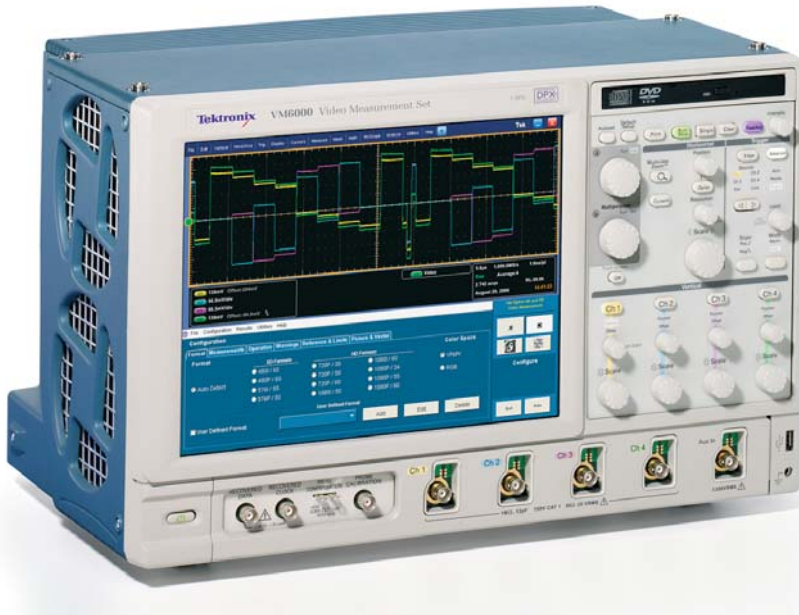


Automated Video Measurement Set

► VM6000



The VM6000 automates video testing of consumer HDTV and PC graphics devices such as digital set-top boxes, multi-media PCs, graphics cards and video semiconductors. It addresses the needs of engineers developing and deploying the next generation of video devices for the digitally connected home. Unrivalled performance in terms of speed, accuracy and reliability has made the VM6000 the choice of industry leaders for design validation, quality control and ATE applications.

Unlike conventional instruments, the VM6000 integrates acquisition hardware, optimized video measurement algorithms, test signal files and accessories into a cohesive test system solution. Product verification activities that previously took hours or days to complete can now be completed in seconds or minutes. Offering near plug-and-play video measurement capability, even unskilled

operators can reliably assess video output signal quality. The conformance of signals to specifications is reported with obvious pass or fail results, with signal distortions clearly identified for further analysis.

The VM6000 stands alone as the only automatic video analyzer capable of supporting SD, HDTV and PC graphics signal formats. Offering a full 1 GHz bandwidth and 5 GS/s sample rate, the VM6000 is well suited to the demands of measuring high-resolution HDTV and high-frequency PC graphics video signals. Traditional DTV formats from 480i through 1080p and either RGB or YPbPr color space are supported in Options SD and HD. Option VGA supports common analog RGBHV signal resolutions from 640x480 p through 2048x1536 p, and pervasive refresh rates from 60 Hz through 120 Hz.

► Features & Benefits

Automates Test of Consumer HDTV Video Devices

Automates VESA Compliance Test for PC Graphics Devices

Automates Testing of Multi-media PC

Fast, Accurate and Reliable Video Measurements

Comprehensive Component Analog Video Signal Analysis

SDTV, HDTV and RGBHV Component Analog Format Support

Picture, Vector and Waveform Displays

Companion Test Signal Packages

Time Saving Test Utilities

Pass-Fail limit testing

Automatic Report Generator

Video Measurement Accessories

Complete 1 GHz Bandwidth, 4-Channel DPO Functionality

Large 12.1" XGA Touch Screen Display

GPIO Remote Control

LAN Connectivity

CD-R/W Drive (DVD read only)

Pinpoint® Triggering

Technology-specific Software Options for Jitter and Timing Measurements, Power Measurements, Serial Data, Ethernet and USB2.0 Compliance Testing

► Applications

Design Validation

Standards Compliance Testing

Quality Control

Installation and Troubleshooting

Automated Manufacturing Test

Off-air Video Systems Test

Automated Video Measurement Set

► VM6000



► Summary Pass-Fail Test Results Display.

The ultimate solution for component analog video signal analysis, the VM6000 delivers comprehensive characterization of video fidelity, signal quality and standards compliance. With available options, the instrument automatically assesses conformance of video signals to applicable EIA-770.x, SMPTE-274M, 296M and VESA VSIS standards. Traditional “TV” signal fidelity is evaluated utilizing industry-accepted parameters, making 150 individual measurements automatically in less than 20 seconds. PC graphics signal fidelity is assessed via comprehensive RGB video and HV sync measurement parameters made in accordance with VSIS test procedures. Preloaded reference and limit files enable go/no-go evaluation to applicable DMT, CVT or GTF timing standards.

As an integrated signal analyzer, the VM6000 can be reliably deployed as a stand-alone QA station in manufacturing. Unlike modular test systems, extensive programming, complicated system debugging or costly test engineering support is not required with the VM6000. Integrated pass-fail limit testing and documentation utilities link distributed design, supply and manufacturing organizations with standardized test capability. Product quality is enhanced because accurate test results can be reliably generated, easily replicated and readily communicated across a global engineering, manufacturing or sales organization.

