MPEG Transport Stream Monitor

▶ MTM400

▶ MTM400 MPEG transport stream monitor - right content, right place, right time.

Technical Overview

New: COFDM, 8VSB, Turbo 8PSK and QAM-B RF confidence monitoring interfaces.
New: Support for H.264 AVC and VC1 stream types enables stream identification and monitoring where next-generation compression systems are used.
New: RF diagnostic mode enables measurements on signals where lock cannot be achieved.
The MTM400 is a real-time MPEG transport stream monitor. Together with the MLM1000 Multi-Layer Monitoring Application,[*1] the MTM400 provides a complete solution for transmission monitoring of MPEG transport streams. 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 Mbps.[*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 enable 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 and right time. Additionally, optional RF confidence monitoring interfaces including COFDM, 8VSB, Turbo 8PSK, QPSK (L Band) and QAM allow the MTM400 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. Deployed at key network nodes, the MTM400 equipped as a diagnostic monitor enables the cause of faults to be pinpointed and solved.

[*1] Separate data sheet is available.

[*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.

▶ Features & Benefits

Multi Layer, Multi Channel, Remote Monitoring and Measurement at RF and Transport Layers to DVB (TR 101 290), ATSC and ISDB (T&S) Standards

Comprehensive Confidence Monitoring at the RF Modulated Layer with Optional COFDM, 8VSB, Turbo 8PSK, QPSK (L Band) and QAM Interface MER (Up to 38 dB Typical), 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

MTM400 with RF Interface Can Switch Between RF Monitoring and Transport Stream Monitoring Within the One Probe, Enabling Monitoring of the Input and RF Interface with a Single Unit, Minimizing Down Time and Contractual Penalties

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 Minimize Upgrade Time

Simple User Interface Minimizes Staff Familiarization Time

▶ Applications

Terrestrial Distribution

Contribution and Primary Distribution

Cable Headend Monitoring

DTH or Network Operator Satellite Uplink Monitoring

Tektronix
Enabling Innovation

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[*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
- 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

[*1] Separate data sheet is available.

- In-depth PCR analysis with graphical results views enables 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[*2]

Applications

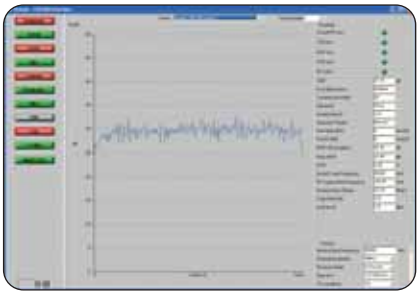
Terrestrial Distribution

Terrestrial broadcasters need to verify accuracy of content at unmanned transmitter sites. They need to check for errors, troubleshoot problems and capture errors for offline investigation.

- The MTM400 is designed for 24/7 unattended operation
- Low-cost, extended-confidence monitoring enables widespread deployment
- Centralized networked operation minimizes staffing requirements
- Remote stream capture means engineers do not have to visit the site
- COFDM and 8VSB RF terrestrial interfaces allow monitoring at the transmitter site or remote off-air monitoring

[*2] MTS400 Series MPEG Test System offline software tools are available for use with the MTM400. These are stand-alone software applications intended to run on the MLM1000 control PC. Separate data sheet is available.

► COFDM QAM64 Constellation.



► COFDM Channel C/N.

Contribution and Primary Distribution

Large networks carry compressed video from many points to many points over limited bandwidth. Content is distributed at high data rates with potential loss of revenue if video content is not delivered per agreement. Right content at right place at right time is key.

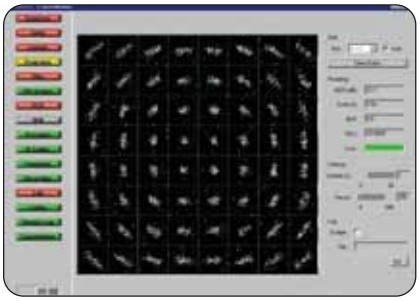
- MTM400's low cost, extended confidence monitoring enables widespread deployment
- High bit rate capability up to 155 Mb/s[*3] for monitoring transport streams carried over GbE/ATM/OC3/SDH
- Bit rate testing and logging enables bandwidth usage to be monitored and Service Level Agreements to be verified

[*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.

