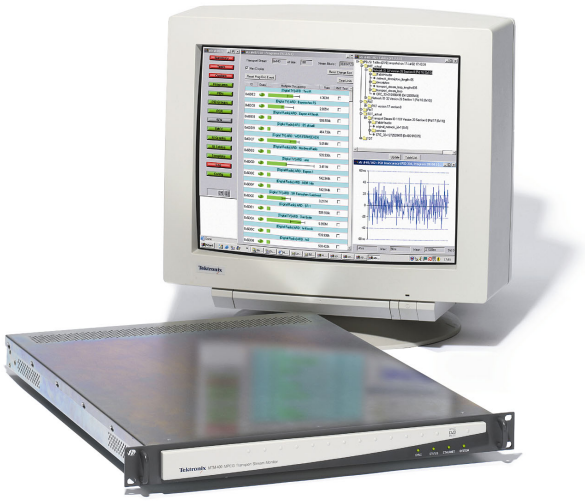
MPEG over IP Real-Time Monitor

MTM400 with GbE Interface Data Sheet



MTM400 MPEG Transport Stream Monitor – Right content, right place, right time.

Features & Benefits

- Multilayer, Multichannel, Remote Monitoring and Measurement at IP, RF, and Transport Layers to DVB (TR 101 290), ATSC, DigiCipher® II (DCII), and ISDB-T (Terrestrial and Mobile) Standards
- Comprehensive Confidence Monitoring of Video over IP with Optional Gigabit Ethernet Electrical and Optical Interfaces, IP Protocol Support Including UDP, RTP with IGMP, ARP, and ICMP (Remote ping)
- Session Monitoring Support for:
  - Discovery of All Sessions/Flows on the Link with RTP/UDP and TS Present Indicators
  - Session Bit Rate Monitoring
  - IP Packet Error and Transport Stream Layer Error*1 Status of All Sessions
- IP Measurements and Alarming, Including Total Traffic Bit Rate, Instantaneous TS Rate, Errored Packets, RTP Dropped Packets, RTP Out-of-Order Packets, and Packet Interarrival Timing (PIT)
- Comprehensive Confidence Monitoring at the RF Modulated Layer with Optional COFDM, 8VSB, Turbo 8PSK, QPSK (L Band), and QAM Interface MER, BER, and Constellation Displays
- Critical RF Measurements, MER, and EVM Provide Early Indication of Signal Degradation before Any Picture Impairment is Visible to the End Customer without Additional Costly RF Test Equipment (MER up to 37 dB typical)
- MTM400 with IP or RF Interface can Switch between IP or RF Monitoring and Transport Stream Monitoring within the One Probe
- DPI (SCTE-35) Local Content Insertion Monitoring
- DigiCipher® II (DCII) Protocol Support
- User-defined Template Monitoring Option to Ensure Right Content at the Right Place at the Right Time while Content Ratings Checking Ensures Only Appropriate Content Broadcast
- Remote Recording Allows Capture and Analysis of Stream Events for Expert Offline Analysis to Diagnose Difficult and Intermittent Problems, Requiring No Engineer Site Visits
- Scalable, Upgradeable Monitoring Capability Provides Extended Confidence Monitoring, where You Buy the Capability You Need when You Need It
- In-field Upgrades Minimizes Upgrade Time
- Simple User Interface Minimizes Staff Familiarization Time

Applications

- Contribution and Primary Distribution:
  - Terrestrial Distribution
  - Cable Head-end Monitoring
  - DTH or Network Operator Satellite Uplink Monitoring
- IPTV
- Edge Network Monitoring:
  - ASI to RF
  - IP to RF (Requires two MTM400 units)
  - IP to ASI

*1 Sync Byte, Sync Error, and Continuity Count.

Tektronix®

Technical Overview

Increasingly, monitoring of Gigabit Ethernet and RF transmission is becoming essential for efficient MPEG network operations and proactive fault prevention. The MTM400 is the industry-leading solution for 24×7 MPEG network monitoring, and with both RF and IP interfaces is ideally positioned for monitoring trunk IP feeds and RF drops to the end customer. The Gigabit Ethernet Interface, which was announced to the market in August 2006, has successfully provided full TR 101 290 Priority 1, 2, and 3 monitoring on a single session within an IP stream.