These unique capabilities enable in-depth signal analysis, speed product development and ensure new designs comply with applicable standards. Fast, accurate and objective video measurements enable manufacturers to ensure that HDTV or PC graphics video signal quality is up to the challenge of today’s high-performance displays, as well as providing clear differentiation between input signal and display device impairments.

Easy to Configure and Operate

The VM6000 offers intuitive Windows-based configuration and measurement menus for easy operation and minimal training. A 12.1 in. (307 mm) color display provides a bright, clear and crisp display of waveforms and measurement results.



► Signal Format Configuration Menu (Option SD and HD).

Users can easily navigate through logically arranged menus and make selections via radio buttons with a mouse or touch screen.

Complicated instrument setups, algorithm selection, programming and other undesirable aspects of making video measurements are eliminated with the VM6000. Configuration is as simple as selecting the auto format function or individually selecting the video format manually and then selecting the measurement parameters from an on-screen menu, eliminating complicated instrument setups, tedious manual measurements, and time-consuming results correlation. These test configuration settings can be readily saved, recalled or copied, further simplifying test of multi-format video devices. Users wanting to make manual measurements can exit the automated measurement application and then access a full-featured oscilloscope.

Supports SD, HDTV and RGBHV Component Analog Video Formats

The VM6000 can be flexibly configured to support any combination of component analog SDTV, HDTV, and RGBHV video

formats with the available options. Broad format support enables automated test of digital set-top boxes, video semiconductors, DVD players, PC graphics cards and other consumer video devices.

User-defined Formats allow user to test non-standard formats by entering custom timing parameters, allowing support of unique formats and future undefined formats.

▶ **Format Support**

Option	Signal Format	Vertical Refresh Frequency	Color Space			Sync Options	
			RGB	YPbPr	Y/G	Composite Sync on Ch4	Separate H&V
SD	480i	59.94/60 Hz	X	X	X	X	X
	576i	50 Hz	X	X	X	X	X
	480p	59.94/60 Hz	X	X	X	X	X
	576p	50 Hz	X	X	X	X	X
HD	720p	30/50/59.94/60 Hz	X	X	X	X	X
	1080i	50/59.94/60 Hz	X	X	X	X	X
	1080p	24/50/59.94/60 Hz	X	X	X	X	X
	Other non-standard HD formats supported via User Define Format menu. User Define Format supports non-standard SD formats, if SD is enabled		X	X	X	X	X
VGA	640x480p	60, 72, 75, 85, 100, 120 Hz	X	X	X	X	X
	800x600p	60, 72, 75, 85, 100, 120 Hz	X				X
	1024x768p	60, 72, 75, 85, 100, 120 Hz	X	X	X	X	X
	1280x1024p	60, 70, 75, 85, 100, 120 Hz	X				X
	1600x1024p	60, 70, 75, 76, 85, 100 Hz	X	X	X	X	X
	1920x1080p	50, 60, 75, 85, 100 Hz	X				X
	1920x1200p	60, 75, 76, 85, 100 Hz	X				X
	1920x1440p	60, 75, 85 Hz	X				X
	2048x1536p	60, 75, 85 Hz	X				X
	2048x2048p	60 Hz	X				X
	Other progressive RGBHV formats and vertical frequencies supported via User Define Format		X				X

Note: Sync combiner (012-1664-00) supports "Separate H&V" operation.

Automated Video Measurement Set

► VM6000

Bandwidth and Sample Rates Suitable for HDTV and High-resolution PC Graphics Signals

The VM6000 utilizes a digital phosphor oscilloscope platform as the basis for signal acquisition and analysis. Utilizing proven, high-speed measurement architecture, Tektronix surpasses the limitations of current video analyzers to address the evolving needs of the video industry. The VM6000 offers over 1 GHz of bandwidth and 5 GS/s maximum real-time sample rates for all four measurement channels – easily assessing the frequency response of 60 MHz HDTV signals or transient response of 350 MHz PCF VESA signals. The high sample rates and low noise floor of the instrument enable noise measurement accuracy that was previously impossible on HDTV signals. A typical rise time of 225 ps and superior time-base performance are sufficient to make critical sync and rise time measurements as required by EIA-770 and SMPTE 274 M and VESA. Standard 10 M (4 Ch.) record length and high sample rates deliver measurement results with minimal time lag.

