priority levels, etc.

(e) Enables capturing of data flowing between units and analyzing the protocols using rich filter/trigger conditions such as the IP addresses, 32-bit user-defined patterns, error occurrences, etc.

(f) Enables monitoring of the frame arrival interval to check the network fluctuation (Frame Arrival Time measurement).

(g) Enables monitoring of the traffic among the units. This function can count and monitor the pair of IP addresses for IP data flow, and the traffic of individual protocol types.

(4) SDH/SONET overhead monitoring

Enables monitoring of the SDH/SONET overhead for alarms and errors.

(5) Protocol support function

Enables protocol emulation for IGMP, and BGP-4.

Section 2 Precautions Before Use

This section provides precautions to be understood before using 2.5G/10G modules. Be sure to read this Section because it also mentions the precautions for safety operations and avoiding unit troubles.

2.1 Installation Site Environmental Conditions

2.5G/10G modules operate normally under temperature 0 to 40°C. Avoid using them in a site exposed to:

- Vibrations
- Moisture or dust
- Direct sunlight
- May be affected by active gas
- Severe temperature fluctuations

CAUTION ⚠

After using 2.5G/10G modules for long time under low temperature, moving them to a place under high temperature may create dew inside them. In this event, sufficiently dehumidify them before turning their power On. Turning their power On with dew inside may cause short-circuiting, resulting in failure.

2.2 Connecting Device being Tested

When connecting a device being tested (Device Under Test: DUT), be sure to check the input/output signal power level. Inputting a signal exceeding the ratings may destroy the internal devices, resulting in a failure.
Avoid connecting output connectors to each other because it may cause failure.

Section 3 Description of Panel

This section describes the 2.5G/10G module panel controls.

3.1 Description of Panel

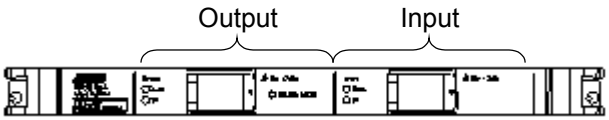


Fig. 3.1-1 2.5G (1.31) Module

Fig. 3.1-2 2.5G (1.55) Module

Fig. 3.1-3 10G (1.31) Module

Fig. 3.1-4 10G (1.55) Module

Output		
Link	Green	Lit when an SDH/SONET frame has been received and LOS, LOG, or AIS alarms have not been detected. Also lit when PPP Negotiation (PPP) has succeeded.
Tx	Green	Lit when a PPP, Cisco HDLC or MAPOS frame, or a bulk pattern is being sent.
Optical Send	Green	Lit when the laser is being output.
Input		
Error	Orange	Lit when an error has been detected. ☞ For the error item detected, refer to the table in the next page.
Rx	Green	Lit when a PPP, Cisco HDLC or MAPOS frame, or a bulk pattern is being received.

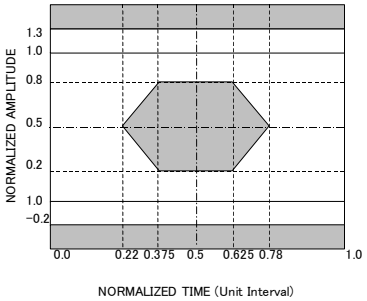
The error items are listed in the table below.

Error items	PPP/Cisco HDLC/MAPOS			Bulk
	SDH/ SONET	PPP/ Cisco HDLC/ MAPOS	High Layer	SDH/SONET
FAS	○			○
Bit all	○			○
B1	○			○
B2	○			○
B3	○			○
MS-REI	○			○
HP-REI	○			○
HP IEC	○			○
Bit info. Error				○
Oversize/Undersize Error		○		
FCS Error		○		
Oversize & FCS Error		○		
Fragments		○		
IP Header checksum Error			○	
TCP/UDP checksum Error			○	

Appendix

A. Specifications

MU120103A

Item	Specifications
Model name	MU120103A
Apparatus name	2.5G (1.31) Module
Composition	Module × 1
Interface	
Corresponding Specification	OC-48/STM-16
Connector	SC
Number of Ports	1
Bit Rate	2488.320 M bit/s ± 50 ppm (NRZ)
Clock	Internal (±50 ppm Variable), Receive, Lock (64 kHz +8 kHz, 1.5 MHz, 2MHz, 1.5 Mbit/s, 2 Mbit/s)
Wavelength	1260 to 1360 nm
Output Level (PRBS23 average power)	–5 to 0 dBm
Extinction Ratio	8.2 dB over
SMSR	30 dB over
Spectral Width	1 nm under
Pulse Mask	
Input Sensitivity	–18 to 0 dBm
Loss Detection	Input: Los-detects by –30 to –25 dBm
Return Loss	27 dB
Maximum Rating Absolutely	+2 dBm
Laser Safety	21 CFR 1040.10:1995 CLASS I IEC 60825-1:2001 CLASS 1
LED	Link, Tx, Rx, Error, Optical Send

MU120103A (Cont'd)

Item	Specifications
SONET/SDH Setting	
Frame	SONET/SDH
Mapping	OC-48c/STM-16c - VC4*16c - PPP OC-48c/STM-16c - VC4*16c - CiscoHDLC OC-48c/STM-16c - VC4*16c - MAPOS Version1 OC-48c/STM-16c - VC4*16c - MAPOS 16 OC-48c/STM-16c - VC4*16c - Bulk Unframed
OH Preset	SOH: All byte except B1, B2, H1, H2, H3, K1, K2 POH: All byte except B3 Path trace: J0, J1 (CRC7, Trace on)
Alarm Addition	LOS, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, TIM-L/MS-TIM, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, PLM-P/HP-SLM, TIM-P/HP-TIM, UNEQ-P/HP-UNEQ
Alarm Addition Timing	Single, Single Burst Frame (Burst Size: 1 to 64,000), Alternative (Alarm Frame: 0 to 8,000, Normal Frame: 1 to 8,000), All
Error Insertion	FAS, B1, B2, B3, REI-P/MS-REI, REI-P/HP-REI, HP-IEC, Bit All, Bit Info.
Error Insertion Timing	Single, Single Burst Bit (Burst Size: 1 to 64,000), Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmed Rate (A*E-B | A: 1.0 to 9.9, B: 3 to 10), All
K1, K2	Conform to G.783 or G.841
Pointer	AU pointer NDF: 0000 to 1111 SS: 00 to 11 Pointer: 0 to 1023 +Justification, –Justification
APS Sequence Generation	K1/K2: 2 to 64 Words, Repeat 1 to 8000 Frame/Word, Single or Repeat generation.
Port setting	
IPv4	
This port	IPv4 Address, Netmask, Gateway
ICMP Echo(PING) Reply	Not send, Reply to this port ping request
PPP	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 32bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit(default1500), Magic-number (random) , IPCP(Send this port IP address), Default, Time out
Mode	Normal, Monitor, Through(with or without OH Overwrite)

MU120103A (Cont'd)

Item	Specifications
Stream	
Number of Streams	256 Streams/Port
Stream Setting	
Distribution	Stream Transport Mode: Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for Count (Loop Count: 1 to 16,000,000)
Frame per Burst	1 to 1,099,511,627,775
Burst per Stream	1 to 1,099,511,627,775
Frame view	Raw frame, Decoded
Gap Setting	
Inter Frame Gap	Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed or Random*1
Inter Burst Gap	Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed.
Inter Stream Gap	Resolution of 3.3 ns, 427.4 ns to 120 s Settable as Fixed.
Frame Setting	FCS: CRC32 MPLS label: Up to 10 MPLS label can be appended. Fixed setting. Protocol Editing: None, IPv4, TCP/IPv4, UDP/IPv4, IGMP/IPv4, ICMP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IS-IS IPv4/IPv6: IP Destination/Source Address can be set Fixed, Increment, Decrement, Random independently. *2 TCP/UDP: Either Destination Port Number or Source Port Number can be set Increment, Random. Data Field: Can set any portions of data field as All 0, All 1, Alternate1/0 (Each bit, Each 2bits, Each 4bits, Each 1 byte, Each 2 bytes), Increment, Decrement, Random, Single PRBS9. Only Data Field 1 can set Programmable, Time Stamp*3, Sequence Number*3, Test Frame. Programmable Header Pattern: 1 user defined pattern can be set.
Frame Size	8 to 65,535 byte Settable as Auto, Fixed, Increment*4, or Random*4

*1: To select the Random setting for the inter-frame gap, the frame length must be 64 bytes or more.

*2: For IPv6, any Increment, Decrement, or Random setting can be specified for bit width 1 to 32. Also, only either the destination or Source Address can be selected.

*3: When a sequence number or Time Stamp is used, the checksum field of the TCP/UDP packet contains an error code.

*4: Increment and Random settings can be specified for the frame size only when None is selected for the protocol.

MU120103A (Cont'd)

Item	Specifications
OH Setting PPP/Cisco HDLC /MAPOS Version 1 /MAPOS 16	Address: FFh (User defined) Cisco HDLC: 0Fh MAPOS Version 1: 03h Control: 03h (User defined) Cisco HDLC: 00h MAPOS Version 1: 03h Address MAPOS16: 00003h When MAPOS16 then Address field is 16 bit and Control field is 0 bit Protocol: 16 bit User defined (default 0021) FCS: Auto
Protocol Setting IPv4 (RFC0791)	Version: 4 (DEC) IHL: Auto Type of service: User defined (initial 00(hex)) Bit0 to 2 (Precedence): 111-Network control 110-Internetwork control 101-CRITIC/ECP 100-Flash override 011-Flash 010-Immediate 001-Priority 000-Routine Bit3: 0 = Normal delay, 1 = Low delay Bit4: 0 = Normal throughput, 1 = High throughput Bit5: 0 = Normal Reliability, 1= High Reliability Bit6 to 7: 2 bit user defined Total Length: Auto Identification: User defined (4 byte) Flag: User defined (initial 010(b)) Bit0: User defined Bit1: (DF) 0 = May Fragment, 1= Don't Fragment Bit2: (MF) 0 = Last Fragment, 1= More Fragment Fragment offset: 0 to 8191(DEC) user defined (initial 0) Time to Live: 0 to 255 (DEC) user defined (initial 64) Protocol: 0 to 255 (DEC) user defined (initial 0) Automatically set if TCP or UDP is selected. Header Checksum: Auto Source Address: Static, Increment, Decrement, Random with class and mask setting Destination Address: Static, Increment, Decrement, Random with class and mask setting Option: 0 to 40 byte

MU120103A (Cont'd)

Item	Specifications
IPv6 (RFC2460)	Version (4 bit): 6 Traffic class (8 bit): 0-uncharacterized traffic 1-"filler" traffic 2-unattended data transfer 3-reserved 4-attended bulk transfer 5-reserved 6-interactive traffic 7-internet control traffic Flow Label (20 bit): 20 bit user defined (initial all 0) Payload length (16 bit): Auto Next header (8 bit): 0 to 255 (DEC) user defined (initial 59) Hop Limit (8 bit): 0 to 255 user defined (initial 0) Source Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask) Destination Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask)
TCP (RFC0793)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Sequence number (32 bit): User defined Acknowledgement Number(32 bit): User defined, 0000 to FFFF Data offset (4 bit): Set to 5 Reserved (6 bit): User defined, 0 to 63 Control bit (6 bit): User Defined, Setting by bit Window (16 bit): User defined, 0 to 65535 Checksum (16 bit): Auto Urgent pointer (16 bit): User defined, 0 to 65535 Option: 0 to 40 byte Padding: All 0
UDP (RFC0768)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Length (16 bit): Auto Checksum (16 bit): Auto
IGMP (RFC2236)	Type (4 bit): 11- Membership query 12- Version1 Membership report 16- Version2 Membership report 17- Leave group Max response time (8 bit): User defined, 0 to 255 Checksum (16 bit): Automatically calculated Group address (32 bit): User defined Version: set to 2

MU120103A (Cont'd)

Item	Specifications
ICMP (RFC792, 950, 1256)	Type (8 bit): 0 = Reply 3 = Destination Unreachable 4 = Source Quench 5 = Redirect 8 = Echo 9 = Router Advertisement 10 = Router Selection 11 = Time Exceeded 12 = Parameter Program 13 = Time Stamp 14 = Time Stamp Reply 15 = Information Request 16 = Information Reply 17 = Address Mask Request 18 = Address Mask Reply Code (8 bit): User defined 0 to 255 Checksum (16 bit): Automatically calculated (Soft) Data: For Echo Request/Response Identifier (16 bit): User defined Sequence Number (16 bit): User defined
RIP (RFC2453)	Command (8 bit): 1 = Request 2 = Response Version (8 bit): 1 = RIP version1 2 = RIP version2 Address Family Identifier (16 bit): 0000 0002 = IP protocol FFFF = Authentication entry see next Route tag: User defined IP Address: User defined Subnet Mask: User defined for Version2 Next hop: User defined for Version2 Metric: 0 to 4294967295 (DEC) Authentication type (16 bit): 1-IP Route 2-Password 3-Keyed Message Digest Algorithm Authentication Data: ASCII 16 yte entry

MU120103A (Cont'd)

Item	Specifications
DHCP (RFC2131)	Op Code (8 bit): User defined 1 = Boot request 2 = Boot reply Hardware type (8 bit): User defined 1 = 10 MB Ethernet Hardware address length (8 bit): User defined 6 = for MAC address Hops (8 bit): User defined (0 to 255) Transaction ID (32 bit): User defined (0 to 4294967295(DEC)) Seconds (16 bit): User defined (0 to 65535(DEC)) Flag (16 bit) : User defined 0000 = Nobroadcast 8000 = Broadcast Client IP address (32 bit): User defined Your IP address (32 bit): User defined Server IP address (32 bit): User defined Relay Agent IP address (32 bit): User defined Client Hardware address (16 byte): User defined Server Host Name (64 byte): User defined Boot File Name (128 byte): User defined Option (0 to 64 byte): User defined
MPLS (RFC3031, 3032)	Label (20 bit): User defined 0 = IPv4 explicit null label 1 = Router alert label 2 = IPv6 explicit null label 3 = Implicit null label 4 to 15 = Reserved EXP (3 bit): User defined S (1 bit): Bottom of stack TTL (8 bit): User defined 10 kinds of MPLS can set.
Error Insertion	
PPP	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame
IP	IPv4 Header Checksum Error
TCP/UDP	TCP/UDP Checksum Error
Data	Supported by Option 11 Packet BER Test: PRBS Error
Unframed BER Setting	Test Pattern: PRBS23, PRBS31 Error Insertion: Bit All Insertion Timing: Single, Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmable Rate (1.0E-10 to 9.9E-3)

MU120103A (Cont'd)

Item	Specifications
Measurement Function	
SONET/SDH Test	
Performance	G. 826
K1, K2 Monitor	Conform to G.783 or G.841
Pointer Monitor	AU Pointer Graph: Pointer value, Pointer Inc/Dec Resolution: 1 s, 1 min, 15 min, 60 min
OH Monitor	SOH, POH, J0, J1 Display: CRC, TIM S1, C2: Received octet value are decoded for display
APS Switch Time	Trigger: Error, Alarm, External trigger Resolution: 125 us Threshold:1 ms, 10 ms, 100 ms Start → Waiting trigger → Trigger detect → Stop
APS Sequence Capture	Trigger: Error, Alarm, External trigger Trigger Position: 1 to 64 64 word (1 word: 1 to 8000 frame)
Counter	
Mode	Accumulated, 1 s current
SONET/SDH	NDF Count/Rate, +PJC Count/Rate, –PJC Count/Rate, Consecutive Count/Rate, PPM, HP-IEC Count/Rate, REI-P/HP-REI Count/Rate, B3 Count/Rate, UNEQ-P/HP-UNEQ Count/Second, PLM-P/HP-SLM Count/Second, RDI-P/HP-RDI Count/Second, LOP-P/AU-LOP Count/Second, AIS-P/AU-AIS Count/Second, REI-L/MS-REI Count/Second, B2 Count/Rate, B1 Count/Rate, RDI-L/MS-RDI Count/Second, AIS-L/MS-AIS Count/Second, OOF Count/Second, LOF Count/Second, Bit Info. Count/Rate*5, Pattern Sync. Loss Count/Second*5
PPP	Transmitted/Received Frame Count, Transmitted/Received Frame Rate, Transmitted/Received Bit Count, Transmitted/Received Bit Rate, Transmitted/Received byte Count, Transmitted/Received Rate, FCS Error, Undersize, Fragment, Oversize, Oversize & FCS Error, Transmitted bytes After Stuffing, Received bytes Before Destuffing, Aborted Frame
IPv4	Transmitted/Received IPv4 Packet Count, Transmitted/Received IPv4 Packet Rate, Transmitted/Received Ping Request, Transmitted/Received Ping Reply, IP Header Checksum Error

*5: Measurement is enabled only when the Bulk setting is specified for mapping.

MU120103A (Cont'd)

Item	Specifications
TCP/UDP	Received TCP Packet Count, Received TCP Packet Rate, Received UDP Packet Count, Received UDP Packet Rate, TCP Checksum Error*6, UDP Checksum Error*6
Data	Capture Trigger, Capture Filter, User Defined 1 Count/Rate, User Defined 2 Count/Rate, QoS 0 to 7 Frame Count/Rate.
	User Defined counter conditions; Destination IP Address: don't care,Match,Not match Source IP Address: don't care,Match,Not match Pattern1: don't care,Match,Not match Pattern2: don't care,Match,Not match Error: don't care,Match,Not match
	Refer to Pattern and Error conditions of Capture.
Packet BER Test (Opt11)	Transmitted/Received Test Frame Count, Sequence Error, Received PRBS Frame Error Count/Rate, Received PRBS Bit Error Count/Rate
Unframed BER Test	Bit Error Count/Rate, Pattern Sync. Loss Count/Second
Graph	8 kind of graph are displayed simultaneously. 1 s, 1 min, 15 min, 60 min resolution

*6: The packets fragmented in the IP layer are counted as error packets.