The new polling capability for the MTM400 probe, combined with RF and IP interfaces allows up to 200 RF channels or IP sessions (discovering up to 500 IP sessions) to be monitored in a repeating cyclic measurement process. Control and configuration of the polling is undertaken using flexible XML scripting. This polling ability, combined with the ability to construct and manage multicast groups using IGMP, makes a single MTM400 probe a broader tool, monitoring large numbers of network points in a time-sampled measurement mode.

Enhancements included in the new firmware also provide incremental functional performance within the core product, as well as flexibility offered by the polling capability.

The MTM400 GE with Option 7 provides:

- Broad but shallow IP and narrow and deep MPEG monitoring in a single solution
- RF and IP polling capability to cost-effectively monitor multiple RF and IP channels
- Monitoring across both the IP and MPEG layers
- Optional RF measurement interfaces for network edge monitoring
- Downloadable remote GUI
- Integrates through SNMP with large network control systems

Features and Benefits

The MTM400 uses a single transport stream processor platform packaged in a 1 RU rackmount chassis to provide monitoring of a transport stream at data rates up to 155 Mb/s*2. The platform is used to provide an extended confidence monitoring product that, with the addition of software options, provides diagnostic monitoring capabilities.

The extended confidence monitor provides the key MPEG tests; this basic level of functionality and low cost enables widespread deployment throughout a transmission network, facilitating rapid fault isolation. The diagnostic monitoring options provide more in-depth analysis of the MPEG transport stream including recording capability, PSI/SI/PSIP/ARIB analysis, and unique user-defined template tests to ensure right content, right place, right time. Deployed at key network nodes, the MTM400 equipped as a diagnostic monitor enables the cause of faults to be pinpointed and solved.

The Gigabit Ethernet Interface allows monitoring and measurement of key IP parameters Designed for monitoring networks which carry Multiprogram Transport Streams (MPTS) or Single Program Transport Streams (SPTS) over Gigabit Ethernet networks MTM400 Opt. GE provides:

- Simultaneous monitoring of both IP and MPEG layers to enable rapid fault isolation
- Comprehensive confidence monitoring of video over IP with optional Gigabit Ethernet electrical and optical interfaces, IP Protocol support including UDP, RTP with Internet Group Management Protocol (IGMP), Address Resolution Protocol (ARP) and Internet Control Message Protocol (ICMP remote ping)

IP session monitoring support for:

- Discovery of all sessions/flows on the link with RTP/UDP and TS present indicators
- Session bit rate monitoring
- Simultaneous IP packet error and TS error*1 status of all sessions

*1 Sync Byte, Sync Error, and Continuity Count.

*2 Maximum transport stream bit rate is dependent on transport stream content and depth of analysis being performed. Depth of stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

Flexible and Upgradeable

The MTM400 provides a flexible solution with an upgrade path, including diagnostic monitoring features that enable customers to build a cost-effective monitoring system to suit their individual requirements. Diagnostic capability can be added to the key monitoring points where transport streams are manipulated while extended confidence monitoring probes can be installed throughout the network:

- Triggered recording enables problems to be captured and analyzed in greater depth using offline analysis tools such as the Tektronix MPEG Test System Standalone Software*[3]
- PSI/SI/PSIP/ARIB SI analysis and repetition rate graphing allows broadcasters to determine that the system information is present and correct in the transport stream
- Template testing checks a number of key parameters to ensure that the transport stream has been constructed as the broadcaster intended. These parameters include the Transport Stream ID and Network ID, the number of programs in the multiplex, that each program has all of its components (Video, Audio, Data, Teletext, Subtitles) and Conditional Access (CA) status
- Bit rate testing determines whether PIDs, programs, services, or user-defined groups of PIDs are within user-definable limits to ensure correct multiplex operation. Tektronix-proprietary PID variability test gives indication of PID bit rate variation to assess effects of statistical multiplexing
- In-depth PCR analysis with graphical results views enable timing and Jitter measurements to be made to ensure correct operation of the network
- Service logging enables verification of service-level agreements to ensure that contractual obligations are met
- Offline analysis software applications for in-depth deferred time analysis of streams captured using the MTM400 gives Tektronix the most powerful MPEG monitoring diagnostics available in the world today*[3]