Cable Headend

Cable companies need to verify content accuracy at multiple, unmanned headend sites as operations are centralized. Budgets are tight and resources are limited.

- The MTM400 is a cost-effective solution which can be used for unattended operation for unmanned regional headends
- Network monitoring units linked to central operations center reduces manpower requirements
- Comprehensive coverage of QAM Annex A/B/C RF interfaces allows cost-effective, multi-channel, multi-layer monitoring
- Selection of PLL and AFC characteristics of the QAM interface enables constellation analysis on signals that are too poor for normal operation



▶ QAM Signal Monitoring.

DTH or Network Operator Satellite Uplink Monitoring

Large numbers of channels may be monitored by limited personnel. A fault on a single signal could result in great customer dissatisfaction and churn. Errors in the stream or incorrect content must be identified before large numbers of viewers are affected. Operators need to monitor both before and after modulation.

- The cost-effective MTM400 solution provides low cost per stream
- QPSK (L Band) and Turbo 8PSK RF interfaces allow a stream to be monitored both at the ASI/SMPTE310M interface and the RF interface by switching between the two

Measurement Functions

MTM400 Extended Confidence Monitor in Standard Configuration

- MPEG-2, DVB (TR 101 290), ATSC and ISDB (T&S) supported
- TR 101 290 Priority 1, 2 and 3 measurements[*1] in accordance with the techniques specified in TR 101 290

▶ MTM400 stream testing.

- Bit rate measurement in accordance with the methodology specified in TR 101 290 MGB2
- Maximum input transport stream bit rate up to 155 Mbps[*2]
- SFN measurements according to TR 101 290
- Packet size detection
- Error log
- Status of all tests and measurements available via SNMP MIB with support for SNMP traps[*3]

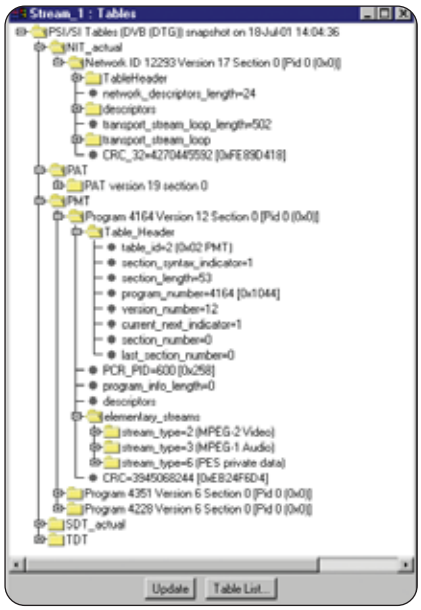
Diagnostic Monitoring Options

- 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 content, plus real-time graphical representation of table repetition rates

[*1] Except T-STD buffer model analysis.

[*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.

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

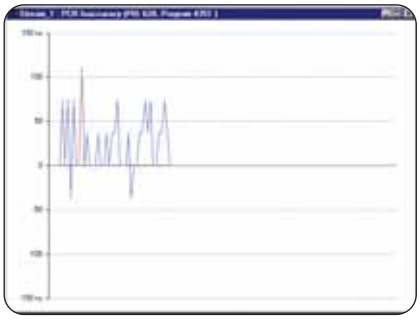


▶ MTM400 SI tables.

▶ MTM400 template testing.

- Template testing (for user-defined service plan testing). User definable tests with scheduled template updating

▶ Bit rate testing on a per PID, program or user-defined groups of PIDs basis



▶ MTM400 PCR inaccuracy analysis.

