

# Digital TV Monitor

## MTM400A Data Sheet



### Applications

- Contribution and Primary Distribution
  - Terrestrial Distribution
  - Cable Headend Monitoring
  - DTH or Network Operator Satellite Uplink Monitoring
- IPTV Ingest and Headend Monitoring

### Introduction

The MTM400A provides a complete solution for real-time transmission monitoring of MPEG Transport Streams over RF 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 QoS levels with reduced operational expenditure.

Deployed at key network nodes, the MTM400A provides an intuitive and simplified presentation of video quality and diagnostic information. This supports the delivery of superior Quality of Service (QoS) levels in an increasingly complex broadcast environment.

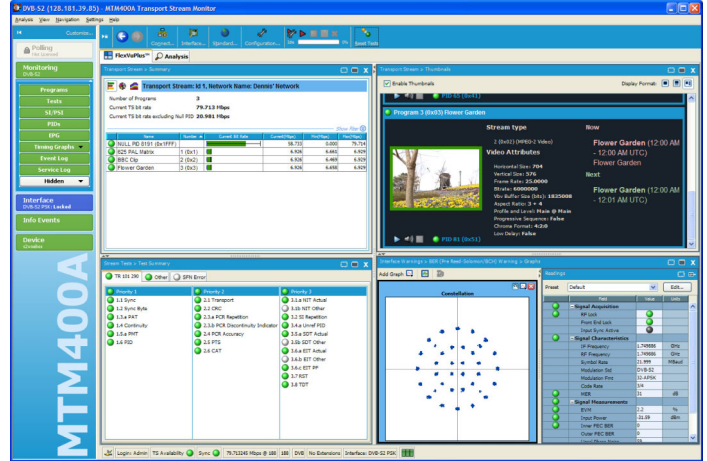
When used together with VQNet™, facility and network-wide views allow engineers to sectionalize network problems.

### Features & Benefits

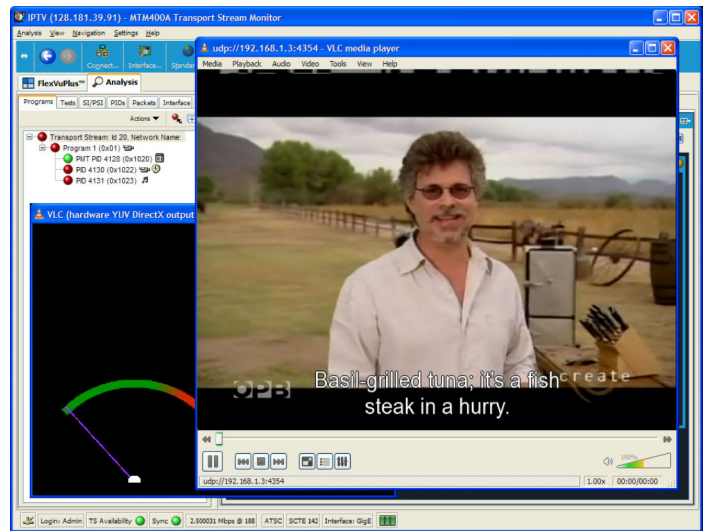
- Multilayer, multichannel, remote monitoring and measurement at RF and TS layers to DVB, ATSC, DCII, and ISDB-T/Tb standards with content-checking support for both MPEG-2 and H.264/AVC
- Displays key RF monitoring parameters for DVB-T and DVB-S/S2 interfaces to provide early indication of signal degradation before any picture impairment is visible to the end customer (**Note:** In DVB-S2 mode only Transport Stream inputs are supported)
- No additional analysis software is needed; all confidence and diagnostic analysis is carried out from the MTM400A alone
- When used in conjunction with the VQS1000 Video Quality Software application, provides reliable and sophisticated analysis algorithms applied to decoded MPEG-2 or H.264 video to identify stuck, black, macro blocking, and compression artifacts