MU120103A (Cont'd)

Item	Specifications
Capture	
Capture Buffer	256 Mbyte/Port
Capture Filter/Trigger	Filter condition settings; Destination IP Address: don't care,Match,Not match Source IP Address: don't care,Match,Not match Pattern1: don't care,Match,Not match Pattern2: don't care,Match,Not match Error: don't care,Match,Not match Trigger condition settings; Destination IP Address: don't care,Match,Not match Source IP Address: don't care,Match,Not match Pattern1: don't care,Match,Not match Pattern2: don't care,Match,Not match Error: don't care,Match,Not match External Trigger: Traffic is out of range:0 to 100% Latency is out of range:1 ns to 59 s Manual Trigger: Trigger Position Settings; Top,Middle,Bottom
Pattern and Error Conditions	Destination IP Address:32 bit Mask:bit mask Source IP Address:32 bit Mask:bit mask Pattern1,2; Pattern:32 bit Mask:byte mask Field: Source IP,Destination IP,TCP,UDP, Custom(Offset:0 to 65535) Error; Error type: Good Frame,FCS Error,Undersize, Fragments,Oversize,Oversize&FCS Error, IP Header checksum Error,TCP checksum Error,UDP checksum Error,Sequence Error※7,PRBS Frame Error※7 Combination; And,Or

*7: Option 11 Packet BER Test is required.

MU120103A (Cont'd)

Item	Specifications
Decode Protocol	Ethernet (Type II, IEEE802.3, Mac Control), VLAN, MPLS, LLC, LACP, BPDU (STP, RST, MST), ARP, Ethernet OAM, IP, IPv6 (include Extended, Header), IPX, OSINL, IS-IS, IGMP (include IGAP), ICMP, ICMPv6 (include NDP, MLD, MLDA), TCP, UDP, OSPF, OSPFv3, DVMRP, LDP (CR-LDP), BGP4, RIP, DHCP, RSVP (RSVP-TE), BGP4+, PIM-SMv2, PPP (include LCP, IPCP, IPv6CP, OSINLCP, MPLSCP), CiscoHDLC, MAPOS, NSP, SSP, Test Frame
Extended Decode Protocol	By Sniffer® Technologies (Opt04) or MX123002A Expert Analysis Module, the number of decode protocols can be increased up to 400. MD1230 Family includes Ethereal® Convert Function.
Replay	Capture frames are converted to Tx streams.
Latency	When Test Frames are received, the latency is indicated. The result includes 1s sampling value, max, min, avg. and number of samples.

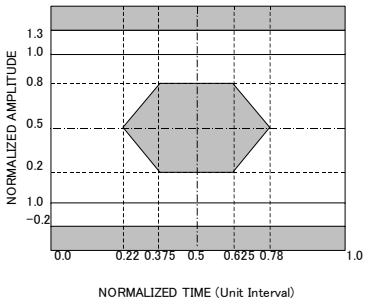
MU120103A (Cont'd)

Item	Specifications
Protocol Emulation	PPP (LCP, IPCP), ICMP, BGP-4, IGMP
Ping	Destination: User defined Send: 4 times Result: Reply, bytes, time, TTL
Frame Arrival Time Variation (Packet Jitter)	
Resolution	32 counters indicate the results. Resolution: 1 us, 10 us, 100 us, 1 ms, 10 ms, 100 ms, 1 s.
Offset	Depend on resolution, Max. 3 min.
Graph	Frame Count vs. Time Interval Auto scale: On/Off
Traffic Monitor	Traffic Monitor can measure up to 64 streams in real-time. Target: IPv4 Address, Protocol Number (IP Protocol)
Traffic Map	Traffic Map can measure up to 64 streams in real-time. Target: IPv4 Address
Service Disruption Time	Time of frame disruption.
Power Meter	Range: –25 to +1 dBm Accuracy: +/–2 dB
Automatic Test	
RFC2544 Automatic Test	Following 6 types of tests can be supported. (MD1230 Family supports continuous test [1] to [5]). [1] Throughput [2] Latency [3] Frame Loss Rate [4] Back-to-back frames [5] System recovery [6] Reset
Port Pairs	Traffic Distribution: One to one, Partially meshed, Fully meshed Traffic Orientation: Unidirectional, Bidirectional Mesh Type: Round Robin, Peak Loading VLAN Tag: On/Off VLAN ID: 1 to 4095
Test Setting	Frame Size: 64, 128, 256, 512, 1024, 1280, 1518 byte Custom: 1 to 25 point Step: Start form 64 to 65535 Step Size 1 to 65471 Count 1 to 25 Test Frame Protocol: MAC, IP Device Type: Store and forward, Bit forward Leaning Frame: Leaning Mode: Never, Once, Every Trial Retries: 1 to 999

MU120103A (Cont'd)

Item	Specifications
Throughput	Duration: 2 to 999 s Number of Trials: 1 to 50 Burst Size: 1 to 1000 Rate (%): Initial rate, minimum rate, maximum rate, resolution, 0.01% step Loss Tolerance: 0 to 100%, 0.0001% step Result: Frame Rate (%), Frame/s, Bit/s, byte/s Graph: Frame Rate (%), or Frame/s or Bit/s or byte/s vs. frame size, Theoretical value
Latency	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step, Result of Throughput Rate Burst Size: 1 to 1000 Result: Latency (0.01 us resolution) Graph: Latency vs. frame size
Frame Loss Rate	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Result: Frame Loss Rate (%) Graph: Frame Rate vs. Frame Loss Rate
Back-to-Back Frames	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Loss Tolerance: 0 to 100%, 0.0001% step Result: Number of frames Graph: Number of frames vs. frame size
System Recovery	Duration: 2 to 999 s Number of Trials: 1 to 50 Threshold Time: 0 to 999 s Rate (%): Overload Rate (110% of the Throughput Rate user defined), Moderate Rate Burst Size: 1 to 1000 Result: Recovery time (1 us resolution, Accuracy 1 us) Graph: Recovery time vs. frame size
Reset	Rate (%): User definedBurst Size: 1 to 1000Sequence: Start → Waiting trigger → Triggered → Stop Graph: Reset time (1 us resolution, Accuracy 1 us)
Environmental Performance	
Temperature range	Operation: 0 to +40°C Storage: –20 to +60°C
Power Consumption	Less than 25 W
Size	Based on PICMG2.0 R2.1 262.0 (W) × 20.0 (H) × 174.5 (D) mm It doesn't contain protuberance.
Weight	Less than 1.5 kg

MU120104A

Item	Specifications
Model name	MU120104A
Apparatus name	2.5G (1.55) Module
Composition	Module × 1
Interface	
Corresponding Specification	OC-48/STM-16
Connector	SC
Number of Ports	1
Bit Rate	2488.320 M bit/s ±50 ppm (NRZ)
Clock	Internal (±50 ppm Variable), Receive, Lock (64 kHz +8 kHz, 1.5 MHz, 2MHz, 1.5 Mbit/s, 2 Mbit/s)
Wavelength	1500 to 1580 nm
Output Level (PRBS23 average power)	–2 to +3 dBm
Extinction Ratio	8.2 dB over
SMSR	30 dB over
Spectral Width	1 nm under
Pulse Mask	
Input Sensitivity	–28 to –9 dBm
Loss Detection	Input: –40 to –35 dBm
Return Loss	27 dB
Maximum Rating Absolutely	–6 dBm
Laser Safety	21 CFR 1040.10:1995 CLASS I IEC60825-1:2001 CLASS 1
LED	Link, Tx, Rx, Error, Optical Send

MU120104A (Cont'd)

Item	Specifications
SONET/SDH Setting	
Frame	SONET/SDH
Mapping	OC-48c/STM-16c - VC4*16c - PPP OC-48c/STM-16c - VC4*16c - CiscoHDLC OC-48c/STM-16c - VC4*16c - MAPOS Version1 OC-48c/STM-16c - VC4*16c - MAPOS 16 OC-48c/STM-16c - VC4*16c - Bulk Unframed
OH Preset	SOH: All byte except B1, B2, H1, H2, H3, K1, K2 POH: All byte except B3 Path trace: J0, J1 (CRC7, Trace on)
Alarm Addition	LOS, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, TIM-L/MS-TIM, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, PLM-P/HP-SLM, TIM-P/HP-TIM, UNEQ-P/HP-UNEQ
Alarm Addition Timing	Single, Single Burst Frame (Burst Size: 1 to 64,000), Alternative (Alarm Frame: 0 to 8,000, Normal Frame: 1 to 8,000), All
Error Insertion	FAS, B1, B2, B3, REI-P/MS-REI, REI-P/HP-REI, HP-IEC, Bit All, Bit Info.
Error Insertion Timing	Single, Single Burst Bit (Burst Size: 1 to 64,000), Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmed Rate (A*E-B | A: 1.0 to 9.9, B: 3 to 10), All
K1, K2	Conform to G.783 or G.841
Pointer	AU pointer NDF: 0000 to 1111 SS: 00 to 11 Pointer: 0 to 1023 +Justification, –Justification
APS Sequence Generation	K1/K2: 2 to 64 Words, Repeat 1 to 8000 Frame/Word, Single or Repeat generation.
Port setting	
IPv4	
This port	IPv4 Address, Netmask, Gateway
ICMP Echo(PING) Reply	Not send, Reply to this port ping request
PPP	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 32 bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit(default1500), Magic-number (random) , IPCP(Send this port IP address), Default, Time out
Mode	Normal, Monitor, Through(with or without OH Overwrite)

MU120104A (Cont'd)

Item	Specifications
Stream	
Number of Streams	256 Streams/Port
Stream Setting	
Distribution	Stream Transport Mode: Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for Count (Loop Count: 1 to 16,000,000)
Frame per Burst	1 to 1,099,511,627,775
Burst per Stream	1 to 1,099,511,627,775
Frame view	Raw frame, Decoded
Gap Setting	
Inter Frame Gap	Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed or Random*1
Inter Burst Gap	Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed.
Inter Stream Gap	Resolution of 3.3 ns, 427.4 ns to 120 s Settable as Fixed.
Frame Setting	FCS: CRC32 MPLS label: Up to 10 MPLS label can be appended. Fixed setting. Protocol Editing: None, IPv4, TCP/IPv4, UDP/IPv4, IGMP/IPv4, ICMP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IS-IS IPv4/IPv6: IP Destination/Source Address can be set Fixed, Increment, Decrement, Random independently. *2 TCP/UDP: Either Destination Port Number or Source Port Number can be set Increment, Random. Data Field: Can set any portions of data field as All 0, All 1, Alternate1/0 (Each bit, Each 2bits, Each 4 bits, Each 1 byte, Each 2 bytes), Increment, Decrement, Random, Single PRBS9. Only Data Field 1 can set Programmable, Time Stamp*3, Sequence Number*3, Test Frame. Programmable Header Pattern: 1 user defined pattern can be set.
Frame Size	8 to 65,535 byte Settable as Auto, Fixed, Increment*4, or Random*4

*1: To select the Random setting for the inter-frame gap, the frame length must be 64 bytes or more.

*2: For IPv6, any Increment, Decrement, or Random setting can be specified for bit width 1 to 32. Also, only either the destination or Source Address can be selected.

*3: When a sequence number or Time Stamp is used, the checksum field of the TCP/UDP packet contains an error code.

*4: Increment and Random settings can be specified for the frame size only when None is selected for the protocol.

MU120104A (Cont'd)

Item	Specifications
OH Setting PPP/Cisco HDLC /MAPOS Version 1 /MAPOS 16	Address: FFh (User defined) Cisco HDLC : 0Fh MAPOS Version 1: 03h Control: 03h (User defined) Cisco HDLC: 00h MAPOS Version 1: 03h Address MAPOS16: 00003h When MAPOS16 then Address field is 16 bit and Control field is 0 bit Protocol: 16 bit User defined (default 0021) FCS: Auto
Protocol Setting IPv4 (RFC0791)	Version: 4 (DEC) IHL: Auto Type of service: User defined (initial 00(hex)) Bit0 to 2 (Precedence): 111-Network control 110-Internetwork control 101-CRITIC/ECP 100-Flash override 011-Flash 010-Immediate 001-Priority 000-Routine Bit3: 0 = Normal delay, 1 = Low delay Bit4: 0 = Normal throughput, 1 = High throughput Bit5: 0 = Normal Reliability, 1= High Reliability Bit6 to 7: 2 bit user defined Total Length: Auto Identification: User defined (4 byte) Flag: User defined (initial 010(b)) Bit0: User defined Bit1: (DF) 0 = May Fragment, 1= Don't Fragment Bit2: (MF) 0 = Last Fragment, 1= More Fragment Fragment offset: 0 to 8191(DEC) user defined (initial 0) Time to Live: 0 to 255 (DEC) user defined (initial 64) Protocol: 0 to 255 (DEC) user defined (initial 0) Automatically set if TCP or UDP is selected. Header Checksum: Auto Source Address: Static, Increment, Decrement, Random with class and mask setting Destination Address:Static, Increment, Decrement, Random with class and mask setting Option: 0 to 40 byte

MU120104A (Cont'd)

Item	Specifications
IPv6 (RFC2460)	Version (4 bit): 6 Traffic class (8 bit): 0-uncharacterized traffic 1-"filler" traffic 2-unattended data transfer 3-reserved 4-attended bulk transfer 5-reserved 6-interactive traffic 7-internet control traffic Flow Label (20 bit): 20 bit user defined (initial all 0) Payload length (16 bit): Auto Next header (8 bit): 0 to 255 (DEC) user defined (initial 59) Hop Limit (8 bit): 0 to 255 user defined (initial 0) Source Address (128b it): Static, Increment, Decrement, Random with class and mask setting (byte mask) Destination Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask)
TCP (RFC0793)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Sequence number (32 bit): User defined Acknowledgement Number(32 bit): User defined, 0000 to FFFF Data offset (4 bit): Set to 5 Reserved (6 bit): User defined, 0 to 63 Control bit (6 bit): User Defined, Setting by bit Window (16 bit): User defined, 0 to 65535 Checksum (16 bit): Auto Urgent pointer (16 bit): User defined, 0 to 65535 Option: 0 to 40 byte Padding: All 0
UDP (RFC0768)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Length (16 bit): Auto Checksum (16 bit): Auto
IGMP (RFC2236)	Type (4 bit): 11- Membership query 12- Version1 Membership report 16- Version2 Membership report 17- Leave group Max response time (8 bit): User defined, 0 to 255 Checksum (16 bit): Automatically calculated Group address (32 bit): User defined Version: set to 2

MU120104A (Cont'd)

Item	Specifications
ICMP (RFC792, 950, 1256)	Type (8 bit): 0 = Reply 3 = Destination Unreachable 4 = Source Quench 5 = Redirect 8 = Echo 9 = Router Advertisement 10 = Router Selection 11 = Time Exceeded 12 = Parameter Program 13 = Time Stamp 14 = Time Stamp Reply 15 = Information Request 16 = Information Reply 17 = Address Mask Request 8 = Address Mask Reply Code (8 bit): User defined 0 to 255 Checksum (16 bit): Automatically calculated (Soft) Data: For Echo Request/Response Identifier (16 bit): User defined Sequence Number (16 bit): User defined
RIP (RFC2453)	Command (8 bit): 1 = Request 2 = Response Version (8 bit): 1 = RIP version1 2 = RIP version2 Address Family Identifier (16 bit): 0000 0002 = IP protocol FFFF = Authentication entry see next Route tag: User defined IP Address: User defined Subnet Mask: User defined for Version2 Next hop: User defined for Version2 Metric: 0 to 4294967295 (DEC) Authentication type (16 bit): 1-IP Route 2-Password 3-Keyed Message Digest Algorithm Authentication Data: ASCII 16 byte entry

MU120104A (Cont'd)

Item	Specifications
DHCP (RFC2131)	Op Code (8 bit):User defined 1 = Boot request 2 = Boot reply Hardware type (8 bit): User defined 1 = 10 MB Ethernet Hardware address length (8 bit): User defined 6 = for MAC address Hops (8 bit): User defined (0 to 255) Transaction ID (32bit): User defined (0 to 4294967295(DEC)) Seconds (16 bit): User defined (0 to 65535(DEC)) Flag (16 bit) : User defined 0000 = Nobroadcast 8000 = Broadcast Client IP address (32 bit): User defined Your IP address (32 bit): User defined Server IP address (32 bit): User defined Relay Agent IP address (32 bit): User defined Client Hardware address (16 byte): User defined Server Host Name (64 byte): User defined Boot File Name (128 byte): User defined Option (0 to 64 byte): User defined
MPLS (RFC3031, 3032)	Label (20 bit): User defined 0 = IPv4 explicit null label 1 = Router alert label 2 = IPv6 explicit null label 3 = Implicit null label 4 to 15 = Reserved EXP (3 bit): User defined S (1 bit): Bottom of stack TTL (8 bit): User defined 10 kinds of MPLS can set.
Error Insertion	
PPP	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame
IP	IPv4 Header Checksum Error
TCP/UDP	TCP/UDP Checksum Error
Data	Supported by Option 11 Packet BER Test: PRBS Error
Unframed BER Setting	Test Pattern: PRBS23, PRBS31 Error Insertion: Bit All Insertion Timing: Single, Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmable Rate (1.0E-10 to 9.9E-3)

MU120104A (Cont'd)

Item	Specifications
Measurement Function	
SONET/SDH Test	
Performance	G. 826
K1, K2 Monitor	Conform to G.783 or G.841
Pointer Monitor	AU Pointer Graph: Pointer value, Pointer Inc/Dec Resolution: 1 s, 1 min, 15 min, 60 min
OH Monitor	SOH, POH, J0, J1 Display: CRC, TIM S1, C2: Received octet value are decoded for display
APS Switch Time	Trigger: Error, Alarm, External trigger Resolution: 125 us Threshold: 1 ms, 10 ms, 100 ms Start → Waiting trigger → Trigger detect → Stop
APS Sequence Capture	Trigger: Error, Alarm, External trigger Trigger Position: 1 to 64 64 word (1 word: 1 to 8000 frame)
Counter	
Mode	Accumulated, 1 s current
SONET/SDH	NDF Count/Rate, +PJC Count/Rate, –PJC Count/Rate, Consecutive Count/Rate, PPM, HP-IEC Count/Rate, REI-P/HP-REI Count/Rate, B3 Count/Rate, UNEQ-P/HP-UNEQ Count/Second, PLM-P/HP-SLM Count/Second, RDI-P/HP-RDI Count/Second, LOP-P/AU-LOP Count/Second, AIS-P/AU-AIS Count/Second, REI-L/MS-REI Count/Second, B2 Count/Rate, B1 Count/Rate, RDI-L/MS-RDI Count/Second, AIS-L/MS-AIS Count/Second, OOF Count/Second, LOF Count/Second, Bit Info. Count/Rate*5, Pattern Sync. Loss Count/Second*5
PPP	Transmitted/Received Frame Count, Transmitted/Received Frame Rate, Transmitted/Received Bit Count, Transmitted/Received Bit Rate, Transmitted/Received byte Count, Transmitted/Received Rate, FCS Error, Undersize, Fragment, Oversize, Oversize & FCS Error, Transmitted bytes After Stuffing, Received bytes Before Destuffing, Aborted Frame
IPv4	Transmitted/Received IPv4 Packet Count, Transmitted/Received IPv4 Packet Rate, Transmitted/Received Ping Request, Transmitted/Received Ping Reply, IP Header Checksum Error

*5: Measurement is enabled only when the Bulk setting is specified for mapping.