▶ In-depth PCR analysis with graphical results views of:

▶ PCR_OJ (overall jitter)

▶ PCR_AC (accuracy)

▶ PCR_FO (frequency offset)

▶ PCR_DR (drift rate)

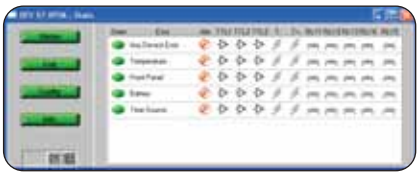
▶ Arrival interval

▶ Service logging of user selected PIDs to record packet rates at user definable intervals

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

Graphical User Interface

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



▶ The device status summary displays hardware status of the MTM400 including battery status, temperature, etc.

▸ Characteristics

Power Requirements

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

Monitoring

Data Rate

Maximum Data Rate – 155 Mbps[*1].
Minimum Data Rate – 250 Kbps.

[*1] 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

▶ COFDM Interface Characteristics (Option CF)

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 adapter
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 be supported, including no hierarchy, and alpha = 1, 2 and 4
Viturbi 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
RF Measurements	
Carrier Offset	Carrier offset is measured from the tuned channel frequency to an accuracy of ±10 ppm typical
Signal to Noise Ratio (SNR)	Display Range: 6 dB to 40 dB for QPSK (4QAM): 11 dB to 40 dB for 16QAM 16 dB to 40 dB for 64QAM Resolution: 1 dB Accuracy: ±1 dB to 30 dB SNR (measured at –30 dBm input in high-resolution mode) typical
EVM (Error Vector Magnitude)	Display Range: 1% to 30% rms, for QPSK 1% to 20% rms, 16QAM 1% to 8.5% rms, 64QAM Resolution: 0.1%
Modulation Error Ratio (MER) with Equalizer	Both MER Peak and MER Average are displayed as measured across all carriers Display Range: 6 dB to 37 dB for QPSK (4QAM) 11 dB to 37 dB for 16QAM 16 dB to 37 dB for 64QAM Resolution: 0.1 dB Accuracy: ±1 dB to 30 dB (measured at –30 dBm input in high-resolution mode) typical
Constellation	The RF constellation is displayed on the UI
Bit Error Ratio (BER)	Pre FEC, BER and Error Sec BER values are displayed
Post Reed Solomon BER	Post RS BER (Uncorrectable Error Count) displayed
Transport Error Flag (TEF)	Alarm generated on detection of a TEF

► 8VSB Interface Characteristics (Option VS)

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
RF Measurements	
RF Lock	RF lock is indicated by a LED on the rear panel and a status indicator on the UI
Input Level	Range: –72 dBm to –2 dBm –23 dBmV to +47 dBmV relative to 75 Ω Resolution: 1 dB Accuracy: ±3 dB up to –6 dBm input level typical
Error Vector Magnitude (EVM)	Display Range: 3% to 12.5% RMS Resolution: 0.1% typical
Equivalent Modulation Error Ratio (MER)	Display Range: 17 dB to 31 dB Resolution: 1 dB Accuracy: ±1 dB for MER <25 dB typical ±3 dB for MER 25 dB to 31 dB typical
Signal to Noise Ratio (SNR)	Display Range: 15 dB to 35 dB Resolution: 1 dB Accuracy: ±1 dB for SNR <25 dB typical ±3 dB for SNR 25 dB to 35 dB typical
Bit Error Ratio (BER)	Pre FEC, SER and Error Sec BER values displayed on UI
Constellation	The RF symbol distribution is displayed in the UI
Echo Profile	The Echo Profile is shown in the UI

► QPSK (L-Band) Interface Characteristics (Option QP)

Input Frequency Range	950 MHz to 2150 MHz step size of 1 MHz
Input Signal Amplitude Range	–60 dBm to –30 dBm for a CBER of <1e–6
Modulation Format	QPSK in accordance with ETSI EN 300 421
Modulated Baud Rate	1 MBaud min, 45 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
Connector Style	F-style
Input Termination Impedance	75 Ω nominal
Input Return Loss	10 dB min, 950 MHz to 2150 MHz typical
Loopthrough Output Amplitude	–6 dB to +3 dB typical
Loopthrough Output Reverse Isolation	30 dB typical
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 Signalling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signalling Amplitude	600 $mV_{pk\text{-}pk}$ nominal with 100 Ω load

