

MPEG Transport Stream Monitor

MTM400A Data Sheet



MTM400A MPEG transport stream monitor

Features & Benefits

- FlexVuPlus™ uniquely empowers operations staff with the simplest information necessary to prove their service is delivering above their defined thresholds for superior quality of service (QoS).
- Powerful diagnostic user interface provides intelligent hierarchical views of network information, media and data, allowing engineers to rapidly identify the root cause of underlying service problems.
- Unique dual-level alarming and seven-day trend information proactively identifies impending problems before they become visible to the viewer.
- Multilayer, multichannel, remote monitoring and measurement at IP, RF, and transport layers to DVB (TR 101 290), ATSC, DigiCipher® II (DCII), ISDB-T (terrestrial and mobile), and ISDB-TB (Brazil) standards.
- Simultaneously monitor up to 500 IP sessions including all essential parameters including continuity count, sync byte, Media Delivery Index (MDI), and Packet Inter-Arrival time (PIT).
- Designed for monitoring networks which carry both multiprogram transport streams (MPTS) or single program transport streams (SPTS), at either constant bit rate (CBR) or variable bit rate (VBR).
- Comprehensive confidence monitoring at the RF modulated layer with optional COFDM, 8VSB, Turbo 8PSK, QPSK (L-band) interfaces. These RF Interfaces allow the MTM400 to receive RF inputs and display key RF monitoring parameters including MER, BER and constellation displays to provide early indication of signal degradation before any picture impairment is visible to the end customer without additional costly RF test equipment.
- Unique learning capability creates a true "monitor by exception" mode of operation. This reduces operational expenditure by eliminating non-customer impacting alarms to focus resources only on critical activities.
- Comprehensive user-defined template monitoring ensures right content at the right place at the right time while content ratings checking ensures only appropriate content broadcast.
- Simultaneous connection of multiple remote users and network management systems (NMS) provides early visibility of problems to key individuals throughout the organization to support quicker corrective action.
- Embedded architecture designed specifically for continuous 24x7 operation maximizes service assurance, thus minimizing cost of customer complaints and equipment maintenance (disk free operation).
- Video and Audio backhaul for content checking and verification along with remote recording allows capture and analysis of stream events for expert offline analysis to diagnose difficult and intermittent problems, requiring no engineer site visits.
- Highly scalable and field upgradeable monitoring solution to tailor capital expenditure with operational growth.

Applications

- Contribution and primary distribution
 - Terrestrial distribution
 - Cable headend monitoring
 - DTH or network operator satellite uplink monitoring
- IPTV ingest and headend monitoring
- Edge network monitoring
 - ASI to RF
 - IP to RF (requires two MTM400A units)
 - IP to ASI

Deployed at key network nodes, the MTM400A provides an intuitive and simplified presentation of video quality and diagnostic information, to support delivery of superior QoS levels in an increasingly complex broadcast environment.

Technical Overview

The MTM400A provides a complete solution for real-time transmission monitoring of MPEG transport streams over RF, IP, and ASI interfaces. Powerful confidence monitoring capability and deep diagnostic measurements are both combined into a single integrated solution. This supports Broadcasters, Cable, Satellite and Telecommunication Operators to deliver superior quality of service (QoS) levels with reduced operational expenditure.

The confidence monitoring capability uniquely simplifies DTV monitoring with the FlexVuPlus summary displays, that includes video thumbnail and electronic program guide (EPG) views. This empowers operational staff with the simplest information necessary to ensure their service is delivering above their defined thresholds for superior QoS.

The deep diagnostic options provides engineers with intelligent hierarchical views of network information, media and data to support rapidly identifying the root cause of underlying service problems. These 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. Unique Learning mode creates an automatic baseline for physical & Transport Stream parameters to eliminate non-customer impacting alarms. This enables true "monitoring by exception" showing only real deviations from known good measurement parameters. The Auto configure mode optimizes stream based test parameters at the IP physical layer (for example PIT, MDI), RF physical layer (for example MER, SNR), and Transport layer (for example repetition rates, PCR drift). This reduces operational expenditure by eliminating non-customer impacting alarms and focusing resources on other critical activities.