## Product Information

- Critical RF measurements; MER and EVM, constellation displays, RF levels, channel power, SNR, BER, Phase Noise, and Impulse Response
  - Provides early indication of signal degradation before any picture impairment is visible to the end customer
  - DVB-S2 interface includes 16 and 32APSK for contribution and distribution applications
- Video/Audio content checking for both MPEG-2 and H.264/AVC
  - Thumbnail decode and display of multiple channels, simultaneously provides a visual check of content with encoding parameters available to the user (such as codec type, profiles and levels, aspect ratio, program guide event information, etc.)
  - Backhaul of actual video and/or audio allows content to be fed back to the central monitoring point to see and hear the content being broadcast (encrypted content can be routed to a STB for hardware decode)
- PSI/SI/PSIP/ARIB SI analysis and repetition rate graphing
  - Allows broadcasters to determine that the system and service information is present and correct in the Transport Stream
- "Green Stream" learning mode
  - Allows monitoring by exception and elimination of false alarms
- Multiplex view
  - Allows an at-a-glance view of program utilization over an extended period allowing the user to see if bandwidth spikes occurred
- Unique 2-level alarms
  - Uniquely provides advanced warning of impending problems to avoid customer complaints. Single-level alarming means the alert can only be generated. With 2-level alarms, separate warning and failure alarms are not possible
- FlexVuPlus™
  - Uniquely presents simplified presentation of video quality and diagnostic information
- Filtered logs
  - Allows diagnostics to be performed at the TS, Program, or PID levels to "zoom in" on problems quickly
- Simultaneous connection of multiple remote users and Multi-sink SNMP traps for Network Management Systems (NMS)
  - Provides early visibility of problems to key individuals throughout the organization, supporting quicker notification and corrective action
  - Allows multiple users and/or NMS to access the MTM400A simultaneously



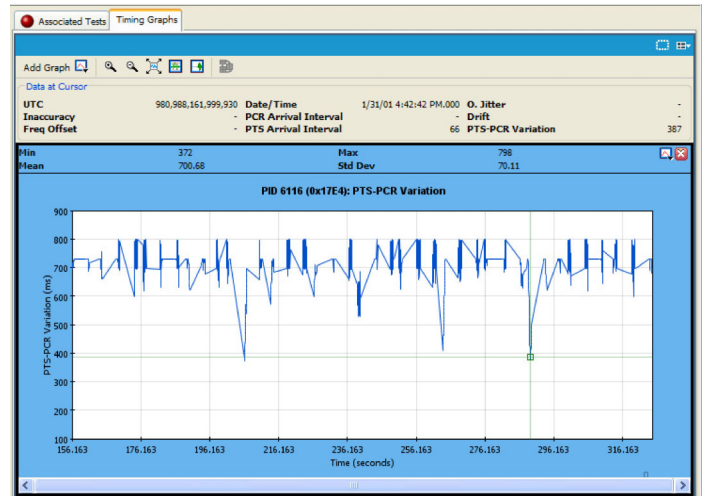
FlexVuPlus™ configurable windows with DVB-S2 display.



Video and audio content monitoring to ensure QoE is maintained.

## MTM400A Diagnostic Analysis Software Option

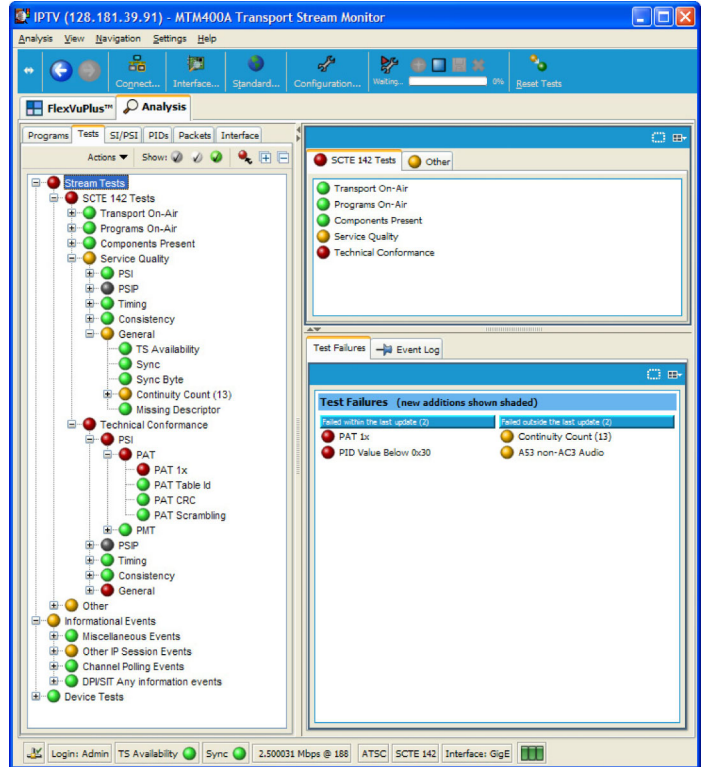
- Trigger recording to be captured and rapidly analyzed in greater depth using powerful offline analysis tools such as the Tektronix MTS4SA software
- Exception monitoring with simple, automated template generation from reference streams. Template testing checks a number of key parameters to ensure the Transport Stream has been constructed as 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
- Advanced Timing Analysis including unique PTS-PCR graphs for real-time buffer measurements. This provides indication of encoding and multiplexing errors and in-depth PCR analysis; the resulting graphical views enable timing and jitter measurements to ensure correct operation of the network
- Bit rate testing determines whether PIDs, programs, services, or user-defined groups of PIDs are within user-definable limits, ensuring correct multiplex operation. Tektronix proprietary PID variability test gives indication of PID bit rate variation to assess effects of statistical multiplexing
- Comprehensive service logging enables verification of service level agreements to ensure contractual obligations are met
- The channel polling capability for the MTM400A, combined with RF interfaces, allows up to 200 RF channels to be monitored in a repeating cyclical 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