MU120104A (Cont'd)

Item	Specifications
TCP/UDP	Received TCP Packet Count, Received TCP Packet Rate, Received UDP Packet Count, Received UDP Packet Rate, TCP Checksum Error*6, UDP Checksum Error*6
Data	Capture Trigger, Capture Filter, User Defined 1 Count/Rate, User Defined 2 Count/Rate, QoS 0 to 7 Frame Count/Rate. User Defined counter conditions; Destination IP Address: don't care,Match,Not match Source IP Address: don't care,Match,Not match Pattern1: don't care,Match,Not match Pattern2: don't care,Match,Not match Error: don't care,Match,Not match Refer to Pattern and Error conditions of Capture.
Packet BER Test (Opt11)	Transmitted/Received Test Frame Count, Sequence Error, Received PRBS Frame Error Count/Rate, Received PRBS Bit Error Count/Rate
Unframed BER Test	Bit Error Count/Rate, Pattern Sync. Loss Count/Second
Graph	8 kind of graph are displayed simultaneously. 1 s, 1 min, 15 min, 60 min resolution

*6: The packets fragmented in the IP layer are counted as error packets.

MU120104A (Cont'd)

Item	Specifications
Capture	
Capture Buffer	256 Mbyte/Port
Capture Filter/Trigger	Filter condition settings; Destination IP Address: don't care, Match,Not match Source IP Address: don't care,Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Trigger condition settings; Destination IP Address: don't care, Match,Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match External Trigger: Traffic is out of range:0 to 100% Latency is out of range:1 ns to 59 s Manual Trigger: Trigger Position Settings; Top,Middle, Bottom
Pattern and Error Conditions	Destination IP Address:32 bit Mask:bit mask Source IP Address:32 bit Mask:bit mask Pattern1,2; Pattern:32 bit Mask:byte mask Field:Source IP , Destination IP, TCP, UDP, Custom (Offset:0 to 65535) Error; Error type: Good Frame, FCS Error, Undersize, Fragments, Oversize, Oversize&FCS Error, IP Header checksum Error, TCP checksum Error, UDP checksum Error, Sequence Error※7, PRBS Frame Error※7 Combination; And, Or
Decode Protocol	Ethernet (Type II, IEEE802.3, Mac Control), VLAN, MPLS, LLC, LACP, BPDU (STP, RST, MST), ARP, Ethernet OAM, IP, IPv6 (include Extended, Header), IPX, OSINL, IS-IS, IGMP (include IGAP), ICMP, ICMPv6 (include NDP, MLD, MLDA), TCP, UDP, OSPF, OSPFv3, DVMRP, LDP (CR-LDP), BGP4, RIP, DHCP, RSVP (RSVP-TE), BGP4+, PIM-SMv2, PPP (include LCP, IPCP, IPv6CP, OSINLCP, MPLSCP), CiscoHDLC, MAPOS, NSP, SSP, Test Frame
Extended Decode Protocol	By Sniffer® Technologies (Opt04) or MX123002A Expert Analysis Module, the number of decode protocols can be increased up to 400. MD1230 Family includes Ethereal® Convert Function.

*7: Option 11 Packet BER Test is required.

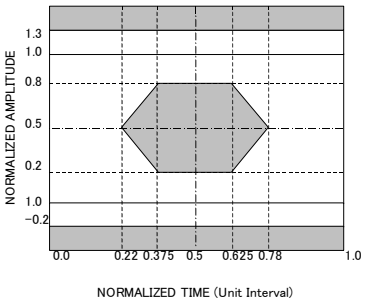
MU120104A (Cont'd)

Item	Specifications
Replay	Capture frames are converted to Tx streams.
Latency	When Test Frames are received, the latency is indicated. The result includes 1s sampling value, max, min, avg. and number of samples.
Protocol Emulation	PPP (LCP, IPCP), ICMP, BGP-4, IGMP
Ping	Destination: User defined Send: 4 times Result: Reply, bytes, time, TTL
Frame Arrival Time Variation(Packet Jitter)	
Resolution	32 counters indicate the results. Resolution: 1 us, 10 us, 100 us, 1 ms, 10 ms, 100 ms, 1 s.
Offset	Depend on resolution, Max. 3 min.
Graph	Frame Count vs. Time Interval Auto scale: On/Off
Traffic Monitor	Traffic Monitor can measure up to 64 streams in real-time. Target: IPv4 Address, Protocol Number (IP Protocol)
Traffic Map	Traffic Map can measure up to 64 streams in real-time. Target: IPv4 Address
Service Disruption Time	Time of frame disruption.
Power Meter	Range: –35 to –9 dBm Accuracy: ±2 dB
Automatic Test	
RFC2544 Automatic Test	Following 6 types of tests can be supported. (MD1230 Family supports continuous test [1] to [5]). [1] Throughput [2] Latency [3] Frame Loss Rate [4] Back-to-back frames [5] System recovery [6] Reset
Port Pairs	Traffic Distribution: One to one, Partially meshed, Fully meshed Traffic Orientation: Unidirectional, Bidirectional Mesh Type: Round Robin, Peak Loading VLAN Tag: On/Off VLAN ID: 1 to 4095
Test Setting	Frame Size: 64, 128, 256, 512, 1024, 1280, 1518 byte Custom: 1 to 25 point Step: Start form 64 to 65535 Step Size 1 to 65471 Count 1 to 25 Test Frame Protocol: MAC, IP Device Type: Store and forward, Bit forward Leaning Frame: Leaning Mode: Never, Once, Every Trial Retries: 1 to 999

MU120104A (Cont'd)

Item	Specifications
Throughput	Duration: 2 to 999 s Number of Trials: 1 to 50 Burst Size: 1 to 1000 Rate (%): Initial rate, minimum rate, maximum rate, resolution, 0.01% step Loss Tolerance: 0 to 100%, 0.0001% step Result: Frame Rate (%), Frame/s, Bit/s, byte/s Graph: Frame Rate (%), or Frame/s or Bit/s or byte/s vs. frame size, Theoretical value
Latency	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step, Result of Throughput Rate Burst Size: 1 to 1000 Result: Latency (0.01 us resolution) Graph: Latency vs. frame size
Frame Loss Rate	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Result: Frame Loss Rate (%) Graph: Frame Rate vs. Frame Loss Rate
Back-to-Back Frames	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Loss Tolerance: 0 to 100%, 0.0001% step Result: Number of frames Graph: Number of frames vs. frame size
System Recovery	Duration: 2 to 999 s Number of Trials: 1 to 50 Threshold Time: 0 to 999 s Rate (%): Overload Rate (110% of the Throughput Rate user defined), Moderate Rate Burst Size: 1 to 1000 Result: Recovery time (1 us resolution, Accuracy 1 us) Graph: Recovery time vs. frame size
Reset	Rate (%): User defined Burst Size: 1 to 1000 Sequence: Start → Waiting trigger → Triggered → Stop Graph: Reset time (1 us resolution, Accuracy 1 us)
Environmental Performance	
Temperature range	Operation: 0 to +40 °C Storage: –20 to +60 °C
Power Consumption	Less than 25 W
Size	Based on PICMG2.0 R2.1 262.0 (W) × 20.0 (H) × 174.5 (D) mm It doesn't contain protuberance.
Weight	Less than 1.5 kg

MU120105A

Item	Specifications
Model name	MU120105A
Apparatus name	10G (1.31) Module
Composition	Module × 1
Interface	
Corresponding Specification	OC-192/STM-64
Connector	SC
Number of Ports	1
Bit Rate	9953.280 M bit/s ±100 ppm (NRZ)
Clock	Internal (±100 ppm Variable), Receive, Lock (64 kHz +8 kHz, 1.5 MHz, 2MHz, 1.5 Mbit/s, 2 Mbit/s)
Wavelength	1290 to 1330 nm
Output Level (PRBS23 average power)	–4 to 0 dBm
Extinction Ratio	6 dB over
SMSR	30 dB over
Spectral Width	1 nm under
Pulse Mask	
Input Sensitivity	–12 to 0 dBm
Loss Detection	–18 to –16 dBm
Return Loss	27 dB
Maximum Rating Absolutely	+2 dBm
Laser Safety	21 CFR 1040.10:1995 CLASS I IEC60825-1:2001 CLASS 1
LED	Link, Tx, Rx, Error, Optical Send

MU120105A (Cont'd)

Item	Specifications
SONET/SDH Setting	
Frame	SONET/SDH
Mapping	OC-192c/STM-64c - VC4*64c - PPP OC-192c/STM-64c - VC4*64c - CiscoHDLC OC-192c/STM-64c - VC4*64c - MAPOS Version1 OC-192c/STM-64c - VC4*64c - MAPOS 16 OC-192c/STM-64c - VC4*64c - Bulk Unframed
OH Preset	SOH: All byte except B1, B2, H1, H2, H3, K1, K2 POH: All byte except B3 Path trace: J0, J1 (CRC7, Trace on)
Alarm Addition	LOS, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, TIM-L/MS-TIM, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, PLM-P/HP-SLM, TIM-P/HP-TIM, UNEQ-P/HP-UNEQ
Alarm Addition Timing	Single, Single Burst Frame (Burst Size: 1 to 64,000), Alternative (Alarm Frame: 0 to 8,000, Normal Frame: 1 to 8,000), All
Error Insertion	FAS, B1, B2, B3, REI-P/MS-REI, REI-P/HP-REI, HP-IEC, Bit All, Bit Info.
Error Insertion Timing	Single, Single Burst Bit (Burst Size: 1 to 64,000), Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmed Rate (A*E-B | A: 1.0 to 9.9, B: 3 to 10), All
K1, K2	Conform to G.783 or G.841
Pointer	AU pointer NDF: 0000 to 1111 SS: 00 to 11 Pointer: 0 to 1023 +Justification, –Justification
APS Sequence Generation	K1/K2: 2 to 64 Words, Repeat 1 to 8000 Frame/Word, Single or Repeat generation.
Port setting	
IPv4	
This port	IPv4 Address, Netmask, Gateway
ICMP Echo(PING) Reply	Not send, Reply to this port ping request
PPP	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 32 bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit(default1500), Magic-number (random) , IPCP(Send this port IP address), Default, Time out
Mode	Normal, Monitor, Through(with or without OH Overwrite)

MU120105A (Cont'd)

Item	Specifications
Stream	
Number of Streams	256 Streams/Port
Stream Setting	
Distribution	Stream Transport Mode: Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for Count (Loop Count: 1 to 16,000,000)
Frame per Burst	1 to 1,099,511,627,775
Burst per Stream	1 to 1,099,511,627,775
Frame view	Raw frame, Decoded
Gap Setting	
Inter Frame Gap	Resolution of 0.8 ns, 0.8 ns to 120 s Settable as Fixed or Random*1
Inter Burst Gap	Resolution of 0.8 ns, 0.8 ns to 120 s Settable as Fixed.
Inter Stream Gap	Resolution of 0.8 ns, 106.8 ns to 120 s Settable as Fixed.
Frame Setting	FCS: CRC32 MPLS label: Up to 10 MPLS label can be appended. Fixed setting. Protocol Editing: None, IPv4, TCP/IPv4, UDP/IPv4, IGMP/IPv4, ICMP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IS-IS IPv4/IPv6: IP Destination/Source Address can be set Fixed, Increment, Decrement, Random independently.*2 TCP/UDP: Either Destination Port Number or Source Port Number can be set Increment, Random. Data Field: Can set any portions of data field as All 0, All 1, Alternate1/0 (Each bit, Each 2 bits, Each 4 bits, Each 1 byte, Each 2 bytes), Increment, Decrement, Random, Single PRBS9. Only Data Field 1 can set Programmable, Time Stamp*3, Sequence Number*3, Test Frame. Programmable Header Pattern: 1 user defined pattern can be set.
Frame Size	8 to 65,535 byte Settable as Auto, Fixed, Increment*4, or Random*4

*1: To select the Random setting for the inter-frame gap, the frame length must be 64 bytes or more.

*2: For IPv6, any Increment, Decrement, or Random setting can be specified for bit width 1 to 32. Also, only either the destination or Source Address can be selected.

*3: When a sequence number or Time Stamp is used, the checksum field of the TCP/UDP packet contains an error code.

*4: Increment and Random settings can be specified for the frame size only when None is selected for the protocol.

MU120105A (Cont'd)

Item	Specifications
OH Setting PPP/Cisco HDLC /MAPOS Version 1 /MAPOS 16	Address: FFh (User defined) Cisco HDLC: 0Fh MAPOS Version 1: 03h Control: 03h (User defined) Cisco HDLC: 00h MAPOS Version 1: 03h Address MAPOS16: 00003h When MAPOS16 then Address field is 16 bit and Control field is 0 bit Protocol: 16 bit User defined (default 0021) FCS: Auto
Protocol Setting IPv4 (RFC0791)	Version: 4 (DEC) IHL: Auto Type of service: User defined (initial 00(hex)) Bit0 to 2 (Precedence): 111-Network control 110-Internetwork control 101-CRITIC/ECP 100-Flash override 011-Flash 010-Immediate 001-Priority 000-Routine Bit3: 0 = Normal delay, 1 = Low delay Bit4: 0 = Normal throughput, 1 = High throughput Bit5: 0 = Normal Reliability, 1= High Reliability Bit6 to 7: 2 bit user defined Total Length: Auto Identification: User defined (4 byte) Flag: User defined (initial 010(b)) Bit0: User defined Bit1: (DF) 0 = May Fragment, 1= Don't Fragment Bit2: (MF) 0 = Last Fragment, 1= More Fragment Fragment offset: 0 to 8191(DEC) user defined (initial 0) Time to Live: 0 to 255 (DEC) user defined (initial 64) Protocol: 0 to 255 (DEC) user defined (initial 0) Automatically set if TCP or UDP is selected. Header Checksum: Auto Source Address: Static, Increment, Decrement, Random with class and mask setting Destination Address: Static, Increment, Decrement, Random with class and mask setting Option: 0 to 40 byte

MU120105A (Cont'd)

Item	Specifications
IPv6 (RFC2460)	Version (4 bit): 6 Traffic class (8 bit): 0-uncharacterized traffic 1-"filler" traffic 2-unattended data transfer 3-reserved 4-attended bulk transfer 5-reserved 6-interactive traffic 7-internet control traffic Flow Label (20 bit): 20 bit user defined (initial all 0) Payload length (16 bit): Auto Next header (8 bit): 0 to 255 (DEC) user defined (initial 59) Hop Limit (8 bit): 0 to 255 user defined (initial 0) Source Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask) Destination Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask)
TCP (RFC0793)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Sequence number (32 bit): User defined Acknowledgement Number(32 bit): User defined, 0000 to FFFF Data offset (4 bit): Set to 5 Reserved (6 bit): User defined, 0 to 63 Control bit (6 bit): User Defined, Setting by bit Window (16 bit): User defined, 0 to 65535 Checksum (16 bit): Auto Urgent pointer (16 bit): User defined, 0 to 65535 Option: 0 to 40 byte Padding: All 0
UDP (RFC0768)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Length (16 bit): Auto Checksum (16 bit): Auto
IGMP (RFC2236)	Type (4 bit): 11- Membership query 12- Version1 Membership report 16- Version2 Membership report 17- Leave group Max response time (8 bit): User defined, 0 to 255 Checksum (16 bit): Automatically calculated Group address (32 bit): User defined Version: set to 2

MU120105A (Cont'd)

