

Digital TV Monitor

MTM400A Datasheet



The MTM400A provides a complete solution for real-time transmission monitoring of MPEG Transport Streams over RF and ASI interfaces.

Key features

- 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

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.

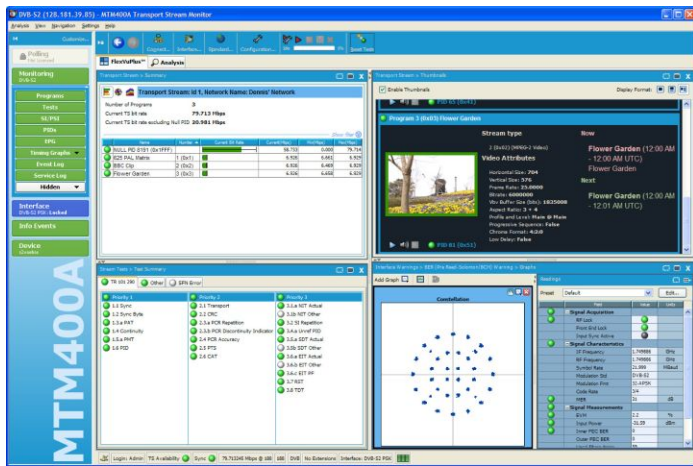
Deployed at key network nodes, the MTM400A provides an intuitive and simplified presentation of video quality and diagnostic information. This supports the delivery of superior Quality of Service (QoS) levels in an increasingly complex broadcast environment.

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

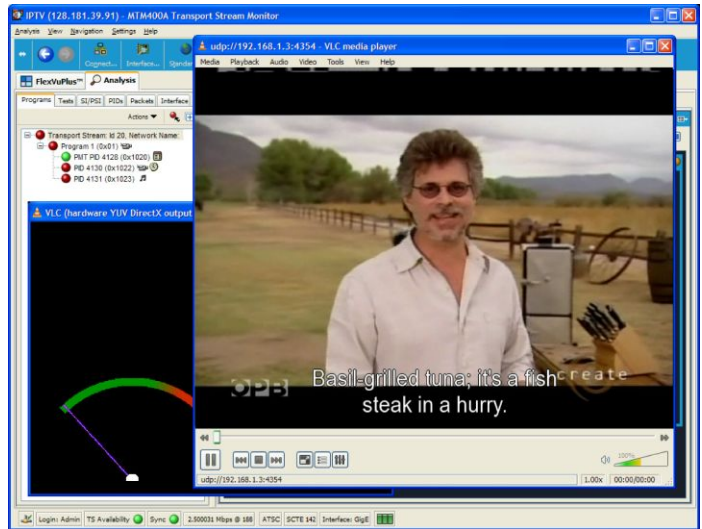
Product information

- 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



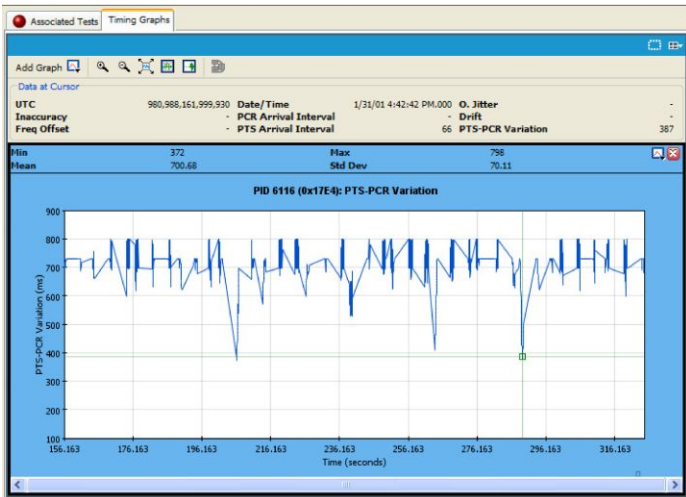
FlexVuPlus™ configurable windows with DVB-S2 display.



Video and audio content monitoring to ensure QoE is maintained.