Comprehensive Component Analog Video Signal Analysis

The VM6000 incorporates an extensive set of automated video measurements that deliver comprehensive characterization of the fidelity and conformance of component analog signals. Approximately 150 individual measurements completely characterize video signal amplitudes, timing and noise distortions into parameter categories that are easily

► VM6000 Automated Measurements

Measurement Parameters	
TV Signals Options SD and HD	PC Graphics Signals Option VGA
Color Bars Levels (1 to 8 Pedestals)	Color Bars Luma Levels ^{*1}
H & V Sync H Sync Jitter	H & V Timing ^{*1} H & V Sync ^{*1} H Sync Jitter ^{*1}
Noise	Noise Injection Ratio ^{*1}
Non-linearity	Integral and Differential Linearity, Monotonicity ^{*1}
Inter-channel timing	Channel-Channel Mismatch Channel-Channel Skew ^{*1}
Transient Response, K2T	Video Transient Response
Multiburst	—
Frequency Response	—
—	Resolution ^{*1}
Spatial Distortion	

^{*1} VESA Parameters.

understood, facilitating troubleshooting and design optimization. Enabled by such broad and thorough signal analysis, the VM6000 is able to identify relevant video signal impairments, verify compliance with applicable standards and ensure operability with connected displays.

Measurement parameters have been appropriately selected for testing TV signals (Options SD and HD) and PC graphics signals (Option VGA). These parameters vary by application because of differences in hardware technology, signal attributes, applicable standards and historical test methodology. TV test measurements are based on the de-facto industry standard VM700T and have been adapted to assess



► H Sync Measurement Results (Option VGA).

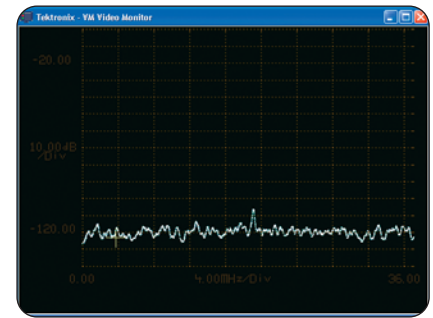
distortions unique to digital devices and HDTV signals. The PC graphics measurement set delivers fully automated VESA compliance testing and video measurements, as well as reporting other parameters commonly utilized to characterize PC graphics device performance.



▶ Multiburst Measurement Results Display (Option SD and HD).



▶ Frequency Response Measurement Input Selections (Option SD and HD).



▶ Noise Spectrum Display (Option SD and HD).

Fast, Accurate and Reliable Automated Video Measurements

The VM6000 is differentiated from conventional oscilloscopes, waveform monitors or modular instruments by its automated video measurements. Automated measurements deliver benefits in terms of speed, accuracy and repeatability with ease of use that almost obsoletes manual approaches, and even user developed programs. Automating signal configuration, signal acquisition and data analysis enables robust and reliable operation, impervious to signal variations. The VM6000 applies optimized video measurement algorithms and extended data processing to deliver accuracy and reliability that outperforms even the most skilled expert user.

Auto Format Detect – Simplifies operation by automatically detecting the format applied to the instrument. Allows multiple formats to be tested automatically in sequence without the need for user intervention.

Auto Configuration – By selecting the applicable format and desired measurements from the configuration menu, the VM6000 automatically configures gain, offset and time scale based on the nominal signal values expected. Variations from nominal values are accommodated with auto range capabilities.

Auto Range – The auto range feature enhances accuracy and enables automated measurement of signals that vary from nominal levels. This feature automatically optimizes gain and offset based on the signal conditions when they deviate from nominal, enabling the instrument to consistently present the best results possible.

Automatic Special Position – The VM6000's automatic special position function ensures that automated measurements are robust to temporal signal distortions, alternate test signals and alternate output display modes. Always active, this feature identifies appropriate test signal events and sets measurement cursor locations optimally to ensure consistent and meaningful test results. Measurement location selections made by the VM6000 can be analyzed or documented with the selectable feature included in the report generator.

Auto Mode – Auto Mode enables users to instruct the instrument to make one, selected or all automated video measurements with a single run command. While functioning in Auto Mode, the instrument automatically selects the appropriate test signal line, utilizes pre-set measurement configurations and averaging selected by the user, and completes each measurement. Option VGA includes multi-line measurements

capability, enabling users to measure selected parameters on many or all lines in a frame with a single run command.

Measurement Cursors (Special Position) – Options SD and HD address requirements for custom signal analysis by enabling users to input customized measurement locations for the Frequency Response, Levels and Noise measurement parameters. For frequency response measurements, users can select either timing location input or frequency input to make response measurements anywhere within the supported video bandwidth utilizing a standard sweep signal. Input locations can be further toggled within YPbPr signals to accommodate either 4:2:2 or 4:4:4 video. This enables detailed analysis of roll-off, frequency distortion, identification of spurs and aliasing anywhere across the useful frequency spectrum. Cursors for the Levels parameter enable flexible, automated measurement of three channel levels for one to eight individual pedestals on a line, such as can be found with ARIB signals, MacBeth Charts or other non-color bar signals. Noise special position cursors allow temporal windowing for noise measurements, enabling noise measurements on signals such as color bars, staircases or camera test charts.

Automated Video Measurement Set

▶ VM6000



▶ V sync Display (Option SD and HD).