Item	Specifications
ICMP (RFC792, 950, 1256)	Type (8 bit): 0 = Reply 3 = Destination Unreachable 4 = Source Quench 5 = Redirect 8 = Echo 9 = Router Advertisement 10 = Router Selection 11 = Time Exceeded 12 = Parameter Program 13 = Time Stamp 14 = Time Stamp Reply 15 = Information Request 16 = Information Reply 17 = Address Mask Request 18 = Address Mask Reply Code (8 bit): User defined 0 to 255 Checksum (16 bit): Automatically calculated (Soft) Data: For Echo Request/Response Identifier (16 bit): User defined Sequence Number (16 bit): User defined
RIP (RFC2453)	Command (8 bit): 1 = Request 2 = Response Version (8 bit): 1 = RIP version1 2 = RIP version2 Address Family Identifier (16 bit): 0000 0002 = IP protocol FFFF = Authentication entry see next Route tag: User defined IP Address: User defined Subnet Mask: User defined for Version2 Next hop: User defined for Version2 Metric: 0 to 4294967295 (DEC) Authentication type (16 bit): 1-IP Route 2-Password 3-Keyed Message Digest Algorithm Authentication Data: ASCII 16 byte entry

MU120105A (Cont'd)

Item	Specifications
DHCP (RFC2131)	Op Code (8 bit): User defined 1 = Boot request 2 = Boot reply Hardware type (8 bit): User defined 1 = 10 MB Ethernet Hardware address length (8 bit): User defined 6 = for MAC address Hops (8 bit): User defined (0 to 255) Transaction ID (32bit): User defined (0 to 4294967295(DEC)) Seconds (16 bit): User defined (0 to 65535(DEC)) Flag (16 bit) : User defined 0000 = Nobroadcast 8000 = Broadcast Client IP address (32 bit): User defined Your IP address (32 bit): User defined Server IP address (32 bit): User defined Relay Agent IP address (32 bit): User defined Client Hardware address (16 byte): User defined Server Host Name (64 byte): User defined Boot File Name (128 byte): User defined Option (0 to 64 byte): User defined
MPLS (RFC3031, 3032)	Label (20 bit): User defined 0 = IPv4 explicit null label 1 = Router alert label 2 = IPv6 explicit null label 3 = Implicit null label 4 to 15 = Reserved EXP (3 bit): User defined S (1 bit): Bottom of stack TTL (8 bit): User defined 10 kinds of MPLS can set.
Error Insertion	
PPP	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame
IP	IPv4 Header Checksum Error
TCP/UDP	TCP/UDP Checksum Error
Data	Supported by Option 11 Packet BER Test: PRBS Error
Unframed BER Setting	Test Pattern: PRBS23, PRBS31 Error Insertion: Bit All Insertion Timing: Single, Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmable Rate (1.0E-10 to 9.9E-3)

MU120105A (Cont'd)

Item	Specifications
Measurement Function	
SONET/SDH Test	
Performance	G. 826
K1, K2 Monitor	Conform to G.783 or G.841
Pointer Monitor	AU Pointer Graph: Pointer value, Pointer Inc/Dec Resolution: 1 s, 1 min, 15 min, 60 min
OH Monitor	SOH, POH, J0, J1 Display: CRC, TIM S1, C2: Received octet value are decoded for display
APS Switch Time	Trigger: Error, Alarm, External trigger Resolution: 125 us Threshold: 1 ms, 10 ms, 100 ms Start → Waiting trigger → Trigger detect → Stop
APS Sequence Capture	Trigger: Error, Alarm, External trigger Trigger Position: 1 to 64 64 word (1 word: 1 to 8000 frame)
Counter	
Mode	Accumulated, 1 s current
SONET/SDH	NDF Count/Rate, +PJC Count/Rate, –PJC Count/Rate, Consecutive Count/Rate, PPM, HP-IEC Count/Rate, REI-P/HP-REI Count/Rate, B3 Count/Rate, UNEQ-P/HP-UNEQ Count/Second, PLM-P/HP-SLM Count/Second, RDI-P/HP-RDI Count/Second, LOP-P/AU-LOP Count/Second, AIS-P/AU-AIS Count/Second, REI-L/MS-REI Count/Second, B2 Count/Rate, B1 Count/Rate, RDI-L/MS-RDI Count/Second, AIS-L/MS-AIS Count/Second, OOF Count/Second, LOF Count/Second, Bit Info. Count/Rate*5, Pattern Sync. Loss Count/Second*5
PPP	Transmitted/Received Frame Count, Transmitted/Received Frame Rate, Transmitted/Received Bit Count, Transmitted/Received Bit Rate, Transmitted/Received byte Count, Transmitted/Received Rate, FCS Error, Undersize, Fragment, Oversize, Oversize & FCS Error, Transmitted bytes After Stuffing, Received bytes Before Destuffing, Aborted Frame
IPv4	Transmitted/Received IPv4 Packet Count, Transmitted/Received IPv4 Packet Rate, Transmitted/Received Ping Request, Transmitted/Received Ping Reply, IP Header Checksum Error

*5: Measurement is enabled only when the Bulk setting is specified for mapping.

MU120105A (Cont'd)

Item	Specifications
TCP/UDP	Received TCP Packet Count, Received TCP Packet Rate, Received UDP Packet Count, Received UDP Packet Rate, TCP Checksum Error*6, UDP Checksum Error*6
Data	Capture Trigger, Capture Filter, User Defined 1 Count/Rate, User Defined 2 Count/Rate, QoS 0 to 7 Frame Count/Rate. User Defined counter conditions; Destination IP Address: don't care, Match, Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Refer to Pattern and Error conditions of Capture.
Packet BER Test (Opt11)	Transmitted/Received Test Frame Count, Sequence Error, Received PRBS Frame Error Count/Rate, Received PRBS Bit Error Count/Rate
Unframed BER Test	Bit Error Count/Rate, Pattern Sync. Loss Count/Second
Graph	8 kind of graph are displayed simultaneously. 1 s, 1 min, 15 min, 60 min resolution

MU120105A (Cont'd)

Item	Specifications
Capture	
Capture Buffer	256 Mbyte/Port
Capture Filter/Trigger	Filter condition settings; Destination IP Address: don't care, Match,Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Trigger condition settings; Destination IP Address: don't care, Match,Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match External Trigger: Traffic is out of range:0 to 100% Latency is out of range:1 ns to 59 s Manual Trigger: Trigger Position Settings; Top, Middle, Bottom
Pattern and Error Conditions	Destination IP Address:32 bit Mask:bit mask Source IP Address:32 bit Mask:bit mask Pattern1,2; Pattern:32 bit Mask:byte mask Field:Source IP, Destination IP, TCP, UDP, Custom(Offset:0 to 65535) Error; Error type: Good Frame,FCS Error,Undersize, Fragments, Oversize,Oversize&FCS Error, IP Header checksum Error, TCP checksum Error, UDP checksum Error, Sequence Error※7, PRBS Frame Error※7 Combination; And,Or

*7: Option 11 Packet BER Test is required.

MU120105A (Cont'd)

Item	Specifications
Decode Protocol	Ethernet (Type II, IEEE802.3, Mac Control), VLAN, MPLS, LLC, LACP, BPDU (STP, RST, MST), ARP, Ethernet OAM, IP, IPv6 (include Extended, Header), IPX, OSINL, IS-IS, IGMP (include IGAP), ICMP, ICMPv6 (include NDP, MLD, MLDA), TCP, UDP, OSPF, OSPFv3, DVMRP, LDP (CR-LDP), BGP4, RIP, DHCP, RSVP (RSVP-TE), BGP4+, PIM-SMv2, PPP (include LCP, IPCP, IPv6CP, OSINLCP, MPLSCP), CiscoHDLC, MAPOS, NSP, SSP, Test Frame
Extended Decode Protocol	By Sniffer® Technologies (Opt04) or MX123002A Expert Analysis Module, the number of decode protocols can be increased up to 400. MD1230 Family includes Ethereal® Convert Function.
Replay	Capture frames are converted to Tx streams.
Latency	When Test Frames are received, the latency is indicated. The result includes 1s sampling value, max, min, avg. and number of samples.
Protocol Emulation	PPP (LCP, IPCP), ICMP, BGP-4, IGMP
Ping	Destination: User defined Send: 4 times Result: Reply, bytes, time, TTL

*6: The packets fragmented in the IP layer are counted as error packets.

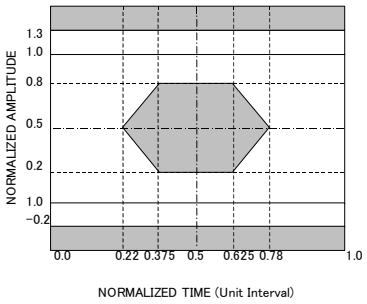
MU120105A (Cont'd)

Item	Specifications
Frame Arrival Time Variation (Packet Jitter)	
Resolution	32 counters indicate the results. Resolution: 1 us, 10 us, 100 us, 1 ms, 10 ms, 100 ms, 1 s.
Offset	Depend on resolution, Max. 3 min.
Graph	Frame Count vs. Time Interval Auto scale: On/Off
Traffic Monitor	Traffic Monitor can measure up to 64 streams in real-time. Target: IPv4 Address, Protocol Number (IP Protocol)
Traffic Map	Traffic Map can measure up to 64 streams in real-time. Target: IPv4 Address
Service Disruption Time	Time of frame disruption.
Power Meter	Range: –14 to 0 dBm Accuracy: ±2 dB
Automatic Test	
RFC2544 Automatic Test	Following 6 types of tests can be supported. (MD1230 Family supports continuous test [1] to [5]). [1] Throughput [2] Latency [3] Frame Loss Rate [4] Back-to-back frames [5] System recovery [6] Reset
Port Pairs	Traffic Distribution: One to one, Partially meshed, Fully meshed Traffic Orientation: Unidirectional, Bidirectional Mesh Type: Round Robin, Peak Loading VLAN Tag: On/Off VLAN ID: 1 to 4095
Test Setting	Frame Size: 64, 128, 256, 512, 1024, 1280, 1518 byte Custom: 1 to 25 point Step: Start form 64 to 65535 Step Size 1 to 65471 Count 1 to 25 Test Frame Protocol: MAC, IP Device Type: Store and forward, Bit forward Leaning Frame: Leaning Mode: Never, Once, Every Trial Retries: 1 to 999
Throughput	Duration: 2 to 999 s Number of Trials: 1 to 50 Burst Size: 1 to 1000 Rate (%): Initial rate, minimum rate, maximum rate, resolution, 0.01% step Loss Tolerance: 0 to 100%, 0.0001% step Result: Frame Rate (%), Frame/s, Bit/s, byte/s Graph: Frame Rate (%), or Frame/s or Bit/s or byte/s vs. frame size, Theoretical value

MU120105A (Cont'd)

Item	Specifications
Latency	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step, Result of Throughput Rate Burst Size: 1 to 1000 Result: Latency (0.01 us resolution) Graph: Latency vs. frame size
Frame Loss Rate	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Result: Frame Loss Rate (%) Graph: Frame Rate vs. Frame Loss Rate
Back-to-Back Frames	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Loss Tolerance: 0 to 100%, 0.0001% step Result: Number of frames Graph: Number of frames vs. frame size
System Recovery	Duration: 2 to 999 s Number of Trials: 1 to 50 Threshold Time: 0 to 999 s Rate (%): Overload Rate (110% of the Throughput Rate user defined), Moderate Rate Burst Size: 1 to 1000 Result: Recovery time (1 us resolution, Accuracy 1 us) Graph: Recovery time vs. frame size
Reset	Rate (%): User defined Burst Size: 1 to 1000 Sequence: Start → Waiting trigger → Triggered → Stop Graph: Reset time (1 us resolution, Accuracy 1 us)
Environmental Performance	
Temperature range	Operation: 0 to +40°C Storage: –20 to +60°C
Power Consumption	Less than 50 W
Size	Based on PICMG2.0 R2.1 262.0 (W) × 20.0 (H) × 174.5 (D) mm It doesn't contain protuberance.
Weight	Less than 1.5 kg

MU120106A

Item	Specifications
Model name	MU120106A
Apparatus name	10G (1.55) Module
Composition	Module × 1
Interface	
Corresponding Specification	OC-192/STM-64
Connector	SC
Number of Ports	1
Bit Rate	9953.280 M bit/s ±100 ppm (NRZ)
Clock	Internal (±100 ppm Variable), Receive, Lock (64 kHz +8 kHz, 1.5 MHz, 2MHz, 1.5 Mbit/s, 2 Mbit/s)
Wavelength	1530 to 1565 nm
Output Level (PRBS23 average power)	–1 to +2 dBm
Extinction Ratio	8.2 dB over
SMSR	30 dB over
Spectral Width	1 nm under
Pulse Mask	
Input Sensitivity	–14 to –3 dBm
Loss Detection	–18 to –16 dBm
Return Loss	27 dB
Maximum Rating Absolutely	+2 dBm
Laser Safety	21 CFR 1040.10:1995 CLASS I IEC60825-1:2001 CLASS 1
LED	Link, Tx, Rx, Error, Optical Send

MU120106A (Cont'd)

Item	Specifications
SONET/SDH Setting	
Frame	SONET/SDH
Mapping	OC-192c/STM-64c - VC4*64c - PPP OC-192c/STM-64c - VC4*64c - CiscoHDLC OC-192c/STM-64c - VC4*64c - MAPOS Version1 OC-192c/STM-64c - VC4*64c - MAPOS 16 OC-192c/STM-64c - VC4*64c - Bulk Unframed
OH Preset	SOH: All byte except B1, B2, H1, H2, H3, K1, K2 POH: All byte except B3 Path trace: J0, J1 (CRC7, Trace on)
Alarm Addition	LOS, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, TIM-L/MS-TIM, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, PLM-P/HP-SLM, TIM-P/HP-TIM, UNEQ-P/HP-UNEQ
Alarm Addition Timing	Single, Single Burst Frame (Burst Size: 1 to 64,000), Alternative (Alarm Frame: 0 to 8,000, Normal Frame: 1 to 8,000), All
Error Insertion	FAS, B1, B2, B3, REI-P/MS-REI, REI-P/HP-REI, HP-IEC, Bit All, Bit Info.
Error Insertion Timing	Single, Single Burst Bit (Burst Size: 1 to 64,000), Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmed Rate (A*E-B | A: 1.0 to 9.9, B: 3 to 10), All
K1, K2	Conform to G.783 or G.841
Pointer	AU pointer NDF: 0000 to 1111 SS: 00 to 11 Pointer: 0 to 1023 +Justification, –Justification
APS Sequence Generation	K1/K2: 2 to 64 Words, Repeat 1 to 8000 Frame/Word, Single or Repeat generation.
Port setting	
IPv4	
This port	IPv4 Address, Netmask, Gateway
ICMP Echo(PING) Reply	Not send, Reply to this port ping request
PPP	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 32bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit(default1500), Magic-number (random) , IPCP(Send this port IP address), Default, Time out
Mode	Normal, Monitor, Through(with or without OH Overwrite)

MU120106A (Cont'd)

Item	Specifications
Stream	
Number of Streams	256 Streams/Port
Stream Setting	
Distribution	Stream Transport Mode: Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for Count (Loop Count: 1 to 16,000,000)
Frame per Burst	1 to 1,099,511,627,775
Burst per Stream	1 to 1,099,511,627,775
Frame view	Raw frame, Decoded
Gap Setting	
Inter Frame Gap	Resolution of 0.8 ns, 0.8 ns to 120 s Settable as Fixed or Random*1
Inter Burst Gap	Resolution of 0.8 ns, 0.8 ns to 120 s Settable as Fixed.
Inter Stream Gap	Resolution of 0.8 ns, 106.8 ns to 120 s Settable as Fixed.
Frame Setting	FCS: CRC32 MPLS label: Up to 10 MPLS label can be appended. Fixed setting. Protocol Editing: None, IPv4, TCP/IPv4, UDP/IPv4, IGMP/IPv4, ICMP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IS-IS IPv4/IPv6: IP Destination/Source Address can be set Fixed, Increment, Decrement, Random independently.*2 TCP/UDP: Either Destination Port Number or Source Port Number can be set Increment, Random. Data Field: Can set any portions of data field as All 0, All 1, Alternate1/0 (Each bit, Each 2bits, Each 4bits, Each 1 byte, Each 2 bytes), Increment, Decrement, Random Single PRBS9. Only Data Field 1 can set Programmable, Time Stamp*3, Sequence Number*3, Test Frame. Programmable Header Pattern: 1 user defined pattern can be set.
Frame Size	8 to 65,535 byte Settable as Auto, Fixed, Increment*4, or Random*4

*1: To select the Random setting for the inter-frame gap, the frame length must be 64 bytes or more.

*2: For IPv6, any Increment, Decrement, or Random setting can be specified for bit width 1 to 32. Also, only either the destination or Source Address can be selected.

*3: When a sequence number or Time Stamp is used, the checksum field of the TCP/UDP packet contains an error code.

*4: Increment and Random settings can be specified for the frame size only when None is selected for the protocol.