The MTM400A provides a single transport stream processor platform packaged in a 1 RU rack mount chassis to provide monitoring of SPTS and MPTS transport streams. The optional IP and RF confidence monitoring interfaces including Gigabit Ethernet, COFDM, 8VSB, Turbo 8PSK, QPSK (L-band) and QAM. The RF Interfaces allow the MTM400A to receive RF inputs and display key RF monitoring parameters including MER, BER, and constellation displays before demodulating the signal to provide measurements on the health of the transport stream. The Gigabit Ethernet interface is designed for monitoring networks which carry both multiprogram transport streams (MPTS) or single-program transport streams (SPTS) including both constant bit rate (CBR) and variable bit rate (VBR) over gigabit ethernet networks. It monitors the IP key parameters for up to 500 sessions including Continuity Count, Sync Byte, Media Delivery Index (MDI), and Packet Inter-Arrival Time (PIT).

The channel polling capability for the MTM400A, combined with RF and IP interfaces allows up to 200 RF channels or 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 makes a single MTM400A a broader tool, monitoring large numbers of network points in a time sampled measurement mode.

The MTM400A remote user interface provides a highly simplified presentation of video quality and diagnostic information for operations and engineering teams. For a fully integrated monitoring solution network management platforms are supported with a full set of APIs to support wider distributed network intelligence. This also includes video walls that can display both MPEG-2 and H.264 thumbnails at the full transmitted resolution. To support content checking and verification at remote locations or critical monitoring points within the network, the MTM400A provides video and audio backhaul capability.

Flexible and Upgradeable

The MTM400A provides a highly scalable and field upgradeable monitoring solution to tailor capital expenditure with operational growth. The extended confidence monitoring probes can be installed throughout the network and powerful diagnostic capability can be added to the key monitoring points where transport streams are manipulated.

- Triggered recording to be captured and rapidly analyzed in greater depth using powerful offline analysis tools such as the Tektronix MPEG Test System Standalone Software^{*1}.
- 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.
- Exception monitoring with simple automated template generation from reference streams. 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.
- Comprehensive service logging enables verification of service level agreements to ensure that contractual obligations are met.

^{*1} MTS400 Series MPEG Test System offline software tools are available for use with the MTM400A. These are stand-alone software applications intended to run on the customers control PC. Separate data sheet is available.

Measurement Functions

MTM400A Extended Confidence Monitor in Standard Configuration

- MPEG-2, DVB (TR 101 290), ATSC, and ISDB (Japan & Brazil) supported
- TR 101 290 Priority 1, 2, and 3 measurements^{*2} 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 Mbps^{*3}
- SFN measurements according to TR 101 290
- Packet size detection
- Comprehensive error logging that context filters with navigation
- Status of all tests and measurements available via SNMP MIB with support for SNMP traps^{*4}

^{*2} Except T-STD buffer model analysis.

^{*3} 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} Programmers Guide is available on request with full SNMP MIB and HTTP interface documentation.

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
- Bit rate testing on a per PID, program, IP session, 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.