In addition, key enhancements provided by the **v.2.5.x** firmware release and new Option 7 are as follows:

- Channel Polling: Allows up to 200 channels to be polled sequentially from either the IP or the RF interface (requires Option 7 enabled)
- Monitoring up to 500 IP Sessions: Wide but shallow IP monitoring of key MPEG parameters, including Continuity Count, Sync Loss, Sync byte, and Packet Interarrival Time (PIT)
- Logging and Trap Enhancements: Provide logging and SNMP trap support for all identified streams to include TS and IP errors
- Multichannel IGMP: Manually construct and manage groups of multicast (IGMP) streams for monitoring
- Automatic Template Generation: Simple automated template generation from reference stream for exception monitoring
- Filtered error logs for all IP sessions, locked session only, and all error entries

*[3] MTS400 Series MPEG Test System offline software tools are available for use with the MTM400. These are standalone software applications intended to run on the customer's control PC. Separate data sheet is available.

Applications

Contribution and Primary Distribution

Digital video contribution and distribution networks carry compressed video from many origination points to multiple delivery points over limited bandwidth links. Delivery of the right content at the right place at the right time is key to efficient network operation and customer satisfaction. Failure to deliver video services at the appropriate Quality of Service (QoS) leads to potential loss of revenue if video content is not delivered per the service-level agreement.

- MTM400's low-cost extended confidence monitoring enables widespread deployment
- High bit rate capability, up to 155 Mb/s*[2], for monitoring transport streams carried over GbE/ATM/OC3/SDH
- Bit rate testing and logging enables bandwidth usage to be monitored and service-level agreements to be verified

*[2] Maximum transport stream bit rate is dependent on transport stream content and depth of analysis being performed. Depth of stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

MPEG over IP Distribution

Internet Protocol distribution of MPEG-2, MPEG-4/AVC (H.264), and VC1 encoded material is increasing dramatically due to the low cost, and ease of routing of packet-based transmission networks. While IP distribution has some clear advantages it also brings its own challenges, particularly in terms of ensuring consistent quality of service. MTM400 with its IP interface option provides MSOs, broadcasters, and network operators with the toolset required to monitor and diagnose complex transmission problems seamlessly across an IP to MPEG network.

With dedicated Gigabit Ethernet electrical and pluggable optical Small Format Pluggable (SFP) modules, the IP monitoring option on MTM400 provides all the industry-standard interfaces required to connect to IP-based MPEG transmission and distribution networks.

Additionally the Gigabit Ethernet Interface provides an ASI/SMPTE310M input and output allowing access to a direct de-packetized MPEG stream for analysis and recording. Input source on the Gigabit Ethernet card can be switched between Ethernet Electrical (RJ45) and Ethernet Optical (SFP at Multi Mode 850 nm, Single Mode 1310 nm, Single Mode 1550 nm).

Protocols supported include:

- User Datagram Protocol (UDP)
- Real Time Protocol (RTP)
- Internet Protocol (IP)
- Virtual Local Area Network (VLAN)
- Ethernet (10/100/1000 Mb/s)

With multicast and control support for:

- Address Resolution Protocol (ARP)
- Internet Control Message Protocol (ICMP remote ping)
- Internet Group Management Protocol (IGMP)

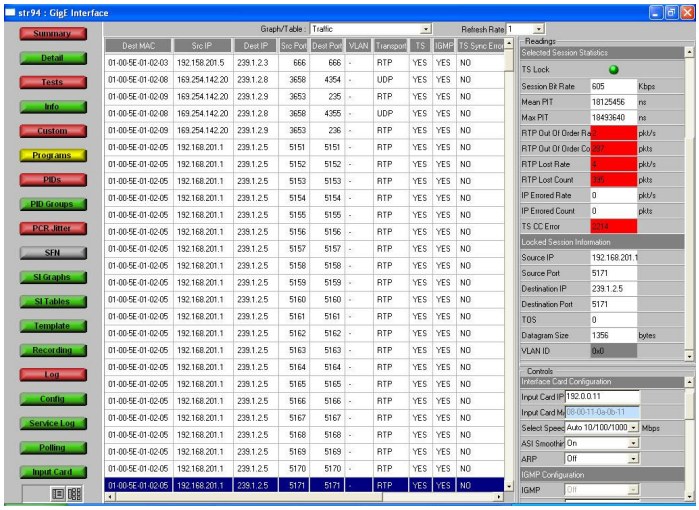
IP packet support includes:

- 7 Transport Stream packets per IP packet
- FEC (FEC parsed but not processed)

Measurement and display features include:

- Link information display
  - Line speed
  - Total bit rate
  - Session count
  - All sessions IP error indication
  - All sessions Packet Interarrival Time (PIT) error indication
  - All sessions Transport Stream error indication
- Discovery of all sessions/flows on the link with RTP/UDP, VLAN, and TS present indicator
- IP packet error and Transport Stream error*[1] status of all sessions
- Statistics:
  - Session bit rate
  - Static IP header contents
  - Mean Packet Interarrival Time (PIT)
  - Maximum Packet Interarrival Time (PIT)
  - RTP out-of-order packets rate and count
  - RTP lost rate and count
  - IP errored packets rate and count
- Graphs / Information Screens:
  - IP session TS bit rate graph
  - Select IP address and port number from a tabular sessions list (traffic sessions graph)
  - IP packet interval variation of selected IP session Min, Max, and Average (trend graph)
  - IGMP session information
  - Remote ping information
- Alarms: User-definable thresholds for
  - Errored packets
  - Dropped packets
  - IP packet interarrival variation
  - Out-of-order packet rate
- Controls:
  - Line select (optical, electrical rate)
  - Filters for MAC, IP, Port
  - Protocol control for ARP, RTP, IGMP, ICMP (inbound, outbound ping)

*[1] Sync Byte, Sync Error, and Continuity Count.



MTM400 Traffic Screen

IPTV

IPTV presents new monitoring challenges for video test. MTM400 offers broad IP monitoring capability to show multisession IP traffic display with IP packet and Transport Stream errors for all sessions on the link backed up with deep MPEG measurement and recording capability. Strong linkage between IP and MPEG layer errors in the MTM400 integrated error log show the relationship between IP and TS errors. Additional filtered log views are available for faster tracking of IP and Transport Stream problems.

Edge Device Monitoring

Edge device monitoring is becoming key in modern hybrid networks. MTM400 addresses this need with ASI to IP or RF measurement interfaces:

- ASI to RF
- IP to RF (requires two MTM400 units)
- IP to ASI

Measurement Functions

MTM400 GbE Interface Card

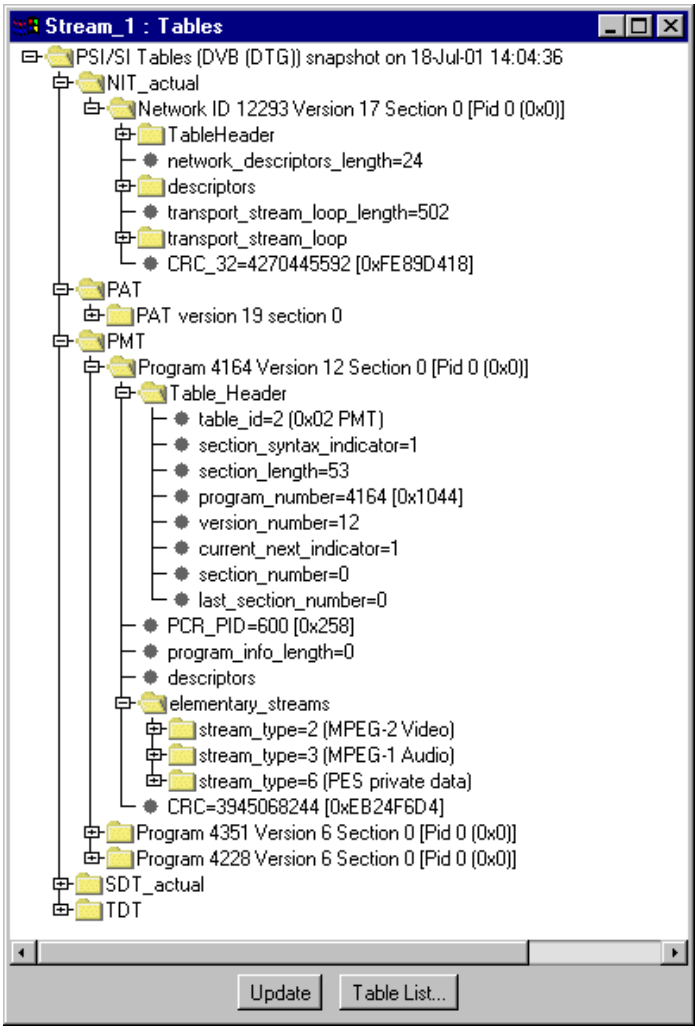
MTM400 Extended Confidence Monitor in Standard Configuration