MU120106A (Cont'd)

Item	Specifications
OH Setting PPP/Cisco HDLC /MAPOS Version 1 /MAPOS 16	Address: FFh (User defined) Cisco HDLC: 0Fh MAPOS Version 1: 03h Control: 03h (User defined) Cisco HDLC: 00h MAPOS Version 1: 03h Address MAPOS16: 00003h When MAPOS16 then Address field is 16 bit and Control field is 0 bit Protocol: 16 bit User defined (default 0021) FCS: Auto
Protocol Setting IPv4 (RFC0791)	Version: 4 (DEC) IHL: Auto Type of service: User defined (initial 00(hex)) Bit0 to 2 (Precedence): 111-Network control 110-Internetwork control 101-CRITIC/ECP 100-Flash override 011-Flash 010-Immediate 001-Priority 000-Routine Bit3: 0 = Normal delay, 1 = Low delay Bit4: 0 = Normal throughput, 1 = High throughput Bit5: 0 = Normal Reliability, 1= High Reliability Bit6 to 7: 2 bit user defined Total Length: Auto Identification: User defined (4 byte) Flag: User defined (initial 010(b)) Bit0: User defined Bit1: (DF) 0 = May Fragment, 1= Don't Fragment Bit2: (MF) 0 = Last Fragment, 1= More Fragment Fragment offset: 0 to 8191(DEC) user defined (initial 0) Time to Live: 0 to 255 (DEC) user defined (initial 64) Protocol: 0 to 255 (DEC) user defined (initial 0) Automatically set if TCP or UDP is selected. Header Checksum: Auto Source Address: Static, Increment, Decrement, Random with class and mask setting Destination Address: Static, Increment, Decrement, Random with class and mask setting Option: 0 to 40 byte

MU120106A (Cont'd)

Item	Specifications
IPv6 (RFC2460)	Version (4 bit): 6 Traffic class (8 bit): 0-uncharacterized traffic 1-"filler" traffic 2-unattended data transfer 3-reserved 4-attended bulk transfer 5-reserved 6-interactive traffic 7-internet control traffic Flow Label (20 bit): 20 bit user defined (initial all 0) Payload length (16 bit): Auto Next header (8 bit): 0 to 255 (DEC) user defined (initial 59) Hop Limit (8 bit): 0 to 255 user defined (initial 0) Source Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask) Destination Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask)
TCP (RFC0793)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Sequence number (32 bit): User defined Acknowledgement Number(32 bit): User defined, 0000 to FFFF Data offset (4 bit): Set to 5 Reserved (6 bit): User defined, 0 to 63 Control bit (6 bit): User Defined, Setting by bit Window (16 bit): User defined, 0 to 65535 Checksum (16 bit): Auto Urgent pointer (16 bit): User defined, 0 to 65535 Option: 0 to 40 byte Padding: All 0
UDP (RFC0768)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Length (16 bit): Auto Checksum (16 bit): Auto
IGMP (RFC2236)	Type (4 bit): 11- Membership query 12- Version1 Membership report 16- Version2 Membership report 17- Leave group Max response time (8 bit): User defined, 0 to 255 Checksum (16 bit): Automatically calculated Group address (32 bit): User defined Version: set to 2

MU120106A (Cont'd)

Item	Specifications
ICMP (RFC792, 950, 1256)	Type (8 bit): 0 = Reply 3 = Destination Unreachable 4 = Source Quench 5 = Redirect 8 = Echo 9 = Router Advertisement 10 = Router Selection 11 = Time Exceeded 12 = Parameter Program 13 = Time Stamp 14 = Time Stamp Reply 15 = Information Request 16 = Information Reply 17 = Address Mask Request 18 = Address Mask Reply Code (8 bit): User defined 0 to 255 Checksum (16 bit): Automatically calculated (Soft) Data: For Echo Request/Response Identifier (16 bit): User defined Sequence Number (16 bit): User defined
RIP (RFC2453)	Command (8 bit): 1 = Request 2 = Response Version (8 bit): 1 = RIP version1 2 = RIP version2 Address Family Identifier (16 bit): 0000 0002 = IP protocol FFFF = Authentication entry see next Route tag: User defined IP Address: User defined Subnet Mask: User defined for Version2 Next hop: User defined for Version2 Metric: 0 to 4294967295 (DEC) Authentication type (16 bit): 1-IP Route 2-Password 3-Keyed Message Digest Algorithm Authentication Data: ASCII 16 byte entry

MU120106A (Cont'd)

Item	Specifications
DHCP (RFC2131)	Op Code (8 bit): User defined 1 = Boot request 2 = Boot reply Hardware type (8 bit): User defined 1 = 10MB Ethernet Hardware address length (8 bit): User defined 6 = for MAC address Hops (8 bit): User defined (0 to 255) Transaction ID (32 bit): User defined (0 to 4294967295(DEC)) Seconds (16 bit): User defined (0 to 65535(DEC)) Flag (16 bit): User defined 0000 = Nobroadcast 8000 = Broadcast Client IP address (32 bit): User defined Your IP address (32 bit): User defined Server IP address (32 bit): User defined Relay Agent IP address (32 bit): User defined Client Hardware address (16 byte): User defined Server Host Name (64 byte): User defined Boot File Name (128 byte): User defined Option (0 to 64 byte): User defined
MPLS (RFC3031, 3032)	Label (20 bit): User defined 0 = IPv4 explicit null label 1 = Router alert label 2 = IPv6 explicit null label 3 = Implicit null label 4 to 15 = Reserved EXP (3 bit): User defined S (1 bit): Bottom of stack TTL (8 bit): User defined 10 kinds of MPLS can set.
Error Insertion	
PPP	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame
IP	IPv4 Header Checksum Error
TCP/UDP	TCP/UDP Checksum Error
Data	Supported by Option 11 Packet BER Test: PRBS Error
Unframed BER Setting	Test Pattern: PRBS23, PRBS31 Error Insertion: Bit All Insertion Timing: Single, Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmable Rate (1.0E-10 to 9.9E-3)

MU120106A (Cont'd)

Item	Specifications
Measurement Function	
SONET/SDH Test	
Performance	G. 826
K1, K2 Monitor	Conform to G.783 or G.841
Pointer Monitor	AU Pointer Graph: Pointer value, Pointer Inc/Dec Resolution: 1 s, 1 min, 15 min, 60 min
OH Monitor	SOH, POH, J0, J1 Display: CRC, TIM S1, C2: Received octet value are decoded for display
APS Switch Time	Trigger: Error, Alarm, External trigger Resolution: 125 us Threshold: 1 ms, 10 ms, 100 ms Start → Waiting trigger → Trigger detect → Stop
APS Sequence Capture	Trigger: Error, Alarm, External trigger Trigger Position: 1 to 64 64 word (1 word: 1 to 8000 frame)
Counter	
Mode	Accumulated, 1 s current
SONET/SDH	NDF Count/Rate, +PJC Count/Rate, –PJC Count/Rate, Consecutive Count/Rate, PPM, HP-IEC Count/Rate, REI-P/HP-REI Count/Rate, B3 Count/Rate, UNEQ-P/HP-UNEQ Count/Second, PLM-P/HP-SLM Count/Second, RDI-P/HP-RDI Count/Second, LOP-P/AU-LOP Count/Second, AIS-P/AU-AIS Count/Second, REI-L/MS-REI Count/Second, B2 Count/Rate, B1 Count/Rate, RDI-L/MS-RDI Count/Second, AIS-L/MS-AIS Count/Second, OOF Count/Second, LOF Count/Second, Bit Info. Count/Rate*5, Pattern Sync. Loss Count/Second*5
PPP	Transmitted/Received Frame Count, Transmitted/Received Frame Rate, Transmitted/Received Bit Count, Transmitted/Received Bit Rate, Transmitted/Received byte Count, Transmitted/Received Rate, FCS Error, Undersize, Fragment, Oversize, Oversize & FCS Error, Transmitted bytes After Stuffing, Received bytes Before Destuffing, Aborted Frame
IPv4	Transmitted/Received IPv4 Packet Count, Transmitted/Received IPv4 Packet Rate, Transmitted/Received Ping Request, Transmitted/Received Ping Reply, IP Header Checksum Error

*5: Measurement is enabled only when the Bulk setting is specified for mapping.

MU120106A (Cont'd)

Item	Specifications
TCP/UDP	Received TCP Packet Count, Received TCP Packet Rate, Received UDP Packet Count, Received UDP Packet Rate, TCP Checksum Error*6, UDP Checksum Error*6
Data	Capture Trigger, Capture Filter, User Defined 1 Count/Rate, User Defined 2 Count/Rate, QoS 0 to 7 Frame Count/Rate. User Defined counter conditions; Destination IP Address: don't care, Match, Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Refer to Pattern and Error conditions of Capture.
Packet BER Test (Opt11)	Transmitted/Received Test Frame Count, Sequence Error, Received PRBS Frame Error Count/Rate, Received PRBS Bit Error Count/Rate
Unframed BER Test	Bit Error Count/Rate, Pattern Sync. Loss Count/Second
Graph	8 kind of graph are displayed simultaneously. 1 s, 1 min, 15 min, 60 min resolution

*6: The packets fragmented in the IP layer are counted as error packets

MU120106A (Cont'd)

Item	Specifications
Capture	
Capture Buffer	256 Mbyte/Port
Capture Filter/Trigger	Filter condition settings; Destination IP Address: don't care, Match, Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Trigger condition settings; Destination IP Address: don't care, Match, Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match External Trigger: Traffic is out of range:0 to 100% Latency is out of range:1 ns to 59 s Manual Trigger: Trigger Position Settings; Top, Middle, Bottom
Pattern and Error Conditions	Destination IP Address:32 bit Mask:bit mask Source IP Address:32 bit Mask:bit mask Pattern1,2 Pattern:32 bit Mask:byte mask Field: Source IP, Destination IP, TCP, UDP, Custom(Offset:0 to 65535) Error; Error type: Good Frame,FCS Error,Undersize, Fragments, Oversize, Oversize&FCS Error, IP Header checksum Error, TCP checksum Error, UDP checksum Error, Sequence Error※7, PRBS Frame Error※7 Combination; And,Or

*7: Option 11 Packet BER Test is required.

MU120106A (Cont'd)

Item	Specifications
Decode Protocol	Ethernet (Type II, IEEE802.3, Mac Control), VLAN, MPLS, LLC, LACP, BPDU (STP, RST, MST), ARP, Ethernet OAM, IP, IPv6 (include Extended, Header), IPX, OSINL, IS-IS, IGMP (include IGAP), ICMP, ICMPv6 (include NDP, MLD, MLDA), TCP, UDP, OSPF, OSPFv3, DVMRP, LDP (CR-LDP), BGP4, RIP, DHCP, RSVP (RSVP-TE), BGP4+, PIM-SMv2, PPP (include LCP, IPCP, IPv6CP, OSINLCP, MPLSCP), CiscoHDLC, MAPOS, NSP, SSP, Test Frame
Extended Decode Protocol	By Sniffer® Technologies (Opt04) or MX123002A Expert Analysis Module, the number of decode protocols can be increased up to 400. MD1230 Family includes Ethereal® Convert Function.
Replay	Capture frames are converted to Tx streams.
Latency	When Test Frames are received, the latency is indicated. The result includes 1 s sampling value, max, min, avg. and number of samples.
Protocol Emulation	PPP (LCP, IPCP), ICMP, BGP-4, IGMP
Ping	Destination: User defined Send: 4 times Result: Reply, bytes, time, TTL

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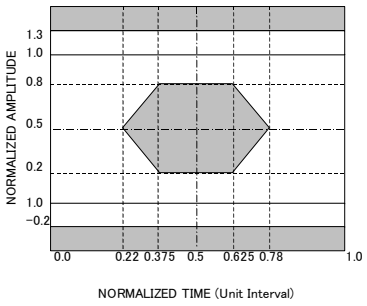
MU120106A (Cont'd)

Item	Specifications
Frame Arrival Time Variation (Packet Jitter)	
Resolution	32 counters indicate the results. Resolution: 1 us, 10 us, 100 us, 1 ms, 10 ms, 100 ms, 1 s.
Offset	Depend on resolution, Max. 3 min.
Graph	Frame Count vs. Time Interval Auto scale: On/Off
Traffic Monitor	Traffic Monitor can measure up to 64 streams in real-time. Target: IPv4 Address, Protocol Number (IP Protocol)
Traffic Map	Traffic Map can measure up to 64 streams in real-time. Target: IPv4 Address
Service Disruption Time	Time of frame disruption.
Power Meter	Range: –14 to 0 dBm Accuracy: ±2 dB
Automatic Test	
RFC2544 Automatic Test	Following 6 types of tests can be supported. (MD1230 Family supports continuous test [1] to [5]). [1] Throughput [2] Latency [3] Frame Loss Rate [4] Back-to-back frames [5] System recovery [6] Reset
Port Pairs	Traffic Distribution: One to one, Partially meshed, Fully meshed Traffic Orientation: Unidirectional, Bidirectional Mesh Type: Round Robin, Peak Loading VLAN Tag: On/Off VLAN ID: 1 to 4095
Test Setting	Frame Size: 64, 128, 256, 512, 1024, 1280, 1518 byte Custom: 1 to 25 point Step: Start form 64 to 65535 Step Size 1 to 65471 Count 1 to 25 Test Frame Protocol: MAC, IP Device Type: Store and forward, Bit forward Leaning Frame: Leaning Mode: Never, Once, Every Trial Retries: 1 to 999
Throughput	Duration: 2 to 999 s Number of Trials: 1 to 50 Burst Size: 1 to 1000 Rate (%): Initial rate, minimum rate, maximum rate, resolution, 0.01% step Loss Tolerance: 0 to 100%, 0.0001% step Result: Frame Rate (%), Frame/s, Bit/s, byte/s Graph: Frame Rate (%), or Frame/s or Bit/s or byte/s vs. frame size, Theoretical value

MU120106A (Cont'd)

Item	Specifications
Latency	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step, Result of Throughput Rate Burst Size: 1 to 1000 Result: Latency (0.01 us resolution) Graph: Latency vs. frame size
Frame Loss Rate	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Result: Frame Loss Rate (%) Graph: Frame Rate vs. Frame Loss Rate
Back-to-Back Frames	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Loss Tolerance: 0 to 100%, 0.0001% step Result: Number of frames Graph: Number of frames vs. frame size
System Recovery	Duration: 2 to 999 s Number of Trials: 1 to 50 Threshold Time: 0 to 999 s Rate (%): Overload Rate (110% of the Throughput Rate user defined), Moderate Rate Burst Size: 1 to 1000 Result: Recovery time (1 us resolution, Accuracy 1 us) Graph: Recovery time vs. frame size
Reset	Rate (%): User defined Burst Size: 1 to 1000 Sequence: Start → Waiting trigger → Triggered → Stop Graph: Reset time (1 us resolution, Accuracy 1 us)
Environmental Performance	
Temperature range	Operation: 0 to +40°C Storage: –20 to +60°C
Power Consumption	Less than 50 W
Size	Based on PICMG2.0 R2.1 262.0 (W) × 20.0 (H) × 174.5 (D) mm It doesn't contain protuberance.
Weight	Less than 1.5 kg

MU120103B

Item	Specifications
Model name	MU120103B
Apparatus name	2.5G (1.31) Module
Composition	Module × 1
Options	MU120103B-01: EoS Mapping Mapping: F-GFP, LAPS, LEX Concatenation: [SDH]VC-4-Xc (X = 16, 8, 4, 3, 2), VC-4, VC-3 [SONET] STS-Xc (X = 48, 24, 12, 9, 6, 3), STS-1 MU120103B-02: Virtual Concatenation [SDH] VC-4-Xv (X = 8, 7, 6, 5, 4, 3, 2), VC-3-Xv (X = 24, 21, 18, 15, 12, 9, 6, 3) [SONET] STS3c-Xv (X = 8, 7, 6, 5, 4, 3, 2), STS1-Xv (X = 24, 21, 18, 15, 12, 9, 6, 3)
Interface	
Corresponding Specification	OC-48/STM-16
Connector	SC
Number of Ports	1
Bit Rate	2488.320 M bit/s ±50 ppm (NRZ)
Clock	Internal ±50 ppm Variable), Receive, Lock (64 kHz +8 kHz, 1.5 MHz, 2MHz, 1.5 Mbit/s, 2 Mbit/s)
Wavelength	1260 to 1360 nm
Output Level (PRBS23 average power)	–5 to 0 dBm
Extinction Ratio	8.2 dB over
SMSR	30 dB over
Spectral Width	1 nm under
Pulse Mask	
Input Sensitivity	–18 to 0 dBm
Loss Detection	–30 to –25 dBm
Return Loss	27 dB
Maximum Rating Absolutely	+2 dBm
Laser Safety	21 CFR 1040.10:1995 CLASS I IEC60825-1:2001 CLASS 1
LED	Link, Tx, Rx, Error, Optical Send

MU120103B (Cont'd)

Item	Specifications
SONET/SDH Setting	
Frame	SONET/SDH
Mapping	OC-48c/STM-16c - (a) - PPP OC-48c/STM-16c - (a) - CiscoHDLC OC-48c/STM-16c - (a) - MAPOS Version1 OC-48c/STM-16c - (a) - MAPOS 16 OC-48c/STM-16c - (a) - Bulk OC-48c/STM-16c - (a) - (b) Unframed (a): VC4*16c VC4*Xc *1, *2 VC4 *1, *2 VC3 *1, *2 VC4*Xv *2 VC3*Xv *2 (b): F-GFP *1 LEX *1 LAPS *1
Measurement CH	Tx/Rx: 1Ch, Others are dummy CHs.
Dummy CH	Contiguous Concatenation Payload All payload and POH of Dummy CHs are same contents. PRBS15, PRBS23, PRBS31, All 0, All 1, Copy, Idle POH All byte except B3 are editable Path trace: J1 (CRC7, Trace on) Pointer NDF: same as the Measurement CH SS: same as the Measurement CH AU pointer: 522 fixed Virtual Concatenation All payload and POH of Dummy CHs are same contents. Size VC-4 when VC-4-Xv, VC-3 when VC-3Xv Payload PRBS15, PRBS23, PRBS31, All 0, All 1, Idle POH All byte except B3 are editable Path trace: J1 (CRC7, Trace on)

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

*2: MU120103B-02/MU120104B-02: Selectable only when virtual concatenation mapping is used.