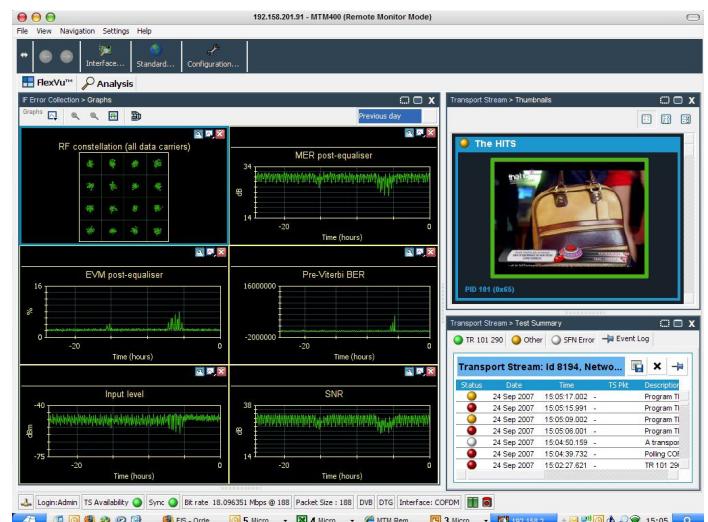


Figure 1: FlexVuPlus™ configurable windows with COFDM card

Remote User Interface

The Remote User Interface (RUI) is capable of providing simultaneous measurement results to multiple key resources, supporting improved organizational efficiency and work-flow to minimize network downtime. It is also capable of being integrated into wider network management platforms to support wider distributed network intelligence.

The confidence monitoring capability uniquely simplifies DTV monitoring with the FlexVuPlus™ summary panels.

For diagnostic monitoring, a context sensitive analysis paradigm provides a rich multilayer environment presenting complex information with an intuitive hierarchical approach. The supporting extensive navigation options ensure that you can identify the route cause of error alarms with minimal mouse clicks.

Confidence Monitoring

- FlexVuPlus™ uniquely presents simplified presentation of video quality and diagnostic information, to enable delivery of superior QoS levels in an increasing complex broadcast environment.
- At-a-glance service view with MPEG-2 and H.264 video thumbnails and interactive electronic programming guide (EPG); empowering operations staff with the simplest information to monitor service delivery
- Comprehensive seven-day trending of IP and RF broadcast streams supports proactive network optimization to minimize downtime.

Diagnostic Monitoring

- Powerful user interface provides intelligent hierarchical views of network information, media and data allowing engineers to rapidly identify the root cause of underlying service problems.
- Accelerate time to insight with context sensitive navigation and filtered logging to isolate root cause of test failure

Data Sheet



Figure 2: RF Trending QAM Interface (with dual alarming)

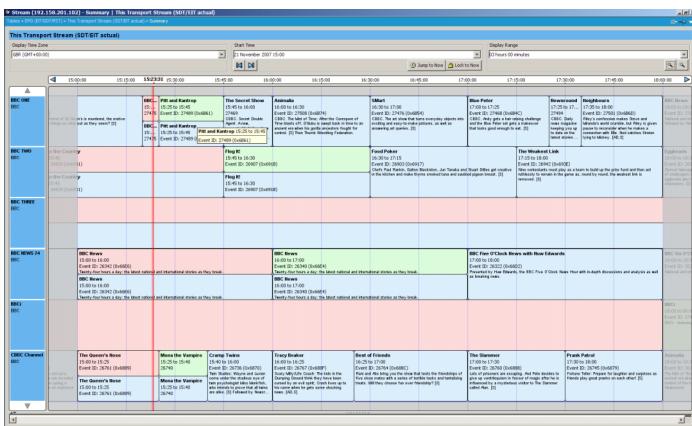


Figure 3: EPG View

Characteristics

Power Requirements

Characteristic	Description
Power Consumption (nominal)	40 VA
Voltage	100 to 240 V
Frequency	50/60 Hz