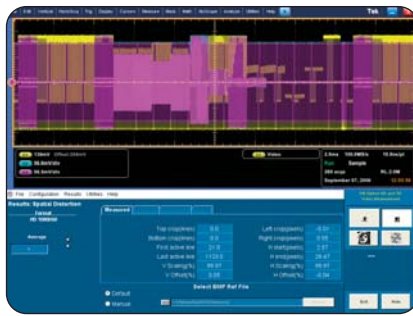


▶ H sync Jitter and Wander Display (Option SD and HD).



▶ Format Configuration Menu (Option VGA).

New Measurements on V3.0 – Options for SD and HD on V3.0 offer the three new measurements. The V sync measurement will support the complete video timing measurement along with the H sync measurement. The H sync Jitter measurement measures the RMS Jitter and Frequency offset and Frequency Drift Rate for wander measurement that support IEEE 1521-2003. The user-definable demarcation frequency and Probability/Jitter read out help to search the root cause during debugging. The spatial distortion measurement measures the size of the video image and detects



▶ Spatial Distortion Display (Option SD and HD).

if any offset or cropping has occurred to the image. This is useful for design engineers to ensure that their video processing is not deforming the picture. This is also good for verifying video aspect ratio mixes such as letter-box or side-panel modes.

Automated VESA Compliance Testing for Analog RGBHV Signal Formats (Option VGA)

The emergence of IP broadcast video and convergence of traditional “TV” and “PC” video entertainment devices have resulted in PCs evolving into media gateways to the digitally connected home. As a result, assessing the fidelity and conformance of analog RGBHV signals has become more important to engineers involved in the design and manufacturing of PC graphics devices. This challenge has been further complicated by the emergence of digital interfaces, proliferation of supported output modes and the persistence of analog RGBHV interfaces on PC graphics cards.

Tektronix addresses these industry test requirements with the VM6000 Option VGA, the first and only “VM” class solution for PC graphics signals and devices. Option VGA automates signal analysis and mandatory VESA standards compliance testing, speeding design validation testing that is typically performed during the release or modification of PC graphics hardware, software or integration of complete video system.



► Measurement Selection Menu (Option VGA).

Option VGA supports pervasive analog RGBHV signal formats typically communicated via VGA, DVI-I or DVI-A interfaces. Automated measurement is possible for 10 standard signal resolutions spanning from 640x480p (VGA) through 2048x2048p (QXGA), at selected vertical refresh frequencies from 60 to 120 Hz. A user-defined format configuration utility enables users to easily create, edit or recall custom modes and seamlessly access the full test automation of the VM6000 instrument.

Approximately 150 video measurements can be performed for each supported mode, delivering a comprehensive assessment of RGB video fidelity, HV sync quality and format conformance. Parameters and test methods are based on industry



► RGB Transient Response Measurement Results (Option VGA).

standard (VESA) test procedures, enabling easy comparison against the requirements of the Video Signal Standard (VSI) and applicable DMT, GTF or CVT timing standards. Convenient averaging and configuration controls deliver the flexibility to perform either speedy or precise measurement in accordance with VESA sampling requirements. A full suite of comprehensive RGBHV video parameters can be measured in less than 5 minutes. Pre-loaded signal reference data and tolerance limit files simplify results analysis, eliminating laborious spreadsheet entry and computation. Test results, and even waveform screen captures, can be quickly documented with reports that can be automatically generated, printed and saved.

An innovative set of PC graphics matrix test signals has been created to enable comprehensive signal characterization for the full range of supported formats. These signals, working in conjunction with a remote controlled measurement interface unit, enable fully automated testing with a single run command. The included measurement interface unit provides connectivity, signal termination, automated switching and variable loads for sync voltage tests. This approach eliminates the need for expensive FET probes and delivers optimized accuracy for both DC amplitude and high frequency timing measurements.

All the necessary elements for compliance or QC testing are integrated into a cohesive solution that delivers easily understood pass or fail test results. Comprehensive parametric signal analysis isolates product performance deficiencies, enables design optimization and ensures interoperability of connected display devices. With Option VGA, even unskilled operators can make reliable and repeatable assessments of VESA standards compliance. Extensive video knowledge, oscilloscope skills, complicated programming or system integration skills are no longer required to assess analog RGBHV signal integrity.

Automated Video Measurement Set

► VM6000

► Option SS Signal Sources Package (020-2769-00): File and Signal Formats of Test Signal Packages

Parts Number	Description	Formats
020-2770-00	Signal Sources DVD	480i, 576i
020-2771-00 ^{*2}	Standard Definition Elementary Streams	480i, 480p, 576i, 576p
020-2772-00	Advanced Definition Elementary Streams	720P, 1080i, 1080p
020-2773-00 ^{*3}	ATSC Transport Streams	480i, 480p, 720P, 1080i, 1080p
020-2774-00 ^{*4 *5 *6}	Baseband Test Signals	525i, 525p, 625i, 625p, 720p, 1080i, 1080p,
020-2775-00 ^{*7}	PC Bitmap Graphics	620x480, 800x600, 1024x768, 1280x1024, 1600x1024, 1600x1200, 1920x1080, 1920x1200, 1920x1440, 2048x1536, 2048x2048
020-2776-00	H.264 SD & HD Streams	480i, 480p, 576i, 576p, 720p, 1080i, 1080p

^{*2} 480i, 480p ES stream provided by 704x480, 720x480 resolution.