MU120103B (Cont'd)

Item	Specifications
OH Preset	SOH: All byte except B1, B2, H1, H2, H3, K1, K2 POH: All byte except B3 Path trace: J0, J1 (CRC7, Trace on)
Virtual Concatenation	POH Setting POH of all members are editable. (except B3, H4) H4 Reserved bits are 0 fixed Differential delay generator: On/Off Range: ±100 pointer Resolution: 1 pointer Differential delay recovery ±100 pointer (on the basis of the start CH pointer)
Alarm Addition	LOS, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, TIM-L/MS-TIM, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, PLM-P/HP-SLM, TIM-P/HP-TIM, UNEQ-P/HP-UNEQ
Alarm Addition Timing	Single, Single Burst Frame (Burst Size: 1 to 64,000), Alternative (Alarm Frame: 0 to 8,000, Normal Frame: 1 to 8,000), All
Error Insertion	FAS, B1, B2, B3, REI-P/MS-REI, REI-P/HP-REI, HP-IEC, Bit All, Bit Info.
Error Insertion Timing	Single, Single Burst Bit (Burst Size: 1 to 64,000), Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmed Rate (A*E-B | A: 1.0 to 9.9, B: 3 to 10), All
K1, K2	Conform to G.783 or G.841
Pointer	AU pointer NDF: 0000 to 1111 SS: 00 to 11 Pointer: 0 to 1023 +Justification, –Justification
APS Sequence Generation	K1/K2: 2 to 64 Words, Repeat 1 to 8000 Frame/Word, Single or Repeat generation.

MU120103B (Cont'd)

Item	Specifications
Port setting	
IPv4	
This port	IPv4 Address, Netmask, Gateway
ARP Reply	Not send,Reply to this port ARP request,Reply to all ARP request
ICMP Echo(PING) Reply	Not send, Reply to this port ping request
PPP	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 16 bit/32 bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit (default1500), Magic-number (random), IPCP (Send this port IP address) Default, Time out
GFP (Opt01)	Scramble: On/Off Descramble: On/Off FCS: 32 bit Receive Conditions: Extension Header size other than NULL or Linear: 2 to 58 byte (except eHEC) cHEC Presync times: 1 to 16 CSF Recovery: 1 to 16 Payload header checking: On/Off
LAPS (Opt01)	Scramble: On only Descramble: On only Minimum Flag Length: 1 byte/2 byte FCS: 32 bit Rate adaptation X/Y (add X byte every Y frame byte) X: 0 to 1024 byte/16 byte Y: 4096/8192/16384/32768/65536
LEX (Opt01)	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 16 bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit(default1500), Magic-number (random) , IPCP(Send this port IP address) Default, Time out
Mode	Normal, Monitor, Through (with or without OH Overwrite)

MU120103B (Cont'd)

Item	Specifications
Stream	
Number of Streams	256 Streams/Port
Stream Setting	
Distribution	Stream Transport Mode: Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for Count (Loop Count: 1 to 16,000,000)
Frame per Burst	1 to 1,099,511,627,775
Burst per Stream	1 to 1,099,511,627,775
Frame view	Raw frame, Decoded
Gap Setting	
Inter Frame Gap*3	PPP/LEX/LAPS: Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed or Random.*4 GFP: Resolution of 13.4 ns, 0 ns to 120 s Settable as Fixed or Random.
Inter Burst Gap*3	PPP/LEX/LAPS: Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed. GFP: Resolution of 13.4 ns, 53.5 ns to 120 s Settable as Fixed or Random.
Inter Stream Gap*3	PPP/LEX/LAPS: Resolution of 3.3 ns, 267.1 ns to 120 s Settable as Fixed. GFP: Resolution of 13.4 ns, 267.1 ns to 120 s Settable as Fixed or Random.

*3: This value indicates the gap measured with OC-48 or STM16 mapping. When contiguous or virtual concatenation mapping is used, the value is inversely proportional to the set bit rate.

*4: To select the Random setting for the inter-frame gap, the frame length must be 64 bytes or more.

MU120103B (Cont'd)

Item	Specifications
Frame Setting	FCS: CRC32, CRC16 MAC Address: Fixed, Increment, Decrement, Random (Changeable portion specified in 4 bits units), Gateway (Only for DA), This port (Only for SA) VLAN tag*5: Up to 1 layer VLAN tags can be appended. VLAN ID can be set Increment, Decrement, Random. MPLS label*5: Up to 10 MPLS labels can be appended. Fixed setting. Protocol Editing: None, IPv4, TCP/IPv4, UDP/IPv4, IGMP/IPv4, ICMP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IPX, ARP, MAC Control, IS-IS, LEX Control Packet*6, GFP, PPP, Ethernet IPv4/IPv6: IP Destination/Source Address can be set Fixed, Increment, Decrement, Random I ndependently.*7 TCP/UDP: Either Destination Port Number or Source Port Number can be set Increment, Random. Data Field: Can set any portions of data field as All 0, All 1, Alternate1/0 (Each bit, Each 2 bits, Each 4 bits, Each 1 byte, Each 2 bytes), Increment, Decrement, Random, Single PRBS9. Only Data Field 1 can set Programmable, Time Stamp*8, Sequence Number*8, Test Frame. Programmable Header Pattern: 1 user defined pattern can be set.
Frame Size	8 to 65,535 byte Settable as Auto, Fixed, Increment*9, or Random*9

*5: VLAN tag and MPLS labels cannot both be used simultaneously.

*6: LEX Control Packet can be chosen only when choosing LEX mapping.

*7: For IPv6, any Increment, Decrement, Random setting can be specified for bit widths 1 to 32. Also, only either the destination or Source Address can be selected.

*8: When a sequence number or Time Stamp is used, the checksum field of the TCP/UDP packet contains an error code.

*9: Increment and Random settings can be specified for the frame size only when None is selected for the protocol.

MU120103B (Cont'd)

Item	Specifications
OH Setting	
PPP/Cisco HDLC /MAPOS Version 1 /MAPOS 16	Address: FFh (User defined) Cisco HDLC: 0Fh MAPOS Version 1: 03h Control: 03h (User defined) Cisco HDLC: 00h MAPOS Version 1: 03h Address MAPOS16: 0003h When MAPOS16 then Address field is 16 bit and Control field is 0 bit Protocol: 16 bit User defined (default 0021) FCS: Auto
GFP*1	PLI: Auto cHEC: Auto PTI: (User defined) PFI: (User defined) EXI: (User defined) UPI: (User defined) tHEC: (User defined) Header information: (User defined) eHEC: Auto FCS: Auto
LAPS*1	AddressI: (User defined) Control: (User defined) SAPI: (User defined) FCS: Auto
LEX*1	AddressI: (User defined) Control: (User defined) Protocol Type: (User defined) frag: (User defined) PAD: (User defined) FCS: Auto

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

MU120103B (Cont'd)

Item	Specifications
Protocol Setting	
Ethernet	DA: (→ Refer Frame setting/MAC Address) SA: (→ Refer Frame setting/MAC Address) Type: Automatically assigned, User defined FCS: Automatically calculated
IPv4 (RFC0791)	Version: 4 (DEC) IHL: Auto Type of service: User defined (initial 00(hex)) Bit0 to 2 (Precedence): 111-Network control 110-Internetwork control 101-CRITIC/ECP 100-Flash override 011-Flash 010-Immediate 001-Priority 000-Routine Bit3: 0 = Normal delay, 1 = Low delay Bit4: 0 = Normal throughput, 1 = High throughput Bit5: 0 = Normal Reliability, 1= High Reliability Bit6 to 7: 2 bit user defined Total Length: Auto Identification: User defined (4 byte) Flag: User defined (initial 010(b)) Bit0: User defined Bit1: (DF) 0 = May Fragment, 1= Don't Fragment Bit2: (MF) 0 = Last Fragment, 1= More Fragment Fragment offset: 0 to 8191(DEC) user defined (initial 0) Time to Live: 0 to 255 (DEC) user defined (initial 64) Protocol: 0 to 255 (DEC) user defined (initial 0) Automatically set if TCP or UDP is selected. Header Checksum: Auto Source Address:Static, Increment, Decrement, Random with class and mask setting Destination Address:Static, Increment, Decrement, Random with class and mask setting Option: 0 to 40 byte

MU120103B (Cont'd)

Item	Specifications
IPv6 (RFC2460)	Version (4 bit): 6 Traffic class (8 bit): 0-uncharacterized traffic 1-"filler" traffic 2-unattended data transfer 3-reserved 4-attended bulk transfer 5-reserved 6-interactive traffic 7-internet control traffic Flow Label (20 bit): 20 bit user defined (initial all 0) Payload length (16 bit): Auto Next header (8 bit): 0 to 255 (DEC) user defined (initial 59) Hop Limit (8 bit): 0 to 255 user defined (initial 0) Source Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask) Destination Address (128 bit):Static, Increment, Decrement, Random with class and mask setting (byte mask)
TCP (RFC0793)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Sequence number (32 bit): User defined Acknowledgement Number (32 bit): User defined, 0000 to FFFF Data offset (4 bit): Set to 5 Reserved (6 bit): User defined, 0 to 63 Control bit (6 bit): User defined, Setting by bit Window (16 bit): User defined, 0 to 65535 Checksum (16 bit): Auto Urgent pointer (16 bit): User defined, 0 to 65535 Option: 0 to 40 byte Padding: All 0
UDP (RFC0768)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Length (16 bit): Auto Checksum (16 bit): Auto
IGMP (RFC2236)	Type (4 bit): 11- Membership query 12- Version1 Membership report 16- Version2 Membership report 17- Leave group Max response time (8 bit): User defined, 0 to 255 Checksum (16 bit): Automatically calculated Group address (32 bit): User defined Version: set to 2

MU120103B (Cont'd)

Item	Specifications
ICMP (RFC792, 950, 1256)	Type (8 bit): 0 = Reply 3 = Destination Unreachable 4 = Source Quench 5 = Redirect 8 = Echo 9 = Router Advertisement 10 = Router Selection 11 = Time Exceeded 12 = Parameter Program 13 = Time Stamp 14 = Time Stamp Reply 15 = Information Request 16 = Information Reply 17 = Address Mask Request 18 = Address Mask Reply Code (8 bit): User defined 0 to 255 Checksum (16 bit): Automatically calculated (Soft) Data: For Echo Request/Response Identifier (16 bit): User defined Sequence Number (16 bit): User defined
RIP (RFC2453)	Command (8 bit): 1 = Request 2 = Response Version (8 bit): 1 = RIP version1 2 = RIP version2 Address Family Identifier (16 bit): 0000 0002 = IP protocol FFFF = Authentication entry see next Route tag: User defined IP Address: User defined Subnet Mask: User defined for Version2 Next hop: User defined for Version2 Metric: 0 to 4294967295 (DEC) Authentication type (16 bit): 1-IP Route 2-Password 3-Keyed Message Digest Algorithm Authentication Data: ASCII 16 byte entry

MU120103B (Cont'd)

Item	Specifications
DHCP (RFC2131)	Op Code (8 bit): User defined 1 = Boot request 2 = Boot reply Hardware type (8 bit): User defined 1 = 10MB Ethernet Hardware address length (8 bit): User defined 6 = for MAC address Hops (8 bit): User defined (0 to 255) Transaction ID (32 bit): User defined (0 to 4294967295(DEC)) Seconds (16 bit): User defined (0 to 65535(DEC)) Flag (16 bit) : User defined 0000 = Nobroadcast 8000 = Broadcast Client IP address (32 bit): User defined Your IP address (32 bit): User defined Server IP address (32 bit): User defined Relay Agent IP address (32 bit): User defined Client Hardware address (16 byte): User defined Server Host Name (64 byte): User defined Boot File Name (128 byte): User defined Option (0 to 64 byte): User defined
MPLS (RFC3031, 3032)	Label (20 bit): User defined 0 = IPv4 explicit null label 1 = Router alert label 2 = IPv6 explicit null label 3 = Implicit null label 4 to 15 = Reserved EXP (3 bit): User defined S (1 bit): Bottom of stack TTL (8 bit): User defined 10 kinds of MPLS can set.

MU120103B (Cont'd)

Item	Specifications
Error Insertion	
PPP	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame
GFP*1	Correctable cHEC Error, Uncorrected cHEC Error, Correctable tHEC Error, Uncorrected tHEC Error, Correctable eHEC Error, Uncorrected eHEC Error, FCS Error Ethernet: FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error
LAPS*1	FCS Error, Aborted Frame, Ethernet: FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error
LEX*1	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame, Ethernet: Undersize
IP	IPv4 Header Checksum Error
TCP/UDP	TCP/UDP Checksum Error
Data	Supported by Option 11 Packet BER Test: PRBS Error
Client Management Frame	Type: Signal Loss/Sync Loss/User1/User2 Header: PFI, EXI, UPI, Payload are editable Size: 8 to 1024 bytes, multiple of 4 Insertion Mode: Single/Repeat Insertion Interval: 10 ms to 2560 ms/10 ms step Insertion Interim Frame: Idle/Stream
Unframed BER Setting	Test Pattern: PRBS23, PRBS31 Error Insertion: Bit All Insertion Timing: Single, Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmable Rate (1.0E-10 to 9.9E-3)

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

MU120103B (Cont'd)

Item	Specifications
Measurement Function	
SONET/SDH Test	
Performance	G. 826
K1, K2 Monitor	Conform to G.783 or G.841
Pointer Monitor	AU Pointer Graph: Pointer value, Pointer Inc/Dec Resolution: 1 s, 1 min, 15 min, 60 min
OH Monitor	SOH, POH, J0, J1 Display: CRC, TIM S1, C2: Received octet value are decoded for display
APS Switch Time	Trigger: Error, Alarm, External trigger Resolution: 125 us Threshold: 1 ms, 10 ms, 100 ms Start → Waiting trigger → Trigger detect → Stop
APS Sequence Capture	Trigger: Error, Alarm, External trigger Trigger Position: 1 to 64 64 word (1word: 1 to 8000 frame)
Counter	
Mode	Accumulated, 1 s current
SONET/SDH	NDF Count/Rate, +PJC Count/Rate, –PJC Count/Rate, Consecutive Count/Rate, PPM, HP-IEC Count/Rate, REI-P/HP-REI Count/Rate, B3 Count/Rate, UNEQ-P/HP-UNEQ Count/Second, PLM-P/HP-SLM Count/Second, RDI-P/HP-RDI Count/Second, LOP-P/AU-LOP Count/Second, AIS-P/AU-AIS Count/Second, REI-L/MS-REI Count/Second, B2 Count/Rate, B1 Count/Rate, RDI-L/MS-RDI Count/Second, AIS-L/MS-AIS Count/Second, OOF Count/Second, LOF Count/Second, Bit Info. Count/Rate*10, Pattern Sync. Loss Count/Second*10, SQ Error Count/Second*11, Out of Alignment Count/Second*11
GFP*1	Transmitted/Received Frame Transmitted/Received Bit Rate Transmitted/Received byte Transmitted Rate Received Rate cHEC Error/correctable cHEC Error tHEC Error/correctable tHEC Error HEC Error FCS Error Server Signal Fail Interval Client Loss of Sync Frame Client Loss of Sync Interval Client Loss of Signal Frame Client Loss of Signal Interval

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

*10: Measurement is enabled only when bulk mapping is used.

*11: Settable as only Virtual Concatenation.

MU120103B (Cont'd)

Item	Specifications
LAPS*1	Transmitted/Received Frame Transmitted/Received Bit Rate Transmitted/Received byte Transmitted byte After Adaptation Transmitted byte After Stuffing Received byte Before Adaptation Received byte Before Destuffing Transmitted Rate Received Rate FCS error Aborted frame
LEX*1	Transmitted/Received Frame, Transmitted/Received Bit Rate, Transmitted/Received byte, Transmitted byte After Stuffing, Received byte Before Destuffing, Transmitted Rate, Received Rate, FCS error, Fragments, Undersize, Oversize, Oversize & FCS Error, Aborted frame
Ethernet	Transmitted/Received Frame Count, Transmitted/Received Frame Rate, Transmitted/Received Bit Count, Transmitted/Received Bit Rate, Transmitted/Received byte Count, Transmitted/Received Rate, FCS Error, Undersize, Fragment, Oversize, Oversize & FCS Error, MAC Control Frame, Transmitted/Received ARP Request, Transmitted/Received ARP Reply
IPv4	Transmitted/Received IPv4 Packet Count, Transmitted/Received IPv4 Packet Rate, Transmitted/Received Ping Request, Transmitted/Received Ping Reply, IP Header Checksum Error
TCP/UDP	Received TCP Packet Count, Received TCP Packet Rate, Received UDP Packer Count, Received UDP Packet Rate, TCP Checksum Error*12, UDP Checksum Error*12

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

*12: The packets fragmented in the IP layer are counted as error packets.

MU120103B (Cont'd)

Item	Specifications
Data	Capture Trigger, Capture Filter, User Defined 1 Count/Rate, User Defined 2 Count/Rate, QoS 0 to 7 Frame Count/Rate. User Defined counter conditions: Destination MAC Address*13: don't care, Match, Not match Source MAC Address*13: don't care, Match, Not match Destination IP Address*14: don't care, Match, Not match Source IP Address*14: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Refer to Pattern and Error conditions of Capture.
Packet BER Test (Opt11)	Transmitted/Received Test Frame Count, Sequence Error, Received PRBS Frame Error Count/Rate, Received PRBS Bit Error Count/Rate
Unframed BER Test	Bit Error Count/Rate, Pattern Sync. Loss Count/Second
Graph	8 kind of graph are displayed simultaneously. 1 s, 1 min, 15 min, 60 min resolution

*13: MAC Address can be set only in Frame-Mapped, GFP/LAPS(X.86)/LEX mapping

*14: IP Address can be set only in PPP/Cisco HDLC/MAPOS Version 1/MAPOS 16 mapping.