- MPEG-2, DVB (TR 101 290), ATSC, and ISDB supported
- TR 101 290 Priority 1, 2, and 3 measurements*4 in accordance with the techniques specified in TR 101 290
- Continuity Count displayed on a per PID or per TS basis
- Bit rate measurement in accordance with the methodology specified in TR 101 290 MGB2
- Maximum input Transport Stream bit rate up to 155 Mb/s*2
- Packet size detection
- Error log
- Status of all tests and measurements available through SNMP MIB with support for SNMP traps*5

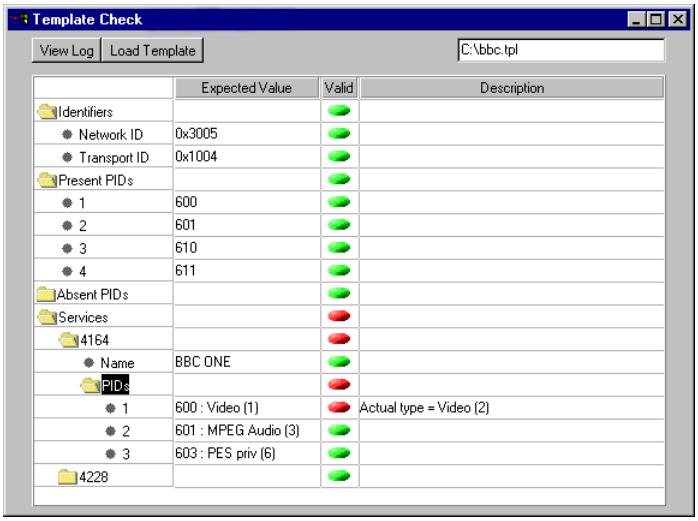
*2 Maximum transport stream bit rate is dependent on transport stream content and depth of analysis being performed. Depth of stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

*4 Except T-STD buffer model analysis.

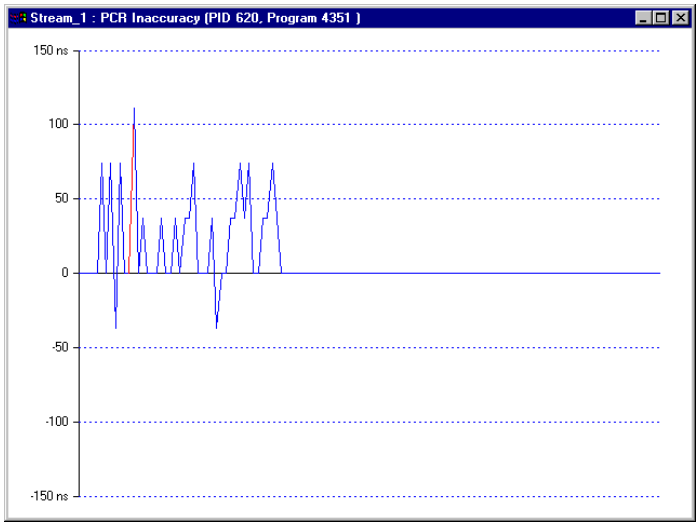
*5 Programmers Guide is available on request with full SNMP MIB and HTTP interface documentation.