^{*3} ATSC transport stream provided for 480i, 480p, 720p/30, 720p/60, 1080i/60, 1080p/24 and 1080p/59.94 formats.

^{*4} Requires TG700 and appropriate module (AVG7, AWWG7, DVG7 and/or HDVG7).

^{*5} SDI signal generation not supported for 525p, 576p format.

^{*6} TG700 DNL files not provided for 1080p/50 and 1080p/60 formats.

^{*7} Includes PC Matrix and Full Field VESA Signals.

Companion Test Signal Packages

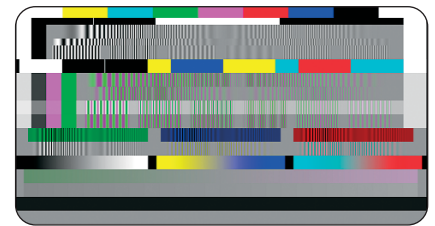
Option SS includes a specific companion test signal package to speed and simplify testing of supported signal formats. This package has been developed to enable comprehensive parametric analysis of signal fidelity without the inconvenience of switching test signals. Test signal package eliminates potential video measurement set operability issues and minimize uncertainties regarding the quality of the input signal.

Because DTV has resulted in a proliferation in video source content and signal formats, test signals are provided in a variety of pervasive formats to enable easy generation and extended format testing. Since encoded test signals may contain artifacts that detract from measuring the analog signal fidelity, the matrix

test signal is also provided in MPEG-2/ H.264 encoded elementary and ATSC transport streams. To ensure the encoded signal is accurate, Tektronix has pre-qualified the matrix test signal for each native video format.

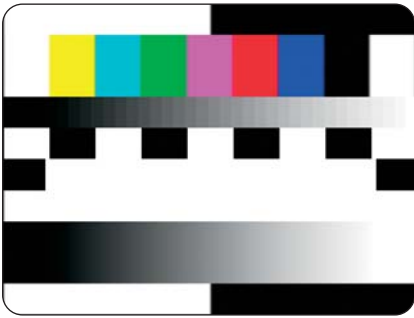
HDTV Matrix Test Signal

A specific matrix test signal has been created to enable efficient and comprehensive test of component analog video signal fidelity. The matrix signal includes a range of test signals on different lines to enable video testing without the inconvenience of switching full field signals, and contents have been customized to exercise the full bandwidth capability of each format. One signal can be flexibly utilized for both RGB and YPbPr color spaces, thereby minimizing test signal proliferation.



► HDTV Matrix Test Signal in 16x9 Aspect Ratio.

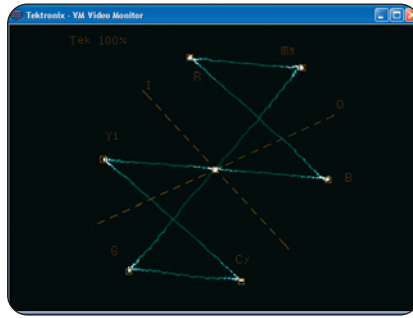
The HDTV matrix test signal is supplied in a variety of file and signal formats to enable convenient and comprehensive test of set-top boxes and other consumer video devices. High quality encoded ATSC transport stream and compressed elementary stream files are supplied for easy play-out on a Tektronix MPEG player such as the RTX100B, RTX130B or MTX100B.



▶ PC graphics Matrix Test Signal (Option VGA).

PC Graphics Matrix Test Signal

VESA compliance and certification testing requires that several different types of test signals be applied to the device under test. Option VGA includes test signal files for these patterns, in both full field and matrix forms, for the full range of supported image resolutions. Test signal files are provided in .bmp and .png file formats. The .png files are beneficial because they enable HV timing measurement to be made without the border artifacts potentially introduced by bitmap files.



▶ Vector Display.

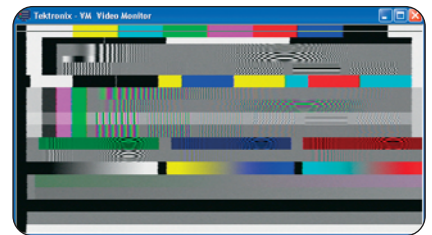
Picture, Vector and Waveform Displays

Picture and Vector displays can be initiated with a single button press and deliver “at-a-glance” confidence checking that simplifies signal identification, troubleshooting and color conversion accuracy. Waveforms are simultaneously displayed with parametric test results to enable visualization of signal impairments.

By selecting Picture mode, a full-color picture display is rendered on screen from the connected sub-sampled and down-converted signals to the available picture area and resolution. Pictures by default appear in an appropriate 16x9 or 4x3 aspect ratio; however users can resize, move or minimize the window as needed. Picture mode incorporates a user-enabled bright line select feature to facilitate test configuration. Live or full-motion video signals can also be viewed at vertical refresh rates of 1 to 2 fps.



▶ Full-screen Waveform Display.



▶ Picture Mode.