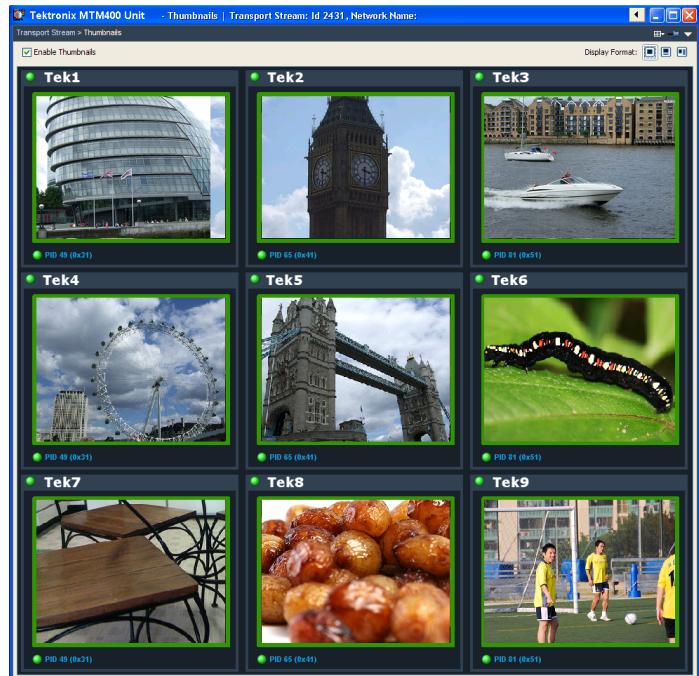


Figure 4: Video Thumbnails (both MPEG-2 & H.264 supported)

Monitoring

Characteristic Description

Characteristic	Description
Data Rate	Maximum Data Rate 155 Mbps* Minimum Data Rate 250 kbps

*3 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.

TR 101 290 Tests and Measurements

1 st Priority Measurements	2 nd Priority Measurements	3 rd 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)

Characteristic	Description
Interconnect Port Options	Opt GE Gigabit Ethernet Interface with 10/100/1000 BASE-T RJ45 electrical port Optical SFP modules which plug into MTM400A Opt GE to provide optical connectivity Opt SX 1000BASE-SX Short Wavelength Optical port with LC connector for MTM400A Gigabit Ethernet Interface (Multi Mode 850 nm) Opt LX 1000BASE-LX Long Wavelength Optical port with LC connector for MTM400A Gigabit Ethernet Interface (Single Mode 1310 nm) Opt ZX 1000BASE-ZX Optical port with LC connector for MTM400A Gigabit Ethernet Interface (Single Mode 1550 nm)
Maximum data rate	Line rate
ASI output	ASI compliant with specification EN 50083-9 ASI smoothing can be activated to compensate for bursty IP traffic
Protocol Stack Support	IPv4 support IPv6 support UDP/IP/Ethernet UDP/IP/VLAN/Ethernet RTP/UDP/IP/Ethernet RTP/UDP/IP/VLAN/Ethernet
Multicast and Control Support	IGMP v2 support IGMP v3 support MLD v2 support ARP ICMP (Inbound and Outbound ping)
IP Packet Support	7 transport stream packets per IP packet (188 byte packets) FEC (FEC is parsed but is not processed)
Session Support	Discovery of up to 500 IP sessions, simultaneous monitoring of key parameters including Continuity Count, Sync Byte, Packet Inter-Arrival Time (PIT) for all sessions. RTP sessions are also monitored for Out of Order and Dropped Packets
Display Features	
Statistics	Statistics: (1) Static IP header contents, (2) Total bit rate for all Ethernet traffic (3) Instantaneous TS bit rate for selected IP session (4) Errored packets rate per minute and absolute count (5) Dropped packets rate per minute and absolute count (6) Out of Order packets rate per minute and absolute count (7) TS Continuity Count (8) Media Delivery Index MDI (RFC4445)
Graphs	(1) IP session TS bit rate (2) Traffic graph for all IP sessions with per session error indication (3) IP packet inter-arrival time of the selected IP session Min, Max & Average (4) IP session lock status trend graph (up to seven days) (5) IP Dropped Packet Rate trend graph (up to seven days) (6) IP Out of Order Packet Rate trend graph (up to seven days) (7) IP Corrupted Packet Rate trend graph (up to seven days) (8) Packet Inter-Arrival Time histogram view, Average and Peak Trend Graph (up to seven days) (9) MDI trend displays, delay factor & media loss rate for selected session
Alarms	User definable thresholds for alarms on all sessions including: (1) errored packets rate (2) dropped packets rate (3) Packet inter-arrival time maximum (4) Out of Order Packet rate Event Alarms on all sessions including: (1) TS Continuity Count Errors (2) TS Sync Byte (3) TS Sync Loss (4) Dropped Session
Control	Controls: (1) Line select (optical, electrical rate) (2) Filters for MAC, IP, Port, (3) Protocol control for ARP, RTP, IGMP and VLAN (4) IGMP (single or multiple subscription)