MTM400 SI tables



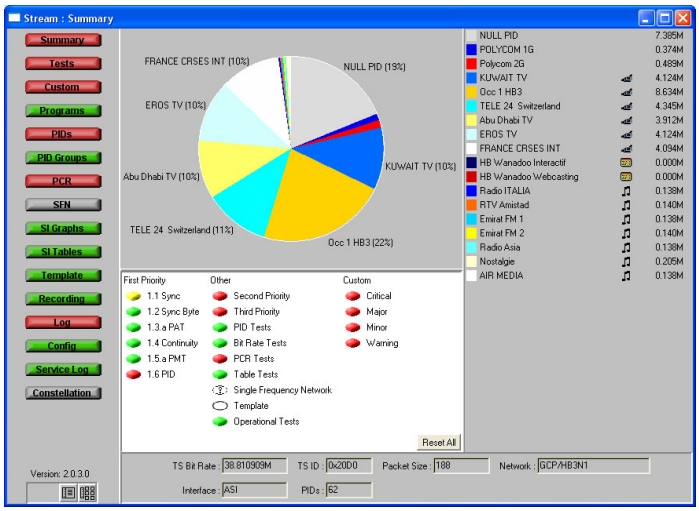
MTM400 template testing



MTM400 PCR inaccuracy analysis

Diagnostic Monitoring Options

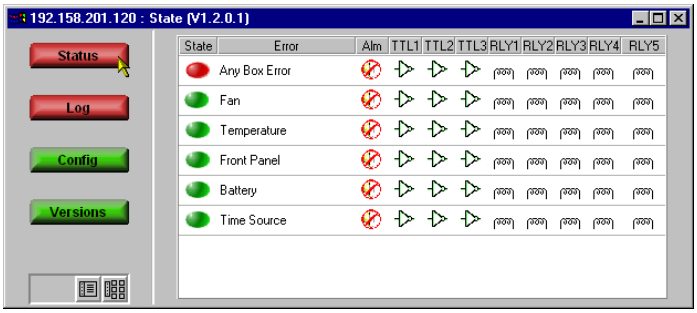
- Triggered recording with user-definable pre-triggered buffering and up to 160 MB available storage
- PSI/SI/PSIP/ARIB SI analysis and repetition rate graphing. Transport Stream structure view with ability to drill down to examine tables and service contents plus real-time graphical representation of table repetition rates
- Template testing (for user-defined service plan testing). User-definable tests with scheduled template updating
- Automatic Template Generation: Simple automated template generation from reference stream for exception monitoring
- Bit rate testing on a per PID, program, or user-defined groups of PIDs basis
- In-depth timing analysis with graphical results views of:
  - PCR_OJ (overall Jitter)
  - PCR_AC (accuracy)
  - PCR_FO (frequency offset)
  - PCR_DR (drift rate)
  - PTS Arrival Interval
- Service logging of user-selected PIDs to record packet rates at user-definable intervals
- Channel Polling: Allows up to 200 channels to be polled sequentially from either the IP or the RF interface



The summary status screen provides a quick overview of the health and contents of the stream

Remote User Interface

The Remote User Interface (RUI) software is a Java applet downloaded from the MTM400. It is accessed using a Web browser (Microsoft Internet Explorer with Microsoft Virtual Machine installed) on any networked personal computer.



The device status summary displays hardware status of the MTM400 including fan status and temperature, etc

The interface initially displays a main status view with menu buttons to access either stream status summary or device status summary. The stream status summary provides an overview of the health and contents of the stream with the ability to access all available tests and measurements licensed for the unit. Summaries can be focused on program content, SI content, or on all PIDs.

Characteristics

Power Requirements

Power Consumption (nominal) – 40 VA.

Voltage – 100 to 240 V.

Frequency – 50/60 Hz.

Monitoring

Data Rate

Maximum Data Rate – 155 Mb/s*[6].

Minimum Data Rate – 250 Kb/s.