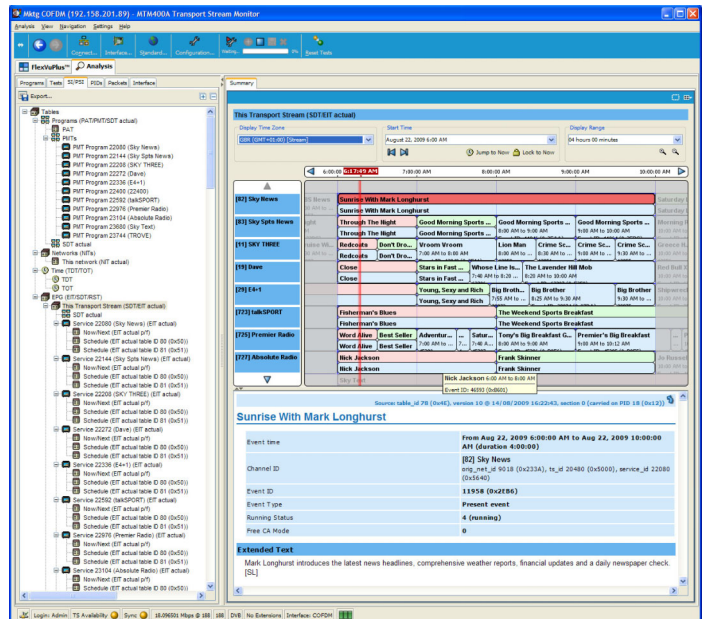
Advanced Timing Analysis including PTS-PCR for real-time buffer measurements to give indication of encoding and multiplexing errors.

## Technical Overview

- SCTE-142 and A/78 monitoring modes classify five distinct levels of importance
  - Transport Stream Off Air (TOA), Program Off Air (POA), Component Missing (CM), Quality of Service (QoS), Technically Nonconformant (TNC)
  - Enables filtering and display only of errors that require immediate attention
- Comprehensive TR 101 290 Priority 1, 2, and 3 MPEG measurements
  - Provides in-depth analysis of Transport Stream, syntax, timing, and content to support root-cause analysis of system errors
- Superior PCR measurements (PCR\_OJ, DR, and FO)
  - PCR\_OJ enable deterministic measurements on Transport Stream and network induced jitter allowing such errors to be isolated
  - DR and FO measurements allow diagnosis of longer-term system degradation
- PSI/SI/PSIP/DC-II conformance and consistency checking
  - Closed Caption (EIA608/708 and SCTE20/21) and Regional Ratings Descriptor (RRT) check ensures conformance to regulations
  - SI/PSI/PSIP testing ensures set-top box performance (channel change, EPG, etc.) can be verified
- SCTE 35 DPI monitoring
  - Allows analysis and diagnostics of "splice" advertising and other local content



SCTE-142 and A/78 modes classify five distinct levels of importance.



EPG View

## Characteristics

### Power Requirements

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

### Monitoring

Characteristic	Description
Data Rate	
Maximum data rate	155 Mb/s*1
Minimum data rate	250 Kb/s

\*1 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 maximum content is exceeded to ensure critical measurements continue to be performed.