QPSK (L-Band) and Turbo 8PSK Interface Characteristics (Option EP)

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

▸ QPSK (L-Band) Interface Characteristics (Option EP)

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 Signalling Amplitude	600 mV_{pk-pk} nominal with 100 Ω load
Modes Supported	Turbo QPSK, QPSK DSS, QPSK DCII, QPSK DVB
RF Measurements	
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)	Range: –60 dBm to –30 dBm Resolution: 1 dBm Accuracy: ±5 dBm typical
EVM (Error Vector Magnitude)	Display Range: ≤4.0% to ≥30.0% RMS Resolution: 0.1%
MER (Modulation Error Ratio) with Equalizer	Display Range: 10 to 26 dB with Equalizer Resolution: 1 dB Accuracy: ±2 dB typical for range 10 to 20 dB
SNR (Signal to Noise Ratio)	Display Range: 5 to 35 dB Resolution: 1 dB Accuracy: ±2 dB typical for range from 5 to 30 dB
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)

Input Frequency Range	950 MHz to 2150 MHz in 100 kHz steps
Modulation Format	Turbo 8PSK*1
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 Signalling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signalling Amplitude	600 mV_{pk-pk} with 100 Ω load
Modes Supported	Turbo 8PSK
RF Measurements	
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)	Range: –60 dBm to –30 dBm Resolution: 1 dBm Accuracy: ±5 dBm typical
EVM (Error Vector Magnitude)	Display Range: ≤4.0% to ≥30.0% RMS Resolution: 0.1%
MER (Modulation Error Ratio) with Equalizer	Display Range: 10 to 26 dB with Equalizer Resolution: 1 dB Accuracy: ±2 dB typical for range 10 to 20 dB
SNR (Signal-to-Noise Ratio)	Display Range: 5 to 35 dB Resolution: 1 dB Accuracy: ±2 dB typical for range from 5 to 30 dB
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

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

▶ QAM Interface Characteristics (Options QA, QB2, QC)

	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[*1] 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
Loopthrough Output Return Loss	>10 dB typical	N/A	N/A

[*1] Level 1 and Level 2 interleaving support compliant with all ITU J-83 Annex B, excluding I, J = 128,7 and 128,8.

▶ QAM Annex 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
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
Ultimate MER (Modulation Error Ratio)	38 dB typical
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon indicative BER (uncorrectable error count) and number of Transport Error Flags are displayed on the UI
Constellation	The RF constellation is displayed on the UI

▶ QAM Annex B Measurements (Option QB2)

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
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
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
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 <25 dB ±3 dB for MER 25 dB to 34 dB typical
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

Temperature –
Operating: +5 ºC to +40 ºC.
Nonoperating: –10 ºC to +60 ºC.

Humidity –
Operating: Maximum relative humidity 80% for temperatures up to 31 ºC decreasing linearly to 50% relative humidity at 40 ºC.
Nonoperating:10% to 95% relative humidity, non-condensing.

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	**kg**	**lbs.**
Net	6.0[*1]	13.3[*1]
Shipping	9.0[*1]	19.7[*1]
Required Clearance	**mm**	**in.**
Top	0	0
Bottom	0	0
Left side	Standard 19" rackmount	
Right Side	Standard 19" rackmount	
Front	Clearance for handles required	
Rear	Clearance for connectors req'd	

[*1] 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. 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.

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.

MLM1000 – Multi-Layer Monitor software package (for full details see MLM1000 data sheet).

Service

Opt. R3 – Repair service three years.

Opt. R5 – Repair service five 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.

MPEG Transport Stream Monitor

▶ MTM400

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