MU120103B (Cont'd)

Item	Specifications
Capture	
Capture Buffer	256 Mbyte/Port
Capture Filter/Trigger	Filter condition settings; Destination MAC Address*13: don't care, Match, Not match Source MAC Address*13: don't care, Match, Not match Destination IP Address: don't care, Match, Not atch Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Trigger condition settings; Destination MAC Address*13: don't care, Match, Not match Source MAC Address*13: don't care, Match, Not match Destination IP Address: don't care, Match,Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match External Trigger: Traffic is out of range:0 to 100% Latency is out of range:1 ns to 59 s Manual Trigger: Trigger Position Settings; Top, Middle, Bottom

*13: MAC Address can be set only in Frame-Mapped, GFP/LAPS(X.86) /LEX mapping

MU120103B (Cont'd)

Item	Specifications
Pattern and Error Conditions	Destination MAC Address*13:48 bit Mask:bit mask Source MAC Address*13:48 bit Mask:bit mask Destination IP Address:32 bit Mask:bit mask Source IP Address:32 bit Mask:bit mask Pattern1,2: Pattern:32 bit Mask:byte mask Base position:Top of Frame, Top of Ethernet Frame*13 Error type: Good Frame,FCS Error,Undersize, Fragments, Oversize,Oversize&FCS Error, IP Header checksum Error, TCP checksum Error, UDP checksum Error, Sequence Error*15, PRBS Frame Error*15, Ethernet FCS Error※16,Ethernet Undersize*13, Ethernet Fragments*16, Ethernet Oversize*16,Ethernet Oversize&FCS Error*16, LEX FCS Error*17, LAPS FCS Error*18, GFP FCS Error*19, Correctable eHEC Error*19, Uncorrectable eHEC Error*19, Correctable tHEC Error*19, eHEC Error*19 Combination; And,Or
Decode Protocol	Ethernet (Type II, IEEE802.3, Mac Control), VLAN, MPLS, LLC, LACP, BPDU (STP, RST, MST), ARP, Ethernet OAM, IP, IPv6 (include Extended, Header), IPX, OSINL, IS-IS, IGMP (include IGAP), ICMP, ICMPv6 (include NDP, MLD, MLDA), TCP, UDP, OSPF, OSPFv3, DVMRP, LDP (CR-LDP), BGP4, RIP, DHCP, RSVP (RSVP-TE), BGP4+, PIM-SMv2, PPP (include LCP, IPCP, IPv6CP, OSINLCP, MPLSCP), CiscoHDLC, MAPOS, NSP, SSP, Test Fram
Extended Decode Protocol	By Sniffer® Technologies (Opt04) or MX123002A Expert Analysis Module, the number of decode protocols can be increased up to 400. MD1230 Family includes Ethereal® Convert Function.
Replay	Capture frames are converted to Tx streams.
Latency	When Test Frames are received, the latency is indicated. The result includes 1s sampling value, max, min, avg. and number of samples.
Protocol Emulation	PPP (LCP, IPCP), ICMP, BGP-4, IGMP, ARP

*13: Available only in Frame-Mapped, GFP/LAPS(X.86)/LEX mapping.

*15: MD1230B-11 is required.

*16: Available only in Frame-Mapped, GFP mapping,LAPS(X.86) mapping

*17: Available only in LEX mapping.

*18: Available only in LAPS(X.86) mapping.

*19: Available only in Frame-Mapped GFP mapping.

MU120103B (Cont'd)

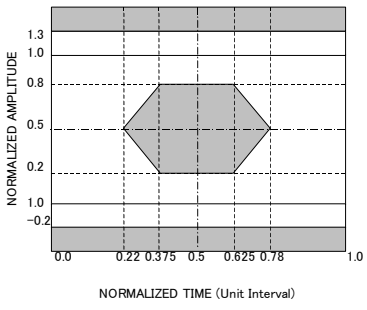
Item	Specifications
Ping	Destination: User defined Send: 4 times Result: Reply, bytes, time, TTL
Frame Arrival Time Variation(Packet Jitter)	
Resolution	32 counters indicate the results. Resolution: 1 us, 10 us, 100 us, 1 ms, 10 ms, 100 ms, 1 s.
Offset	Depend on resolution, Max. 3 min.
Graph	Frame Count vs. Time Interval Auto scale: On/Off
Traffic Monitor	Traffic Monitor can measure up to 64 streams in real-time. Target: IPv4 Address, Protocol Number (IP Protocol)
Traffic Map	Traffic Map can measure up to 64 streams in real-time. Target: MAC Address*13, IPv4 Address
Service Disruption Time	Time of frame disruption.
Power Meter	Range: –25 to +1 dBm Accuracy: ±2 dB
Automatic Test	
RFC2544 Automatic Test	Following 4 types of tests can be supported. (MD1230 Family supports continuous test [1] to [4]). [1] Throughput [2] Latency [3] Frame Loss Rate [4] Back-to-back frames
Port Pairs	Traffic Distribution: One to one, Partially meshed, Fully meshed Traffic Orientation: Unidirectional, Bidirectional Mesh Type: Round Robin, Peak Loading VLAN Tag: On/Off VLAN ID: 1 to 4095
Test Setting	Frame Size: 64, 128, 256, 512, 1024, 1280, 1518 byte Custom: 1 to 25 point Step: Start form 64 to 65535 Step Size 1 to 65471 Count 1 to 25 Test Frame Protocol: MAC, IP Device Type: Store and forward, Bit forward Leaning Frame: Leaning Mode: Never, Once, Every Trial Retries: 1 to 999

*13: MAC Address can be set only in Frame-Mapped, GFP/LAPS(X.86) /LEX mapping

MU120103B (Cont'd)

Item	Specifications
Throughput	Duration: 2 to 999 s Number of Trials: 1 to 50 Burst Size: 1 to 1000 Rate (%): Initial rate, minimum rate, maximum rate, resolution, 0.01% step Loss Tolerance: 0 to 100%, 0.0001% step Result: Frame Rate (%), Frame/s, Bit/s, byte/s Graph: Frame Rate (%), or Frame/s or Bit/s or byte/s vs. frame size, Theoretical value
Latency	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step, Result of Throughput Rate Burst Size: 1 to 1000 Result: Latency (0.01 us resolution) Graph: Latency vs. frame size
Frame Loss Rate	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Result: Frame Loss Rate (%) Graph: Frame Rate vs. Frame Loss Rate
Back-to-Back Frames	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Loss Tolerance: 0 to 100%, 0.0001% step Result: Number of frames Graph: Number of frames vs. frame size
Environmental Performance	
Temperature range	Operation: 0 to +40°C Storage: –20 to +60°C
Power Consumption	Less than 45 W
Size	Based on PICMG2.0 R2.1 262.0 (W) × 20.0 (H) × 174.5 (D) mm It doesn't contain protuberance.
Weight	Less than 1.5 kg

MU120104B

Item	Specifications
Model name	MU120104B
Apparatus name	2.5G (1.55) Module
Composition	Module × 1
Options	MU120104B-01: EoS Mapping Mapping: F-GFP, LAPS, LEX Concatenation: [SDH]VC-4-Xc (X = 16, 8, 4, 3, 2), VC-4, VC-3 [SONET] STS-Xc (X = 48, 24, 12, 9, 6, 3), STS-1 MU120104B-02: Virtual Concatenation [SDH] VC-4-Xv (X = 8, 7, 6, 5, 4, 3, 2), VC-3-Xv (X = 24, 21, 18, 15, 12, 9, 6, 3) [SONET] STS3c-Xv (X = 8, 7, 6, 5, 4, 3, 2), STS1-Xv (X = 24, 21, 18, 15, 12, 9, 6, 3)
Interface	
Corresponding Specification	OC-48/STM-16
Connector	SC
Number of Ports	1
Bit Rate	2488.320 M bit/s ± 50 ppm (NRZ)
Clock	Internal (±50 ppm Variable), Receive, Lock (64 kHz +8 kHz, 1.5 MHz, 2MHz, 1.5 Mbit/s, 2 Mbit/s)
Wavelength	1500 to 1580 nm
Output Level (PRBS23 average power)	–2 to +3 dBm
Extinction Ratio	8.2 dB over
SMSR	30 dB over
Spectral Width	1 nm under
Pulse Mask	
Input Sensitivity	–28 to –9 dBm
Loss Detection	–40 to –35 dBm
Return Loss	27 dB
Maximum Rating Absolutely	–6 dBm
Laser Safety	21 CFR 1040.10:1995 CLASS I IEC60825-1:2001 CLASS 1
LED	Link, Tx, Rx, Error, Optical Send

MU120104B (Cont'd)

Item	Specifications
SONET/SDH Setting	
Frame	SONET/SDH
Mapping	OC-48c/STM-16c - (a) - PPP OC-48c/STM-16c - (a) - CiscoHDLC OC-48c/STM-16c - (a) - MAPOS Version1 OC-48c/STM-16c - (a) - MAPOS 16 OC-48c/STM-16c - (a) - Bulk OC-48c/STM-16c - (a) - (b) Unframed (a): VC4*16c VC4*Xc *1, *2 VC4 *1, *2 VC3 *1, *2 VC4*Xv *2 VC3*Xv *2 (b): F-GFP *1 LEX *1 LAPS *1
Measurement CH	Tx/Rx: 1 Ch, Others are dummy CHs.
Dummy CH	Contiguous Concatenation Payload All payload and POH of Dummy CHs are same contents. PRBS15, PRBS23, PRBS31, All 0, All 1, Copy, Idle POH All byte except B3 are editable Path trace: J1 (CRC7, Trace on) Pointer NDF: same as the Measurement CH SS: same as the Measurement CH AU pointer: 522 fixed Virtual Concatenation All payload and POH of Dummy CHs are same contents. Size VC-4 when VC-4-Xv, VC-3 when VC-3Xv Payload PRBS15, PRBS23, PRBS31, All 0, All 1, Idle POH All byte except B3 are editable Path trace: J1 (CRC7, Trace on)

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

*2: MU120103B-02/MU120104B-02: Selectable only when virtual concatenation mapping is used.

MU120104B (Cont'd)

Item	Specifications
OH Preset	SOH: All byte except B1, B2, H1, H2, H3, K1, K2 POH: All byte except B3 Path trace: J0, J1 (CRC7, Trace on)
Virtual Concatenation	POH Setting POH of all members are editable. (except B3, H4) H4 Reserved bits are 0 fixed Differential delay generator: On/Off Range: ±100 pointer Resolution: 1 pointer Differential delay recovery ±100 pointer (on the basis of the start CH pointer)
Alarm Addition	LOS, LOF, AIS-L/MS-AIS, RDI-L/MS-RDI, TIM-L/MS-TIM, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, PLM-P/HP-SLM, TIM-P/HP-TIM, UNEQ-P/HP-UNEQ
Alarm Addition Timing	Single, Single Burst Frame (Burst Size: 1 to 64,000), Alternative (Alarm Frame: 0 to 8,000, Normal Frame: 1 to 8,000), All
Error Insertion	FAS, B1, B2, B3, REI-P/MS-REI, REI-P/HP-REI, HP-IEC, Bit All, Bit Info.
Error Insertion Timing	Single, Single Burst Bit (Burst Size: 1 to 64,000), Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmed Rate (A*E-B | A: 1.0 to 9.9, B: 3 to 10), All
K1, K2	Conform to G.783 or G.841
Pointer	AU pointer NDF: 0000 to 1111 SS: 00 to 11 Pointer: 0 to 1023 +Justification, –Justification
APS Sequence Generation	K1/K2: 2 to 64 Words, Repeat 1 to 8000 Frame/Word, Single or Repeat generation.

MU120104B (Cont'd)

Item	Specifications
Port setting	
IPv4	
This port	IPv4 Address, Netmask, Gateway
ARP Reply	Not send,Reply to this port ARP request,Reply to all ARP request
ICMP Echo(PING) Reply	Not send, Reply to this port ping request
PPP	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 16 bit/32 bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit (default1500), Magic-number (random), IPCP (Send this port IP address) Default, Time out
GFP (Opt01)	Scramble: On/Off Descramble: On/Off FCS: 32 bit Receive Conditions: Extension Header size other than NULL or Linear: 2 to 58 byte (except eHEC) cHEC Presync times: 1 to 16 CSF Recovery: 1 to 16 Payload header checking: On/Off
LAPS (Opt01)	Scramble: On only Descramble: On only Minimum Flag Length: 1 byte/2 byte FCS: 32 bit Rate adaptation X/Y (add X byte every Y frame byte) X: 0 to 1024 byte/16 byte Y: 4096/8192/16384/32768/65536
LEX (Opt01)	Scramble: On/Off Descramble: On/Off Minimum Flag Length: 1 byte/2 byte FCS: 16 bit Negotiation: On/Off, Restart, Retry, Abort, Max-Receive-Unit(default1500), Magic-number (random) , IPCP(Send this port IP address) Default, Time out
Mode	Normal, Monitor, Through(with or without OH Overwrite)

MU120104B (Cont'd)

Item	Specifications
Stream	
Number of Streams	256 Streams/Port
Stream Setting	
Distribution	Stream Transport Mode: Continuous, Continuous Burst, Stop after this Stream, Next Stream, Jump to Stream, Jump to Stream for Count (Loop Count: 1 to 16,000,000)
Frame per Burst	1 to 1,099,511,627,775
Burst per Stream	1 to 1,099,511,627,775
Frame view	Raw frame, Decoded
Gap Setting	
Inter Frame Gap*3	PPP/LEX/LAPS: Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed or Random.*4 GFP: Resolution of 13.4 ns, 0 ns to 120 s Settable as Fixed or Random.
Inter Burst Gap*3	PPP/LEX/LAPS: Resolution of 3.3 ns, 3.3 ns to 120 s Settable as Fixed. GFP: Resolution of 13.4 ns, 53.5 ns to 120 s Settable as Fixed or Random.
Inter Stream Gap*3	PPP/LEX/LAPS: Resolution of 3.3 ns, 267.1 ns to 120 s Settable as Fixed. GFP: Resolution of 13.4 ns, 267.1 ns to 120 s Settable as Fixed or Random.

*3: This value indicates the gap measured with OC-48 or STM16 mapping. When contiguous or virtual concatenation mapping is used, the value is inversely proportional to the set bit rate.

*4: To select the Random setting for the inter-frame gap, the frame length must be 64 bytes or more.

MU120104B (Cont'd)

Item	Specifications
Frame Setting	FCS: CRC32, CRC16 MAC Address: Fixed, Increment, Decrement, Random (Changeable portion specified in 4 bits units), Gateway (Only for DA), This port (Only for SA) VLAN tag*5: Up to 1 layer VLAN tags can be appended. VLAN ID can be set Increment, Decrement, Random. MPLS label*5: Up to 10 MPLS labels can be appended. Fixed setting. Protocol Editing: None, IPv4, TCP/IPv4, UDP/IPv4, IGMP/IPv4, ICMP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IPX, ARP, MAC Control, IS-IS, LEX Control Packet*6, GFP, PPP, Ethernet IPv4/IPv6: IP Destination/Source Address can be set Fixed, Increment, Decrement, Random independently.*7 TCP/UDP: Either Destination Port Number or Source Port Number can be set Increment, Random. Data Field: Can set any portions of data field as All 0, All 1, Alternate1/0 (Each bit, Each 2bits, Each 4bits, Each 1byte, Each 2 bytes), Increment, Decrement, Random, Single PRBS9. Only Data Field 1 can set Programmable, Time Stamp*8, Sequence Number*8, Test Frame. Programmable Header Pattern: 1user defined pattern can be set.
Frame Size	8 to 65,535 byte Settable as Auto, Fixed, Increment*9, or Random*9

*5: VLAN tag and MPLS labels cannot both be used simultaneously.

*6: LEX Control Packet can be chosen only when choosing LEX mapping

*7: For IPv6, any Increment, Decrement, Random setting can be specified for bit widths 1 to 32. Also, only either the destination or sender address can be selected.

*8: When a sequence number or Time Stamp is used, the check sum field of the TCP/UDP packet contains an error code.

*9: Increment and Random settings can be specified for the frame size only when None is selected for the protocol.