### ATSC A/78A and SCTE142 Error Classifications

Classification	Description
TOA	Transport Stream Off Air
POA	Program Off Air
CM	Component Missing
QoS	Quality of Service
TNC	Technically Nonconforming

### TR 101 290 Tests and Measurements

1 <sup>st</sup> Priority Measurements	2 <sup>nd</sup> Priority Measurements	3 <sup>rd</sup> 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

### DVB-S2 Interface Characteristics (Option S2)

Characteristic	Description
Input Frequency Range	950 MHz to 2150 MHz with 1 MHz step size
Input Signal Amplitude Range	-60 dBm to -30 dBm for a CBER of <1e-6
Modulation Format	QPSK in accordance with DVB-S (ETSI EN 300 421) QPSK, 8PSK, 16APSK, and 32APSK in accordance with DVB-S2 (ETSI EN 302 307) including Constant and Variable Coding and Modulation (CCM and VCM)
Modulated Baud Rate	1 MBaud min, 60 MBaud max
Code Rate	DVB-S: 1/2, 2/3, 3/4, 5/6, 6/7, 7/8 DVB-S2: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
FEC Modes	Viterbi and Reed-solomon in accordance with DVB-S LDPC and BCH in accordance with DVB-S2 Short and Normal FEC blocks in accordance with DVB-S2
Roll Off	0.2, 0.25, 0.35
Connector Style	F-style
Input Termination Impedance	75 Ω nominal
Input Return Loss	>6 dB min, 950 MHz to 2150 MHz
LNB Supply Voltage	Selectable; 13.0 V ±1.5 V or 18.0 V ±1.5 V, with 100 Ω, 5 W resistor load
LNB Supply Maximum Current	200 mA max
LNB 22 kHz Signaling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signaling Amplitude	600 mV <sub>p-p</sub> with 100 Ω load
LNB Mode	DiSEQC 2
Ultimate Modulation Error Ratio	30 dB with Equalizer

### DVB-S2 Measurement Characteristics (Option S2)

Characteristic	Description
RF Lock	RF lock indicated to the user by LED and Status on UI
Input Level (Signal Strength)	Range: -60 dBm to -30 dBm Resolution: 1 dBm Accuracy: ±5 dBm
EVM (Error Vector Magnitude)	Display Range: ≤4.0% to ≥30.0% RMS Resolution: 0.1% Accuracy: ±20% of reading
MER (Modulation Error Ratio) with Equalizer	Display Range: 10 to 30 dB with Equalizer Resolution: 1 dB Accuracy: ±2 dB for range 10 to 20 dB
CNR (Carrier to Noise Ratio)	Display Range: 10 to 30 dB Resolution: 1 dB Accuracy: ±2 dB for range from 10 to 28 dB
Phase Noise	Display Range: 5 to 45° RMS Resolution: 1°
Pre Viterbi BER	Pre-Viterbi BER displayed
Pre Reed Solomon (RS) BER	Pre-RS BER displayed
Pre LDPC BER	Pre-LDPC BER displayed
Pre BCH BER	Pre-BCH BER displayed
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (TEF ratio), TEF rate and number of Transport Error Flags (TEF count) displayed to the user
Transmission Parameters	All Coding and Modulation parameters are indicated to the user in the UI. Transport Stream monitor must be tuned to a valid Transport Stream in order to report RF transmission parameters
Constellation	The RF constellation displayed on the UI

**COFDM Interface Characteristics (Option CF)**

Characteristic	Description
Input Frequency Range	50 MHz to 858 MHz with 166.7 or 62.5 kHz step size
Tuning Accuracy	Better than $\pm 50$ ppm typical
Channel Bandwidth	6 MHz, 7 MHz and 8 MHz (SW selectable)
Connector Style	F-type with BNC adaptor
Input Termination Impedance	75 $\Omega$ 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 Measurement Characteristics (Option CF)**

Characteristic	Description
Carrier Offset	Carrier offset is measured from the tuned channel frequency to a accuracy of $\pm 10$ ppm typical This includes the ability to set alarms and produce trend graphs over a seven-day period including min, max, and average
	<b>Display Range      Resolution      Accuracy</b>
SNR (Signal to Noise Ratio)	6 dB to 40 dB for QPSK (4QAM) 11 dB to 40 dB for 16QAM 16 dB to 40 dB for 64QAM $\pm 1$ 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 —
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 $\pm 1$ 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
BER (Bit Error Ratio)	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
TEF (Transport Error Flag)	Alarm generated on detection of a TEF

**Turbo 8PSK Interface Characteristics (Option EP)**

Interface Option EP provides both QPSK (L-band) and Turbo 8PSK interface and measurement capability. For non-Turbo code modulation formats the Option S2 card is recommended.