The Vector display, available with Option SD and HD, displays the waveform with targets for 75% or 100% color bars and accommodates either 601 or 709 colorimetry targets. Graticule targets and color space can be selected automatically or manually.

Waveforms for all channels are simultaneously viewable in different colors, and displays can be zoomed both vertically and temporally for detailed examination and analysis. Users can selectively expand the waveform to the full display size by minimizing the measurement application.

Automated Video Measurement Set

► VM6000

Time-saving Test Utilities and Results Displays

The VM6000 offers a powerful combination of test utilities and custom displays to make HDTV video testing faster, more robust, more convenient and more accurate. These utilities supplement basic automated measurement capabilities to deliver performance and value unmatched by any other solution. Combined with the extended documentation utilities, these powerful automated measurement utilities and features ensure that the VM6000 meets the demands of all application areas. Research and Development, Quality Control and Production Test personnel can tailor the instrument settings to meet their particular needs for robust acquisition, speed or accuracy. By automating measurement functions, video professionals are ensured that automatic measurements are robust, accurate, repeatable and completely objective.



► Summary Test Results Display with Pass-Fail Indication.

Summary Test Results Display

For the ultimate in test progress and reporting, the VM6000 incorporates a summary test results display screen. This display shows Pass or Fail conditions and the progress of the video signal measurements without having to delve into complicated individual test results. Each of the selected test parameters, measurement progress, pass or fail result per parameter and test errors, if any, are displayed. Upon completion, an overall green or red measurement result flag is displayed. Simply click on the pass/fail measurement to directly access the measurement results. This allows the user to quickly go to the failed test results.



► Color Bar Relative Results Display with Limit Testing Enabled.

Integrated Pass-Fail Limit Testing

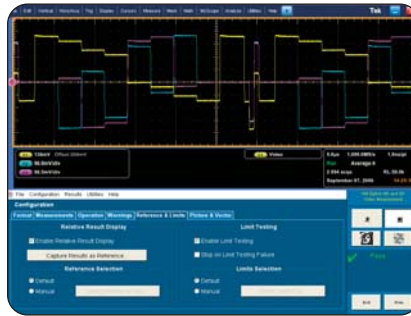
The VM6000 incorporates user selectable pass-fail limit testing. Acceptability of individual parameters or an entire DUT (Device Under Test) can be assessed without browsing hundreds of individual numerical results. Suitable for use in stand-alone applications, there is a PF (Pass/Fail) summary screen that shows the progress and PF result of individual measurements and an overall DUT PF result based on the selected parameters and user-selected limits. When PF limit testing is enabled, measurement results for failed parameters are displayed in an intuitive green-red numerical result for easy identification of unacceptable or non-conforming signal conditions.

Pre-loaded and User-definable Reference and Limit Files

Tektronix supplies set of default reference and limit files for the supported video formats for “out-of-the-box” test functionality. Option SD and HD have been preloaded with SMPTE/EIA standard reference values and Tektronix recommended tolerance limit files. Option VGA has been preloaded with VESA reference and tolerance limit values based on the applicable timing standards. The signal reference data boosts test productivity by minimizing the need to access separate standards or quality documents. Files can be edited with other spreadsheet programs to specify customized target values, conformance limits or go/no-go manufacturing process limits. Reference and limit files can be auto-selected by format (default), manually specified or loaded automatically via pre-set configuration files (.vmset).

Flexible Results Displays

To simplify test results analysis, the VM6000 features tabular results menus. Within each parameter group, users can easily browse measurement results, deviation from reference, nominal (reference) value and max/min tolerance limits for pass and fail. Reference information and calculations necessary to analyze and understand test results are logically organized and readily available. With limit testing enabled, non-conforming test results are highlighted in red, readily highlighting signal distortions for further analysis.



► Reference and Limit Test Configuration Menu.

Save and Recall Measurement Configurations

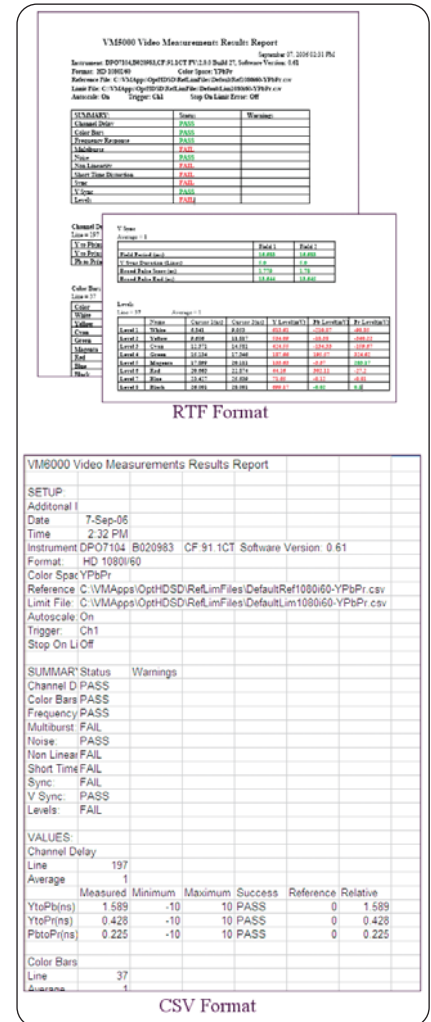
Measurement configuration settings can be stored, instantaneously recalled or easily copied to other instruments. Factory default settings can also be recalled, if necessary. Reference and limit files are associated with configuration files, and are automatically pulled in with a recall configuration command. This feature speeds and simplifies device testing with multiple display output formats, as users can configure, store and recall a set-up for each individual format.