Data Sheet

COFDM Interface Characteristics (Option CF)

Characteristic	Description
Input Frequency Range	50 MHz to 858 MHz in 166.7 or 62.5 kHz steps
Tuning Accuracy	Better than ± 50 ppm typical
Channel Bandwidth	6 MHz, 7 MHz, and 8 MHz (SW selectable)
Connector Style	F Type with BNC adaptor
Input Termination Impedance	75 Ω nominal
Input Return Loss	7 dB typical 50 MHz to 858 MHz
Rx Lock Status	Indicated by LED on rear panel and by the UI
Modulation Scheme Supported	QPSK (4QAM), 16QAM, and 64QAM modulation
Transmission Modes	2K carriers and 8K carriers
Hierarchical Modes	All hierarchies are supported, including no hierarchy, and alpha = 1, 2, and 4
Viterbi puncture rates	1/2, 2/3, 3/4, 5/6, 7/8
Guard interval	1/32, 1/16, 1/8, 1/4
Spectrum Polarity	The receiver will operate with both inverted and normal spectral polarity
Input Signal Amplitude Range	QPSK (4QAM): -85 dBm to -10 dBm (24 dBuV to 99 dBuV) typical 16QAM: -80 dBm to -10 dBm (29 dBuV to 99 dBuV) typical 64QAM: -72 dBm to -15 dBm (37 dBuV to 94 dBuV) typical

COFDM Interface Characteristics (Option CF) RF Measurements

Characteristic	Description		
	Display Range	Resolution	Accuracy
Carrier Offset	Carrier offset is measured from the tuned channel frequency to a accuracy of ± 10 ppm typical This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average		
Signal to Noise Ratio (SNR)	6 dB to 40 dB for QPSK (4QAM): 11 dB to 40 dB for 16QAM 16 dB to 40 dB for 64QAM	1 dB	± 1 dB to 30 dB SNR (measured at -30 dBm in high-resolution mode) typical.
EVM (Error Vector Magnitude)	1% to 30% rms, for QPSK 1% to 20% rms, 16QAM 1% to 8.5% rms, 64QAM	0.1%	—
MER (Modulation Error Ratio) with Equalizer <i>Both MER Peak and MER Average are displayed as measured across all carriers</i>	6 dB to 37 dB for QPSK (4QAM) 11 dB to 37 dB for 16QAM 16 dB to 37 dB for 64QAM	0.1 dB	± 1 dB to 30 dB (measured at -30 dBm in high-resolution mode) typical
This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average			
Constellation	The RF constellation is displayed on the UI		
Channel Impulse Response	Display of channel impulse response		
Channel Spectral Response	Active receive channel spectrum, RF level vs. frequency		
Bit Error Ratio (BER)	Pre FEC, BER and Error Sec BER values are displayed This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average		
Post Reed Solomon BER	Post RS BER (Uncorrectable Error Count) displayed This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average		
Transport Error Flag (TEF)	Alarm generated on detection of a TEF		

8VSB Interface Characteristics (Option VS)

Characteristic	Description
Input Frequency Range	54 MHz to 860 MHz, VHF/UHF channels 2 to 69 (to include low VHF frequencies)
Input Signal Level	-72 dBm to -6 dBm (-23 dBmV to +43 dBmV) typical
Modulation Format	8VSB in accordance with ATSC A/53B
Receiver Bandwidth	6 MHz
Input Termination Impedance	75 Ω nominal
Connector Type	F Type Connector
Input Return Loss	5 dB typical