Characteristic	Description
Input Frequency Range	950 MHz to 2150 MHz with 100 kHz step size
Modulation Format	Turbo 8PSK*2
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 max
LNB 22 kHz Signaling Frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz Signaling Amplitude	600 mV <sub>p-p</sub> with 100 Ω load
Modes Supported	Turbo 8PSK

\*2 Please note that the Turbo 8PSK option does not support nonturbo 8PSK (DVB-DSNG), or DVB-S2. For DVB-S2 please use DVB-S/S2 interface card (Option S2).

**Turbo 8PSK Measurement Characteristics (Option EP)**

**RF Measurements**

**Characteristic Description**

Characteristic	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			

**Environmental**

Characteristic	Description
<b>Temperature</b>	
Operating	+5 °C to +40 °C
Nonoperating	-10 °C to +60 °C
<b>Humidity</b>	
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
<b>Altitude</b>	
Operating	0 m to 3000 m (9800 ft.)
Nonoperating	0 m to 12000 m (40000 ft.)
<b>Random Vibration</b>	
Operating	5 to 500 Hz, G <sub>RMS</sub> = 2.28
Nonoperating	.5 to 500 Hz, G <sub>RMS</sub> = 0.27
<b>Functional Shock</b>	
Operating	30 G, half sine, 11 ms duration
<b>Electromagnetic Compatibility</b>	
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
<b>Weight**3</b>		
	kg	lb.
Net	6.0	13.3
Shipping	9.0	19.7
<b>Required Clearance</b>		
	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	

\*\*3 Weight does not include optional interface cards.

## Ordering Information

### MTM400A

Digital DTV Monitor.

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

### Options

Option	Description
Opt. CF	COFDM Interface
Opt. DIAG	Deep-dive MPEG diagnostic analysis
	Includes: Triggered recording capability up to 160 MB Template testing (for user-defined service plan testing) In-depth PCR analysis with graphical result views Bit rate testing functionality Service logging RF polling functionality
Opt. EP	Turbo 8PSK/QPSK Interface
Opt. S2	DVB-S/S2 Interface

### Language Options

Option	Description
Opt. L0	English User Guide
Opt. L5	Japanese User Guide

### Service Options

Option	Description
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 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

## Complementary Products

Option	Description
MTS4SA Opt. TSCL	Stand-alone Deferred Time Software package. DVB/ATSC/ARIB TS Compliance Analyzer Software (TS file size limited to 192 MB). For full details see separate data sheet
VQNet	Video Service Assurance Management Software for installation on customers own PC. For full details see separate data sheet
VQS1000	Video Quality Software application for single-ended QoE analysis of video and audio content

## Field Upgrade Kits

Option	Description
<b>Field Upgrade Kit to Add:</b>	
MTM4UP Opt. CF	Adds COFDM Interface
MTM4UP Opt. DIAG	Deep-dive MPEG diagnostic analysis
MTM4UP Opt. EP	Adds 8PSK/QPSK Interface
MTM4UP Opt. GE	Adds GbE IP Video Monitoring Interface
MTM4UP Opt. LX	1000BASE-LX Long Wavelength Optical Port with LC connector (Single Mode 1310 nm)
MTM4UP Opt. QA	Adds QAM Annex A Interface to an existing probe
MTM4UP Opt. QB2	Adds QAM Annex B Interface
MTM4UP Opt. QC	Adds QAM Annex C Interface to an existing probe
MTM4UP Opt. SX	1000BASE-SX Short Wavelength Optical Port with LC connector (Multi Mode 850 nm)
MTM4UP Opt. S2	Adds DVB-S/S2 Interface
MTM4UP Opt. VS	Adds 8VSB Interface
MTM4UP Opt. ZX	1000BASE-ZX Optical Port with LC connector (Single Mode 1550 nm) (requires Opt. GE)
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
<b>Other</b>	
MTM4UP Opt. IFC	One-time install of all selected options and calibration for one product



Product(s) are manufactured in ISO registered facilities.









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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](http://www.tektronix.com)



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