Reference Capture Utility

The output of a “golden” DUT or reference test signal generator can be conveniently captured and stored as a reference file. This utility enables current measurement results to be readily compared with other measurement results utilizing the tabular results display screens in the results menus.

Automatic Report Generator

A report generator utility speeds test documentation by creating an organized video measurement report with the touch of a single button. Test results, configuration settings and signal reference data

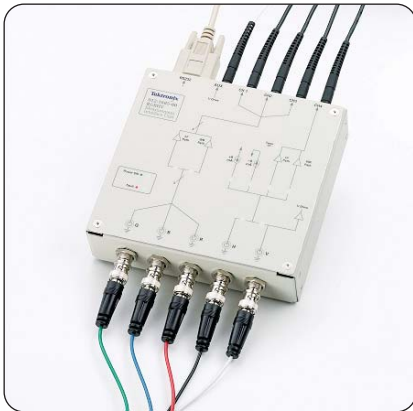


► VM6000 Test Report.

details are summarized in the VM6000 test report. Reports created in .pdf and .rtf formats are organized and suitable for inclusion in certification test results. For data analysis, reports can be output in the form of a .csv file, easily imported into spreadsheet programs. Option VGA even includes the option to embed waveform screen captures into selected report formats.

Automated Video Measurement Set

► VM6000



► Option VGA – Analog RGBHV Measurement Interface Unit (MIU).

Video Measurement Accessories

For convenience and enhanced test performance, the VM6000 includes a logical set of complementary video measurement accessories that simplify connection, termination and measurement. Custom-designed sync pick-off and sync combiner accessories simplify measurement of TV signals. Option VGA includes a custom measurement interface unit (MIU) that has been engineered to enable precision, VESA-compliant and fully automated measurement for 5-channel analog RGBHV signals. The MIU provides termination, signal switching and a current source/sink, eliminating the need for expensive FET probes or manual switching of cables during testing.

Addressing stringent requirements for measurement accuracy, the MIU incorporates an innovative dual input path for RGB and HV channels in order to deliver optimized accuracy for both DC amplitude measurement and high frequency timing measurements. Utilizing RS-232

control, the VM6000 automatically selects either low frequency or wideband mode as required by the parameter being measured. Incorporating a full 1 GHz of bandwidth, with optimized return loss in wideband mode, the MIU delivers unmatched speed, accuracy and convenience in testing PC graphics signals.

Sync Load Testing

Per VESA standards, H and V Sync voltages must be measured under V1 and V0 conditions with ± 8 mA current loads to ensure adequate power is available to handle impedance variations that may occur with connected displays. Option VGA automates this test by providing loads with the remote control MIU.

Standard GPIB Remote Control and LAN Connectivity

A fast and reliable GPIB Port compliant to IEEE 488.2 is standard on the instrument with selectable controller or talk/listener modes. A fully documented oscilloscope GPIB remote command set and simplified video command set enable all of the instrument capabilities accessible via the user interface to be automated via GPIB remote control.

Network connectivity is provided with a LAN port supporting 10Base-T and 100Base-T. This enables video test reports or data stored on the hard drive to be accessed via the network. Network remote control can be accomplished via the Tektronix AD007 GPIB to LAN adapter accessory, available separately. TekVISA™ is functional for LAN remote control of the oscilloscope commands.



► Oscilloscope Measurement Menu.

Complete Oscilloscope Functionality

Recognizing the need for flexibility, Tektronix has integrated the complete DPO7104 functionality into the VM6000. Manual video measurements are enabled with comprehensive analog HDTV/EDTV triggering for emerging standards like 1080i, 1080p, 720p and 480p as well as standard video triggering on any line within a field, all lines, all fields, odd or even fields for NTSC, SECAM and PAL video signals. In addition, IRE and mV graticules can be selected for easier measurements and visual inspection. Complete functionality of the DPO7104 oscilloscope and optional application software packages extend the capabilities and value of the VM6000 platform. Oscilloscope functionality and specifications are detailed in the DPO7104 or appropriate application software data sheet(s).