8VSB Interface Characteristics (Option VS) RF Measurements

Characteristic	Description			
	Range	Display Range	Resolution	Accuracy
RF Lock	RF lock is indicated by a LED on the rear panel and a status indicator on the UI This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average			
Input Level	-72 dBm to -2 dBm -23 dBmV to +47 dBmV relative to 75 Ω	—	1 dB	±3 dB up to -6 dBm input level typical
Error Vector Magnitude (EVM)	—	3% to 12.5% rms	0.1% typical	—
Equivalent MER (Modulation Error Ratio)	—	15 dB to 36 dB	1 dB	±1 dB for MER <25 dB typical ±3 dB for MER 25 dB to 32 dB typical
Signal to Noise Ratio (SNR)	—	15 dB to 35 dB	1 dB	±1 dB for SNR <25 dB ±3 dB for SNR 25 dB to 35 dB typical
This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average				
Bit Error Ratio (BER)	Pre FEC, SER and Error Sec BER values displayed on UI This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average			
Symbol Distribution	The Symbol Distribution is displayed on the UI			

Data Sheet

QPSK (L-band) and Turbo 8PSK Interface Card (Option EP)

Interface option EP provides both QPSK (L-band) and Turbo 8PSK interface and measurement capability

Characteristic	Description
Input Frequency Range	950 MHz to 2150 MHz step size of 1 MHz
Input Signal Amplitude Range	-60 dBm to -30 dBm for CBER < $1e^{-6}$
Modulation Format	QPSK in accordance with ETSI EN 300 421
Modulated Baud Rate	1 MBaud min, 30 MBaud max
Viterbi Values Supported	1/2, 2/3, 3/4, 5/6, 6/7, 7/8
FEC	In accordance with ETSI EN 300 421
Turbo Viterbi Values Supported	1/2, 2/3, 3/4, 5/6, 7/8
Turbo FEC	Turbo Code
Connector Style	F - style
Input Termination Impedance	75 Ω nominal
LNB Supply Voltage	selectable; 13.0 V ±1.5 V or 18.0 V ±1.5 V
LNB Supply Maximum Current	200 mA maximum
LNB 22 kHz Signaling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signaling Amplitude	600 mV _{p-p} nominal with 100 Ω load
Modes Supported	Turbo QPSK, QPSK DSS, QPSK DCII, QPSK DVB

QPSK (L-band) and Turbo 8PSK Interface Card (Option EP) RF Measurements

Characteristic	Description			
	Range	Display Range	Resolution	Accuracy
RF Lock	RF lock is indicated to the user by an LED on the rear panel and a status icon on the UI			
Input Level (Signal Strength)	-60 dBm to -30 dBm	—	1 dBm	±5 dBm typical
EVM (Error Vector Magnitude)	—	≤4.0% to ≥30.0% rms	0.1%	—
MER (Modulation Error Ratio) with Equalizer	—	10 to 26 dB with Equalizer	1 dB	±2 dB typical for range 10 to 20 dB
SNR (Signal to Noise Ratio)	—	5 to 35 dB	1 dB	±2 dB typical for range from 5 to 30 dB

This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average

Pre Reed Solomon (RS) BER	Pre RS BER is displayed on the UI
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (TEF ratio), TEF rate, and number of Transport Error Flags (TEF count) are displayed on the UI.
Constellation	The RF constellation is displayed on the UI

Turbo 8PSK Interface Characteristics (Option EP)

Characteristic	Description
Input Frequency Range	950 MHz to 2150 MHz in 100 kHz steps
Modulation Format	Turbo 8PSK ^{*5}
Modulated Baud Rate	1 MBaud min, 30 MBaud max
Turbo Viterbi Values Supported	2/3, 3/4 (2.05), 3/4 (2.1) 5/6, 8/9
Turbo FEC	Turbo Code
Connector Style	F - style
Input Termination Impedance	75 Ω nominal
LNB Supply Voltage	selectable; 13.0 V ±1.5 V or 18.0 V ±1.5 V
LNB Supply Maximum Current	200 mA maximum
LNB 22 kHz Signaling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signaling Amplitude	600 mV _{p-p} with 100 Ω load
Modes Supported	Turbo 8PSK

^{*5} Please note that the Turbo 8PSK option does not support non-turbo 8PSK (DVB-DSNG), or DVB-S2. For information, please contact Tektronix.