MU120104B (Cont'd)

Item	Specifications
OH Setting	
PPP/CISCO HDLC/MAPOS ver1/MAPOS 16	Address: FFh (User defined) Cisco: 0Fh MAPOS Ver1: 03h Control: 03h (User defined) Cisco: 00h MAPOS Ver1: 03h Address MAPOS16: 0003h When MAPOS16 then Address field is 16 bit and Control field is 0 bit Protocol: 16 bit User defined (default 0021) FCS: Auto
GFP*1	PLI: Auto cHEC: Auto PTI: (User defined) PFI: (User defined) EXI: (User defined) UPI: (User defined) tHEC: (User defined) Header information: (User defined) eHEC: Auto FCS: Auto
LAPS*11	AddressI: (User defined) Control: (User defined) SAPI: (User defined) FCS: Auto
LEX*11	AddressI: (User defined) Control: (User defined) Protocol Type: (User defined) frag: (User defined) PAD: (User defined) FCS: Auto

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

MU120104B (Cont'd)

Item	Specifications
Protocol Setting	
Ethernet	DA: (→ Refer to Frame setting/MAC Address) SA: (→ Refer to Frame setting/MAC Address) Type: Automatically assigned, User defined FCS: Automatically calculated
IPv4 (RFC0791)	Version: 4 (DEC) IHL: Auto Type of service: User defined (initial 00(hex)) Bit0 to 2 (Precedence): 111-Network control 110-Internetwork control 101-CRITIC/ECP 100-Flash override 011-Flash 010-Immediate 001-Priority 000-Routine Bit3: 0 = Normal delay, 1 = Low delay Bit4: 0 = Normal throughput, 1 = High throughput Bit5: 0 = Normal Reliability, 1= High Reliability Bit6 to 7: 2 bit user defined Total Length: Auto Identification: User defined (4 byte) Flag: User defined (initial 010(b)) Bit0: User defined Bit1: (DF) 0 = May Fragment, 1= Don't Fragment Bit2: (MF) 0 = Last Fragment, 1= More Fragment Fragment offset: 0 to 8191(DEC) user defined (initial 0) Time to Live: 0 to 255 (DEC) user defined (initial 64) Protocol:0 to 255 (DEC) user defined (initial 0) Automatically set if TCP or UDP is selected. Header Checksum: Auto Source Address: Static, Increment, Decrement, Random with class and mask setting Destination Address: Static, Increment, Decrement, Random with class and mask setting Option: 0 to 40 byte

MU120104B (Cont'd)

Item	Specifications
IPv6 (RFC2460)	Version (4 bit): 6 Traffic class (8 bit): 0-uncharacterized traffic 1-"filler" traffic 2-unattended data transfer 3-reserved 4-attended bulk transfer 5-reserved 6-interactive traffic 7-internet control traffic Flow Label (20 bit): 20 bit user defined (initial all 0) Payload length (16 bit): Auto Next header (8 bit): 0 to 255 (DEC) user defined (initial 59) Hop Limit (8 bit): 0 to 255 user defined (initial 0) Source Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask) Destination Address (128 bit): Static, Increment, Decrement, Random with class and mask setting (byte mask)
TCP (RFC0793)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Sequence number (32 bit): User defined Acknowledgement Number (32 bit): User defined, 0000 to FFFF Data offset (4 bit): Set to 5 Reserved (6 bit): User defined, 0 to 63 Control bit (6 bit): User defined, Setting by bit Window (16 bit): User defined, 0 to 65535 Checksum (16 bit): Auto Urgent pointer (16 bit): User defined, 0 to 65535 Option: 0 to 40 byte Padding: All 0
UDP (RFC0768)	Source Port (16 bit): User defined, 0 to 65535 Destination Port (16 bit): User defined, 0 to 65535 Length (16 bit): Auto Checksum (16 bit): Auto
IGMP (RFC2236)	Type (4 bit): 11- Membership query 12- Version1 Membership report 16- Version2 Membership report 17- Leave group Max response time (8 bit): User defined, 0 to 255 Checksum (16 bit): Automatically calculated Group address (32 bit): User defined Version: set to 2

MU120104B (Cont'd)

Item	Specifications
ICMP (RFC792, 950, 1256)	Type (8 bit): 0 = Reply 3 = Destination Unreachable 4 = Source Quench 5 = Redirect 8 = Echo 9 = Router Advertisement 10 = Router Selection 11 = Time Exceeded 12 = Parameter Program 13 = Time Stamp 14 = Time Stamp Reply 15 = Information Request 16 = Information Reply 17 = Address Mask Request 18 = Address Mask Reply Code (8 bit): User defined 0 to 255 Checksum (16 bit): Automatically calculated (Soft) Data: For Echo Request/Response Identifier (16 bit): User defined Sequence Number (1 6bit): User defined
RIP (RFC2453)	Command (8 bit): 1 = Request 2 = Response Version (8 bit): 1 = RIP version1 2 = RIP version2 Address Family Identifier (16 bit): 0000 0002 = IP protocol FFFF = Authentication entry see next Route tag: User defined IP Address: User defined Subnet Mask: User defined for Version2 Next hop: User defined for Version2 Metric: 0 to 4294967295 (DEC) Authentication type (16 bit): 1-IP Route 2-Password 3-Keyed Message Digest Algorithm Authentication Data: ASCII 16 byte entry

MU120104B (Cont'd)

Item	Specifications
DHCP (RFC2131)	Op Code (8 bit): User defined 1 = Boot request 2 = Boot reply Hardware type (8 bit): User defined 1 = 10 MB Ethernet Hardware address length (8 bit): User defined 6 = for MAC address Hops (8 bit): User defined (0 to 255) Transaction ID (32bit): User defined (0 to 4294967295(DEC)) Seconds (16 bit): User defined (0 to 65535(DEC)) Flag (16 bit) : User defined 0000 = Nobroadcast 8000 = Broadcast Client IP address (32 bit): User defined Your IP address (32 bit): User defined Server IP address (32 bit): User defined Relay Agent IP address (32 bit): User defined Client Hardware address (16 byte): User defined Server Host Name (64 byte): User defined Boot File Name (128 byte): User defined Option (0 to 64 byte): User defined
MPLS (RFC3031, 3032)	Label (20 bit): User defined 0 = IPv4 explicit null label 1 = Router alert label 2 = IPv6 explicit null label 3 = Implicit null label 4 to 15 = Reserved EXP (3 bit): User defined S (1 bit): Bottom of stack TTL (8 bit): User defined 10 kinds of MPLS can set.

MU120104B (Cont'd)

Item	Specifications
Error Insertion	
PPP	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame
GFP*1	Correctable cHEC Error, Uncorrected cHEC Error, Correctable tHEC Error, Uncorrected tHEC Error, Correctable eHEC Error, Uncorrected eHEC Error, FCS Error Ethernet: FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error
LAPS*1	FCS Error, Aborted Frame Ethernet: FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error
LEX*1	FCS Error, Undersize, Oversize, Fragments, Oversize & FCS Error, Aborted Frame, Ethernet: Undersize
IP	IPv4 Header Checksum Error
TCP/UDP	TCP/UDP Checksum Error
Data	Supported by Option 11 Packet BER Test: PRBS Error
Client Management Frame	Type: Signal Loss/Sync Loss/User1/User2 Header: PFI, EXI, UPI, Payload are editable Size: 8 to 1024 bytes, multiple of 4 Insertion Mode: Single/Repeat Insertion Interval: 10 ms to 2560 ms/10 ms step Insertion Interim Frame: Idle/Stream
Unframed BER Setting	Test Pattern: PRBS23, PRBS31 Error Insertion: Bit All Insertion Timing: Single, Rate (1.0E-9, 1.0E-8, 1.0E-7, 1.0E-6, 1.0E-5, 1.0E-4, 1.0E-3), Programmable Rate (1.0E-10 to 9.9E-3)
Measurement Function	
SONET/SDH Test	
Performance	G. 826
K1, K2 Monitor	Conform to G.783 or G.841

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

MU120104B (Cont'd)

Item	Specifications
Pointer Monitor	AU Pointer Graph: Pointer value, Pointer Inc/Dec Resolution: 1 s, 1 min, 15 min, 60 min
OH Monitor	SOH, POH, J0, J1 Display: CRC, TIM S1, C2: Received octet value are decoded for display
APS Switch Time	Trigger: Error, Alarm, External trigger Resolution: 125 us Threshold: 1 ms, 10 ms, 100 ms Start → Waiting trigger → Trigger detect → Stop
APS Sequence Capture	Trigger: Error, Alarm, External trigger Trigger Position: 1 to 64 64 word (1word: 1 to 8000 frame)
Counter	
Mode	Accumulated, 1 s current
SONET/SDH	NDF Count/Rate, +PJC Count/Rate, –PJC Count/Rate, Consecutive Count/Rate, PPM, HP-IEC Count/Rate, REI-P/HP-REI Count/Rate, B3 Count/Rate, UNEQ-P/HP-UNEQ Count/Second, PLM-P/HP-SLM Count/Second, RDI-P/HP-RDI Count/Second, LOP-P/AU-LOP Count/Second, AIS-P/AU-AIS Count/Second, REI-L/MS-REI Count/Second, B2 Count/Rate, B1 Count/Rate, RDI-L/MS-RDI Count/Second, AIS-L/MS-AIS Count/Second, OOF Count/Second, LOF Count/Second, Bit Info. Count/Rate*10, Pattern Sync. Loss Count/Second*10, SQ Error Count/Second*11, Out of Alignment Count/Second*11
GFP*1	Transmitted/Received Frame Transmitted/Received Bit Rate Transmitted/Received byte Transmitted Rate Received Rate cHEC Error/correctable cHEC Error tHEC Error/correctable tHEC Error HEC Error FCS Error Server Signal Fail Interval Client Loss of Sync Frame Client Loss of Sync Interval Client Loss of Signal Frame Client Loss of Signal Interval

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

*10: Measurement is enabled only when bulk mapping is used.

*11: Settable as only Virtual Concatenation.

MU120104B (Cont'd)

Item	Specifications
LAPS*1	Transmitted/Received Frame Transmitted/Received Bit Rate Transmitted/Received byte Transmitted byte After Adaptation Transmitted byte After Stuffing Received byte Before Adaptation Received byte Before Destuffing Transmitted Rate Received Rate FCS error Aborted frame
LEX*1	Transmitted/Received Frame, Transmitted/Received Bit Rate, Transmitted/Received byte, Transmitted byte After Stuffing, Received byte Before Destuffing, Transmitted Rate, Received Rate, FCS error, Fragments, Undersize, Oversize, Oversize & FCS Error, Aborted frame
Ethernet	Transmitted/Received Frame Count, Transmitted/Received Frame Rate, Transmitted/Received Bit Count, Transmitted/Received Bit Rate, Transmitted/Received byte Count, Transmitted/Received Rate, FCS Error, Undersize, Fragment, Oversize, Oversize & FCS Error, MAC Control Frame, Transmitted/Received ARP Request, Transmitted/Received ARP Reply
IPv4	Transmitted/Received IPv4 Packet Count, Transmitted/Received IPv4 Packet Rate, Transmitted/Received Ping Request, Transmitted/Received Ping Reply, IP Header Checksum Error
TCP/UDP	Received TCP Packet Count, Received TCP Packet Rate, Received UDP Packer Count, Received UDP Packet Rate, TCP Checksum Error*12, UDP Checksum Error*12

*1: MU120103B-01/MU120104B-01: Selectable only when EoS mapping is used.

*12: The packets fragmented in the IP layer are counted as error packets.

MU120104B (Cont'd)

Item	Specifications
Data	Capture Trigger, Capture Filter, User Defined 1 Count/Rate, User Defined 2 Count/Rate, QoS 0 to 7 Frame Count/Rate. User Defined counter conditions; Destination MAC Address*13: don't care, Match, Not match Source MAC Address*13: don't care, Match, Not match Destination IP Address*14: don't care, Match, Not match Source IP Address*14: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Refer to Pattern and Error conditions of Capture.
Packet BER Test (Opt11)	Transmitted/Received Test Frame Count, Sequence Error, Received PRBS Frame Error Count/Rate, Received PRBS Bit Error Count/Rate
Unframed BER Test	Bit Error Count/Rate, Pattern Sync. Loss Count/Second
Graph	8 kind of graph are displayed simultaneously. 1 s, 1 min, 15 min, 60 min resolution

*13: MAC Address can be set only in Frame-Mapped, GFP/LAPS(X.86) /LEX mapping.

*14: IP Address only in PPP/Cisco HDLC/MAPOS Version 1/MAPOS 16 mapping.

MU120104B (Cont'd)

Item	Specifications
Capture	
Capture Buffer	256 Mbyte/Port
Capture Filter/Trigger	Filter condition settings; Destination MAC Address*13: don't care, Match, Not match Source MAC Address*13: don't care, Match, Not match Destination IP Address: don't care, Match, Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match Trigger condition settings; Destination MAC Address*13:don't care, Match, Not match Source MAC Address*13: don't care, Match, Not match Destination IP Address: don't care, Match, Not match Source IP Address: don't care, Match, Not match Pattern1: don't care, Match, Not match Pattern2: don't care, Match, Not match Error: don't care, Match, Not match External Trigger: Traffic is out of range:0 to 100% Latency is out of range:1 ns to 59 s Manual Trigger; Trigger Position Settings: Top, Middle, Bottom

*13: MAC Address can be set only in Frame-Mapped, GFP/LAPS(X.86) /LEX mapping.

MU120104B (Cont'd)

Item	Specifications
Pattern and Error Conditions	Destination MAC Address*13:48 bit Mask:bit mask Source MAC Address*13:48 bit Mask:bit mask Destination IP Address:32 bit Mask:bit mask Source IP Address:32 bit Mask:bit mask Pattern1,2; Pattern:32 bit Mask:byte mask Base position:Top of Frame, Top of Ethernet Frame*13, Top of IPv4 Header, Top of IP Payload Offset:0 to 65535 Error; Error type: Good Frame,FCS Error,Undersize, Fragments, Oversize,Oversize&FCS Error, IP Header checksum Error, TCP checksum Error, UDP checksum Error, Sequence Error*15, PRBS Frame Error*15, Ethernet FCS Error*16,Ethernet Undersize *13, Ethernet Fragments※16, Ethernet Oversize*16,Ethernet Oversize&FCS Error *16, LEX FCS Error*17, LAPS FCS Error*18, GFP FCS Error*19, Correctable eHEC Error*19, Uncorrectable eHEC Error*19, Correctable tHEC Error*19, eHEC Error*19 Combination; And,Or

*13: Available only in Frame-Mapped, GFP/LAPS(X.86)/LEX mapping.

*15: MD1230B-11 is required.

*16: Available only in Frame-Mapped, GFP mapping,LAPS(X.86) mapping

*17: Available only in LEX mapping.

*18: Available only in LAPS(X.86) mapping

*19: Available only in Frame-Mapped GFP mapping.

MU120104B (Cont'd)

Item	Specifications
Decode Protocol	Ethernet (Type II, IEEE802.3, Mac Control), VLAN, MPLS, LLC, LACP, BPDU (STP, RST, MST), ARP, Ethernet OAM, IP, IPv6 (include Extended, Header), IPX, OSINL, IS-IS, IGMP (include IGAP), ICMP, ICMPv6 (include NDP, MLD, MLDA), TCP, UDP, OSPF, OSPFv3, DVMRP, LDP (CR-LDP), BGP4, RIP, DHCP, RSVP (RSVP-TE), BGP4+, PIM-SMv2, PPP (include LCP, IPCP, IPv6CP, OSINLCP, MPLSCP), CiscoHDLC, MAPOS, NSP, SSP, Test Frame
Extended Decode Protocol	By Sniffer® Technologies (Opt04) or MX123002A Expert Analysis Module, the number of decode protocols can be increased up to 400. MD1230 Family includes Ethereal® Convert Function.
Replay	Capture frames are converted to Tx streams.
Latency	When Test Frames are received, the latency is indicated. The result includes 1s sampling value, max, min, avg. and number of samples.
Protocol Emulation	PPP (LCP, IPCP), ICMP, BGP-4, IGMP, ARP
Ping	Destination: User defined Send: 4 times Result: Reply, bytes, time, TTL

MU120104B (Cont'd)

Item	Specifications
Frame Arrival Time Variation(Packet Jitter)	
Resolution	32 counters indicate the results. Resolution: 1 us, 10 us, 100 us, 1 ms, 10 ms, 100 ms, 1 s.
Offset	Depend on resolution, Max. 3 min.
Graph	Frame Count vs. Time Interval Auto scale: On/Off
Traffic Monitor	Traffic Monitor can measure up to 64 streams in real-time. Target: IPv4 Address, Protocol Number (IP Protocol)
Traffic Map	Traffic Map can measure up to 64 streams in real-time. Target: MAC Address*13, IPv4 Address
Service Disruption Time	Time of frame disruption.
Power Meter	Range:–35 to –9 dBm Accuracy: ±2 dB
Automatic Test	
RFC2544 Automatic Test	Following 4 types of tests can be supported. (MD1230 Family supports continuous test [1] to [4]). [1] Throughput [2] Latency [3] Frame Loss Rate [4] Back-to-back frames
Port Pairs	Traffic Distribution: One to one, Partially meshed, Fully meshed Traffic Orientation: Unidirectional, Bidirectional Mesh Type: Round Robin, Peak Loading VLAN Tag: On/Off VLAN ID: 1 to 4095
Test Setting	Frame Size: 64, 128, 256, 512, 1024, 1280, 1518 byte Custom: 1 to 25 point Step: Start form 64 to 65535 Step Size 1 to 65471 Count 1 to 25 Test Frame Protocol: MAC, IP Device Type: Store and forward, Bit forward Leaning Frame: Leaning Mode: Never, Once, Every Trial Retries: 1 to 999
Throughput	Duration: 2 to 999 s Number of Trials: 1 to 50 Burst Size: 1 to 1000 Rate (%): Initial rate, minimum rate, maximum rate, resolution, 0.01% step Loss Tolerance: 0 to 100%, 0.0001% step Result: Frame Rate (%), Frame/s, Bit/s, byte/s Graph: Frame Rate (%), or Frame/s or Bit/s or byte/s vs. frame size, Theoretical value

*13: MAC Address can be set only in Frame-Mapped, GFP/LAPS(X.86) /LEX mapping.

MU120104B (Cont'd)

Item	Specifications
Latency	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step, Result of Throughput Rate Burst Size: 1 to 1000Result: Latency (0.01 us resolution) Graph: Latency vs. frame size
Frame Loss Rate	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Result: Frame Loss Rate (%) Graph: Frame Rate vs. Frame Loss Rate
Back-to-Back Frames	Duration: 2 to 999 s Number of Trials: 1 to 50 Rate (%): Initial rate, step rate, step count, 0.01% step Burst Size: 1 to 1000 Loss Tolerance: 0 to 100%, 0.0001% step Result: Number of frames Graph: Number of frames vs. frame size
Environmental Performance	
Temperature range	Operation: 0 to +40°C Storage: –20 to +60°C
Power Consumption	Less than 45 W
Size	Based on PICMG2.0 R2.1 262.0 (W) × 20.0 (H) × 174.5 (D) mm It doesn't contain protuberance.
Weight	Less than 1.5 kg

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