*[6] Maximum transport stream bit rate is dependent on transport stream content and depth of analysis being performed. Stream analysis is handled gracefully if SI/PSIP max content is exceeded to ensure critical measurements continue to be performed.

TR 101 290 Tests and Measurements

1st Priority Measurements	2nd Priority Measurements	3rd Priority Measurements
1.1 Ts_sync_loss	2.1 Transport error	3.1a NIT_actual_error
1.2 Sync_byte_error	2.2 CRC_error	3.1b NIT_other_error
1.3a PAT_error_2	2.3a PCR_repetition_error	3.2 SI repetition error
1.4 Continuity_count_error	2.3b PCR_discontinuity_indicator_error	3.4a Unreferenced PID
1.5a PMT_error_2	2.4 PCR_accuracy_error	3.5a SDT_actual_error
1.6 PID_error	2.5 PTS_error	3.5b SDT_other_error
	2.6 CAT_error	3.6a EIT_actual_error
		3.6b EIT_other_error
		3.6c EIT_PF_error
		3.7 RST_error
		3.8 TDT_error

MPEG over Gigabit Ethernet (Gigabit Ethernet IP Option GE)

Interconnect Port Option	Description
Opt. GE	Gigabit Ethernet Interface with 10/100/1000Base-T RJ45 electrical port
Optical SFP Modules	Plug into MTM400 Opt. GE to provide optical connectivity
Opt. SX 1000Base-SX	Short-wavelength optical port with LC connector for MTM400 Gigabit Ethernet Interface (Multi Mode 850 nm)
Opt. LX 1000Base-LX	Long-wavelength optical port with LC connector for MTM400 Gigabit Ethernet Interface (Single Mode 1310 nm)
Opt. ZX 1000Base-ZX	Optical port with LC connector for MTM400 Gigabit Ethernet Interface (Single Mode 1550 nm)

Environmental

Characteristic	Description
Temperature	
Operating	+5 °C to +40 °C
Nonoperating	-10 °C to +60 °C
Humidity	
Operating	Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C
Nonoperating	10% to 95% relative humidity, noncondensing
Altitude	
Operating	0 m to 3000 m (9800 ft.)
Nonoperating	0 m to 12000 m (40000 ft.)
Random Vibration	
Operating	5 to 500 Hz, G_{RMS} = 2.28
Nonoperating	.5 to 500 Hz, G_{RMS} = 0.27
Functional Shock	
Operating	30 G, half sine, 11 ms duration
Electromagnetic Compatibility	
EC Declaration of Conformity	Meets EN55103. Electromagnetic environment E4
Australia / New Zealand Declaration of Conformity	Meets AS/NZS 2064
FCC	Emissions are within FCC CFR 47, Part 15, Subpart B, Class A limits
Safety	Meets 73/23/EEC, EN61010-1, UL3111-1 and CAN/CSA 22.2 No. 1010.1-92, IEC61010-1

Physical Characteristics

Dimension	mm	in.
Height	44	1.73
Width	430	17.13
Depth	600	23.62
Weight*[7]	**kg**	**lb.**
Net	6.0	13.3
Shipping	9.0	19.7
Required Clearance	**mm**	**in.**
Top	0	0
Bottom	0	0
Left Side	Standard 19 in. rackmount	
Right Side	Standard 19 in. rackmount	
Front	Clearance for handles required	
Rear	Clearance for connectors required	

*[7] Weight does not include optional interface cards.

Ordering Information

MTM400

Single-stream extended confidence monitor packaged in 1RU chassis.

Includes: 1RU chassis fitted with transport stream processor card, manual, rack slides, power cord, and license key certificate.