MTM400A diagnostic analysis software option

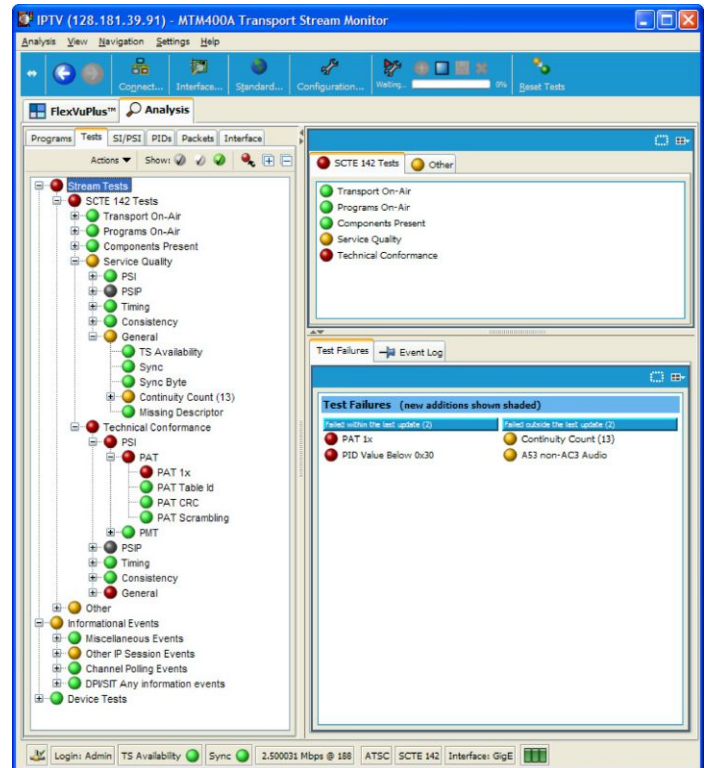
- Trigger recording to be captured and rapidly analyzed in greater depth using powerful offline analysis tools such as the tektronix MTS4SA software
- Exception monitoring with simple, automated template generation from reference streams. Template testing checks a number of key parameters to ensure the 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



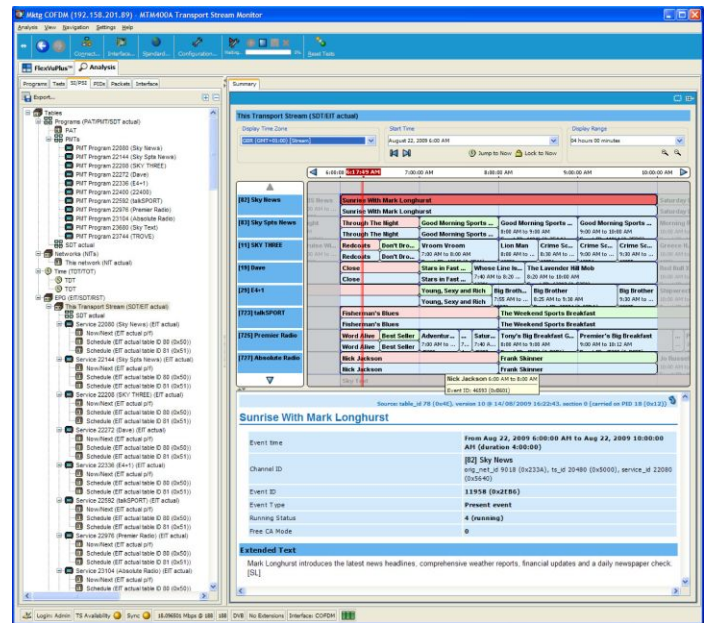
Advanced timing analysis including PTS-PCR for real-time buffer measurements to give indication of encoding and multiplexing errors.

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

Specifications

All specifications apply to all models unless noted otherwise.

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 ¹
Minimum data rate	250 Kb/s

ATSC A/78A and SCTE142 error classifications

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

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	

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.