Turbo 8PSK Interface Characteristics (Option EP) RF Measurements

Characteristic	Description			
	Range	Display Range	Resolution	Accuracy
RF Lock	—	RF lock is indicated to the user by an LED on the rear panel and a status icon on the UI	—	—
Input Level (Signal Strength)	-60 dBm to -30 dBm	—	1 dBm	±5 dBm typical
EVM (Error Vector Magnitude)	—	≤4.0% to ≥30.0% rms	0.1%	—
MER (Modulation Error Ratio) with Equalizer	—	10 to 26 dB with Equalizer	1 dB	±2 dB typical for range 10 to 20 dB
SNR (Signal to Noise Ratio)	—	5 to 35 dB	1 dB	±2 dB typical for range from 5 to 30 dB
This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average				
Pre Reed Solomon (RS) BER	—	Pre-RS BER is displayed on the UI	—	—
Post RS BER and TEF (Transport Error Flag)	—	Post Reed Solomon BER (TEF ratio), TEF rate, and number of Transport Error Flags (TEF count) are displayed on the UI	—	—
Constellation	—	The RF constellation is displayed on the UI	—	—

QAM Interface Characteristics (Options QA, QB2, QC)

Characteristic	QAM Annex A	QAM Annex B	QAM Annex C
Input Frequency Range	51 MHz to 858 MHz, 62.5 kHz steps	88 MHz to 858 MHz , 62.5 kHz steps	—
Modulation Format	16QAM, 64QAM, 256QAM compliant with ITU J-83 and DVB-C ETS 300 429	64QAM, 256QAM compliant with ITU J-83 ^{*6} SCTE07 Compliant	16QAM, 64QAM, 256QAM compliant with ITU J-83
Modulation Baud Rate	5 Mbaud/s min. 6.952 Mbaud/s max	5.057 Mbaud/s and 5.360 Mbaud/s	5 Mbaud/s min. 5.5 Mbaud/s max
Input Signal Level	-59 dBm to -19 dBm (50 dBuV to 90 dBuV relative to 75 Ω), with a 16, 64, and 256 QAM input typical	-64 dBm to -19 dBm (45 dBuV to 90 dBuV relative to 75 Ω) with a 64 and 256 QAM input typical	-59 dBm to -19 dBm (50 dBuV to 90 dBuV relative to 75 Ω), with a 16, 64, and 256 QAM input typical
Ultimate Modulation Error Ratio	—	37 dB typical	—
Receiver Bandwidth	8 MHz nominal	—	6 MHz nominal
Input Termination Impedance	—	75 Ω nominal	—
Input Return Loss	—	-6 dB min, -10 dB typical, 51 MHz to 858 MHz	—
Loopthrough Power Gain	1.5 dB to 4 dB typical, 51 MHz to 858 MHz	N/A	N/A
Loopthrough Noise Figure	8 dB typical	N/A	N/A
Loop Through Output Return Loss	>10 dB typical	N/A	N/A

^{*6} Level 1 and Level 2 interleaving support compliant with all ITU J-83 Annex B, excluding I, J = 128,7 and 128,8 in all modes, 8,16 and 16,8 in 256QAM mode.