Options

Opt. 01 – Triggered recording capability up to 160 MB.
Opt. 02 – Transport Stream service information analysis (PSI/SI/PSIP/ARIB view).
Opt. 03 – Template testing (for user-defined service plan testing).
Opt. 04 – In-depth PCR analysis with graphical result views.
Opt. 05 – Bit rate testing functionality.
Opt. 06 – Service logging.
Opt. 07 – IP/RF polling functionality.
Opt. CF – COFDM Interface.
Opt. QB2 – QAM Annex B Level 1 and Level 2 Interface.
Opt. EP – 8PSK/QPSK Interface.
Opt. VS – 8VSB Interface.
Opt. QA – QAM Annex A Interface.
Opt. QC – QAM Annex C Interface.
Opt. QP – QPSK Interface.
Opt. GE – Gigabit Ethernet Interface with 10/100/1000Base-T RJ45 electrical port.
Opt. SX – 1000Base-SX Short-wavelength optical port with LC connector for MTM400 Gigabit Ethernet Interface (Multi Mode 850 nm).
Opt. LX – 1000Base-LX Long-wavelength optical port with LC connector for MTM400 Gigabit Ethernet Interface (Single Mode 1310 nm).
Opt. ZX – 1000Base-ZX Optical port with LC connector for MTM400 Gigabit Ethernet Interface (Single Mode 1550 nm).

International Language Options

Opt. L0 – English User Guide.
Opt. L5 – Japanese User Guide.

Complementary Products

MTS4SA – Standalone Deferred Time Software package.
Opt. TSCL – DVB/ATSC/ARIB TS Compliance Analyzer Software (TS file size limited to 192 MB). For full details see separate data sheet.

Service

Opt. R3 – Repair Service 3 Years.
Opt. R5 – Repair Service 5 Years.

Power Connections

Opt. A0 – North America power plug.
Opt. A1 – Universal EURO power plug.
Opt. A2 – United Kingdom power plug.
Opt. A3 – Australia power plug.
Opt. A4 – 240 V North America power plug.
Opt. A5 – Switzerland power plug.
Opt. A6 – Japan power plug.
Opt. A10 – China power plug.
Opt. A99 – No power cord or AC adapter.

Field Upgrade Kits

MTM4FQA – Field upgrade kit to add QAM Annex A Interface to an existing probe.
MTM4FQC – Field upgrade kit to add QAM Annex C Interface to an existing probe.
MTM4FQP – Field upgrade kit to add QPSK Interface to an existing probe.
MTM4FCF – Field upgrade kit to add COFDM Interface.
MTM4FQB2 – Field upgrade kit to add QAM Annex B Interface.
MTM4FEP – Field upgrade kit to add 8PSK/QPSK Interface.
MTM4FVS – Field upgrade kit to add 8VSB Interface.
MTM4UP Opt. 01 – Field upgrade kit to add triggered recording capability up to 160 MB.
MTM4UP Opt. 02 – Field upgrade kit to add Transport Stream service information analysis (PSI/SI/PSIP/ARIB view).
MTM4UP Opt. 03 – Field upgrade kit to add template testing (for user-defined service plan testing).
MTM4UP Opt. 04 – Field upgrade kit to add in-depth PCR analysis with graphical result views.
MTM4UP Opt. 05 – Field upgrade kit to add bit rate testing functionality.
MTM4UP Opt. 06 – Field upgrade kit to add service logging.
MTM4UP Opt. 07 – Field upgrade kit to add IP/RF polling functionality.
MTM4FGE – Gigabit Ethernet upgrade kit for MTM400. Requires appropriate options.
Note 1: At least one option must be ordered.
Note 2: Opt. GE is required if MTM400 does not already have GigE capability.
MTM4FGE Opt. GE – Upgrade kit to add Gigabit Ethernet Interface With 10/100/1000Base-T RJ45 electrical port to MTM400.
MTM4FGE Opt. SX – Upgrade kit to add 1000Base-SX Short-wavelength optical port with LC connector (Multi Mode 850 nm) for MTM400 Gigabit Ethernet Interface.
MTM4FGE Opt. LX – Upgrade kit to add 1000Base-LX Long-wavelength optical port with LC connector (Single Mode 1310 nm) for MTM400 Gigabit Ethernet Interface.
MTM4FGE Opt. ZX – Upgrade kit to add 1000Base-ZX optical port with LC connector (Single Mode 1550 nm) for MTM400 Gigabit Ethernet Interface.
MTM4FGE Opt. IFC – One-time install of all selected options and calibration for one product.

CE

ISO 9001 — Product(s) are manufactured in ISO registered facilities.

GPIB IEEE-488 — Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

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