DVB-S2 Interface characteristics (Option S2)

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 minimum, 60 MBaud maximum
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 \pm 1.5 V or 18.0 V \pm 1.5 V, with 100 Ω , 5 W resistor load
LNB supply maximum current	200 mA maximum
LNB 22 kHz signaling frequency	17.6 kHz minimum, 26.4 kHz maximum (22 kHz \pm 20%)
LNB 22 kHz signaling amplitude	600 mV _{p-p} with 100 Ω load
LNB mode	DiSEqC 2
Ultimate modulation error ratio	30 dB with equalizer

DVB-S2 Measurement characteristics (Option S2)

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:	\pm 5 dBm
EVM	(Error vector magnitude)
Display range:	\leq 4.0% to \geq 30.0% RMS
Resolution:	0.1%
Accuracy:	\pm 20% of reading

DVB-S2 Measurement characteristics (Option S2)

MER	(Modulation error ratio) with equalizer
Display range:	10 to 30 dB with equalizer
Resolution:	1 dB
Accuracy:	±2 dB for range from 10 to 28 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 to report RF transmission parameters.
Constellation	The RF constellation displayed on the UI

COFDM Interface characteristics (Option CF)

Input frequency range	50 MHz to 858 MHz with 166.7 or 62.5 kHz step size
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

COFDM Interface characteristics (Option CF)

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)

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.
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SNR, EVM, MER specifications

SNR (Signal to noise ratio)

Display range	Resolution	Accuracy
6 dB to 40 dB for QPSK (4QAM)	1 dBm	± 1 dB to 30 dB SNR (measured at -30 dBm in high-resolution mode) typical
11 dB to 40 dB for 16QAM		
16 dB to 40 dB for 64QAM		

EVM (Error vector magnitude)

Display range	Resolution	Accuracy
1% to 30% RMS, for QPSK	0.1%	-
1% to 20% RMS, 16QAM		
1% to 8.5% RMS, 64QAM		

MER (Modulation error ratio) with equalizer

Display range	Resolution	Accuracy
6 dB to 37 dB for QPSK (4QAM)	0.1 dB	± 1 dB to 30 dB (measured at -30 dBm in high-resolution mode) typical
11 dB to 37 dB for 16QAM		
16 dB to 37 dB for 64QAM		

Both MER peak and MER average are displayed as measured across all carriers.

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 minimum, maximum, 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.

Input frequency range	950 MHz to 2150 MHz with 100 kHz step size
Modulation format	Turbo 8PSK ²
Modulated baud rate	1 Mbaud minimum, 30 Mbaud maximum
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 minimum, 26.4 kHz maximum (22 kHz ±20%)
LNB 22 kHz signaling amplitude	00 mV _{p-p} with 100 Ω load
Modes supported	Turbo 8PSK

Turbo 8PSK Measurement characteristics (Option EP) 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, EVM, MER, SNR specifications	Range	Display Range	Resolution	Accuracy
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.

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).

Environmental

Temperature

Operating	+5 °C to +40 °C (+41 °F to +104 °F)
Nonoperating	-10 °C to +60 °C (+14 °F to +140 °F)

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 12,000 m (40,000 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
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Safety

Meets 73/23/EEC, EN61010-1, UL3111-1 and CAN/CSA 22.2 No. 1010.1-92, IEC61010-1

Physical characteristics

Dimensions

Height	44 mm (1.73 in.)
Width	430 mm (17.13 in.)
Depth	600 mm (23.62 in.)

Weight

Weight does not include optional interface cards.

Net	6.0 kg (13.3 lb.)
Shipping	9.0 kg (19.7 lb.)

Required clearance

Top	0 mm (0 in.)
Bottom	0 mm (0 in.)
Left side	Standard 19 in. rackmount
Right side	Standard 19 in. rackmount
Front	Clearance for handles required
Rear	Clearance for connectors required

Ordering information

Models

MTM400A	Digital DTV monitor Includes: 1RU chassis fitted with Transport Stream processor card, manual, rack slides, power cord, and license key certificate
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Instrument options

Product options

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

Opt. L0	English manual
Opt. L5	Japanese manual

Service options

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 plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A4	North America power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)

Opt. A10 China power plug (50 Hz)

Opt. A99 No power cord

Complementary products

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

Field upgrade kit to add:

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

Other upgrade kits

MTM4UP Opt. IFC One-time install of all selected options and calibration for one product.



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

MTM400A Datasheet

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