Data Sheet

QAM Measurements

QAM Annex	B Measurements (Option QB2)	A/C Measurements (Option QA or QC)
RF Lock	RF lock is indicated by a LED on the rear panel and a status icon on UI	—
Input Level (Signal Strength)		
Range	-64 dBm to -19 dBm	—
Resolution	1 dBm	—
Accuracy	±3 dBm Typical This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average	—
EVM (Error Vector Magnitude)		
Display Range for 64 QAM	≤1% to ≥5% rms	
Display Range for 256 QAM	≤1% to ≥2.5% rms	
Resolution	0.1%	
Accuracy	within 20% of reading for S/N >25 dB Typical This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average	
MER (Modulation Error Ratio) with Equalizer		
Display Range for 64 QAM	22 dB to 37 dB	—
Display Range for 256 QAM	28 dB to 37 dB	—
Resolution	0.1 dB	—
Accuracy	±1 dB for MER <25 dB ±3 dB for MER 25 dB to 34 dB typical This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average	—
Ultimate MER (Modulation Error Ratio)	—	38 dB typical
SNR		
Display Range for 64 QAM	22 dB to 37 dB	—
Display Range for 256 QAM	28 dB to 37 dB	—
Resolution	1 dB	—
Accuracy	±1 dB for MER <25dB ±3 dB for MER 25 dB to 34 dB typical This includes the ability to set alarms and produce trend graphs over a seven day period including min, max and average	—
BER	Pre FEC, SER, and Error Sec BER values are displayed	—
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (uncorrectable error count) and number of Transport Error Flags are displayed on the UI	
Constellation	The RF constellation is displayed on the UI	

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

Dimensions	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" rack mount	
Right side	Standard 19" rack mount	
Front	Clearance for handles required	
Rear	Clearance for connectors required	

*7 Weight does not include optional interface cards.

Ordering Information**MTM400A**

MPEG Transport Stream Monitor

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

Options

Option	Description
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. GE	Gigabit Ethernet Interface with 10/100/1000 BASE-T RJ45 electrical port
Opt. SX	1000BASE-SX Short Wavelength Optical port with LC connector Multi Mode 850 nm (requires Opt. GE)
Opt. LX	1000BASE-LX Long Wavelength Optical port with LC connector Single Mode 1310 nm (requires Opt. GE)
Opt. ZX	1000BASE-ZX Optical port with LC connector Single Mode 1550 nm (requires Opt. GE)

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 Mbytes). For full details see separate data sheet

Service

Opt. R3	Repair service three years (including warranty)
Opt. R5	Repair service five years (including warranty)

Power Connections

Option	Description
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

Data Sheet

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Updated 30 October 2008

Field Upgrade Kits

Option	Description
Field Upgrade Kit to Add:	
MTM4UP Opt. QAA	Adds QAM Annex A Interface to an existing probe
MTM4UP Opt. QC	Adds QAM Annex C Interface to an existing probe
MTM4UP Opt. CF	Adds COFDM Interface
MTM4UP Opt. QB2	Adds QAM Annex B Interface
MTM4UP Opt. EP	Adds 8PSK/QPSK Interface
MTM4UP Opt. VS	Adds 8VSB Interface
MTM4UP Opt. 01	Adds triggered recording capability up to 160 MB
MTM4UP Opt. 02	Adds transport stream service information analysis (PSI/SI/PSIP/ARIB view)
MTM4UP Opt. 03	Adds template testing (for user-defined service plan testing)
MTM4UP Opt. 04	Adds in-depth PCR analysis with graphical result views
MTM4UP Opt. 05	Adds bit rate testing functionality
MTM4UP Opt. 06	Adds service logging
MTM4UP Opt. 07	Adds IP/RF Polling functionality
Upgrade Kit to Add:	
MTM4UP Opt. GE	Adds Gigabit Ethernet Interface With 10/100/1000 BASE-T RJ45 Electrical Port
MTM4UP Opt. SX	Adds 1000BASE-SX Short Wavelength Optical port with LC connector (Multi Mode 850 nm) for Gigabit Ethernet Interface (requires Opt. GE)
MTM4UP Opt. LX	Adds 1000BASE-LX Long Wavelength Optical port with LC connector (Single Mode 1310 nm) for Gigabit Ethernet Interface (requires Opt. GE)
MTM4UP Opt. ZX	Adds Upgrade kit to add 1000BASE-ZX Optical port with LC connector (Single Mode 1550 nm) for Gigabit Ethernet Interface (requires Opt. GE)
Other	
MTM4UP Opt. IFC	One-time install of all selected options and calibration for one product



Product(s) are manufactured in ISO registered facilities.



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

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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05 Feb 2009

2AW-21525-3

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