▶ Characteristics*8

Video Measurement Specifications

▶ Options SD and HD Video Measurements

Characteristic	Description	VM5000HD, VM5000, TDS5054, TDS5054B, TDS5104, TDS5104B4		VM6000, DPO7054, DPO7104, DPO725	
		Absolute	Relative to Reference	Absolute	Relative to Reference
Amplitude Measurements					
Color Bars, Levels	(Typical)	±3 mV ±0.8% of reading	±4 mV	±3 mV ±0.5% of reading	±4 mV
Noise					
Unweighted	32 Average	±1 dB (–20 dB to –60 dB) ±2 dB (–60 dB to –70 dB)	—	±1 dB (–20 dB to –60 dB) ±2 dB (–60 dB to 70 dB and to 30 MHz) ±2.5 dB (–60 dB to –70 dB and to 60 MHz)	—
Weighted	64 Average	±1 dB (–20 dB to –60 dB) ±2 dB (–60 dB to –70 dB)	—	±1 dB (–20 dB to –70 dB)	—
Frequency Response					
Flag Amplitude	Multi burst (typical)	±3 mV ±0.8% of reading	±4 mV	±3 mV ±0.5% of reading	±4 mV
Frequency Response		±0.5 dB (1 MHz to 10 MHz, typical) ±0.75 dB (10 MHz to 30 MHz, typical)	—	±0.4dB (1 MHz to 30 MHz, typical)	±0.3 dB (1 MHz to 30 MHz)
Frequency Readout		±0.5%	±0.7% (typical)	±0.5%	±0.7% (typical)
Linearity					
Non-linearity	(Typical)	±0.5%	±0.3%	±0.5%	±0.3%
Transient					
Rise and Fall	(Typical)	±5 ns (SD) ±2 ns (HD)	±3.5 ns (SD) ±2 ns (HD)	±6.2 ns (SD, DPO7254) ±2 ns (HD, DPO7254) ±5.3 ns (SD, DPO7104, VM6000) ±2 ns (HD, DPO7104, VM6000) ±4.4 ns (SD, DPO7054) ±2 ns (HD, DPO7054)	±4.5 ns (SD, DPO7254) ±2 ns (HD, DPO7254) ±3.8 ns (SD, DPO7104, VM6000) ±2 ns (HD, DPO7104, VM6000) ±3.2 ns (SD, DPO7054) ±2 ns (HD, DPO7054)
K2T	(Typical)	±1%	—	±1%	—
Sync					
Amplitude	(Typical)	±3 mV ±0.8% of reading	±4 mV	±3 mV ±0.5% of reading	±4 mV
Timing		±1 ns	—	±1ns	—
Rise and Fall Time ⁹	(Typical)	±2 ns (SDi) ±1 ns (SDp) ±1 ns (HD)	±2 ns (SDi) ±1 ns (SDp) ±1 ns (HD)	±3.5 ns (SDi, DPO7254) ±3.0 ns (SDi, DPO7104, VM6000) ±2.5 ns (SDi, DPO7054) ±3.5 ns (SDp, DPO7254) ±3.0 ns (SDp, DPO7104, VM6000) ±2.5 ns (SDp, DPO7054) ±2 ns (HD)	±2.6 ns (SDi, DPO7254) ±2.2 ns (SDi, DPO7104, VM6000) ±2 ns (SDi, DPO7054) ±2.6 ns (SDp, DPO7254) ±2.2 ns (SDp, DPO7104, VM6000) ±2 ns (SDp, DPO7054) ±2 ns (HD)

*8 For VM6000 instrument characteristics, please refer to the DPO7104 datasheet.

⁹ SDi: SD Interface, SDp: SD Progressive.

Automated Video Measurement Set

► VM6000

► Options SD and HD Video Measurements (continued)

Characteristic	Description	VM5000HD, VM5000, TDS5054, TDS5054B, TDS5104, TDS5104B4		VM6000, DPO7054, DPO7104, DPO725	
		Absolute	Relative to Reference	Absolute	Relative to Reference
Jitter		±5 ns (RMS) ±15 ns (Peak) (Min 62.5 Hz, VM5000HD/ TDS5104) ±5 ns (RMS) ±15 ns (Peak) Min 25 Hz, VM5000/ TDS5104B	—	±5 ns (RMS) ±15 ns (Peak) (RL: 40 MS, Min 10 Hz) ±5 ns (RMS) ±15 ns (Peak) (RL: 200 MS, Min 2 Hz)	—
Frequency Drift ^{*10}		±40 ppm Hz/sec (480i, Min 0.65 Hz, VM5000HD/ TDS5104 ±40 ppm Hz/sec (480i, Min 0.32 Hz, VM5000/ TDS5104B)	—	±40 ppm Hz/sec (RL: 40 MS, Min 0.25 Hz) ±40 ppm Hz/sec (RL: 200 MS, Min 0.05 Hz)	—
Frequency Offset ^{*10}		±15 ppm Hz (480i, Min 0.65 Hz, VM5000HD/ TDS5104) ±15 ppm Hz (480i, Min 0.32 Hz, VM5000/ TDS5104B)	—	±15 ppm Hz (RL: 40 MS, Min 0.25 Hz) ±15 ppm Hz (RL: 200 MS, Min 0.05 Hz)	—
Channel Delay					
Measurement Range		±35 ns	—	±35 ns	—
Accuracy		±5 ns	±500 ps (SD) ±300 ps (HD)	±2 ns	±500 ps (SD) ±300 ps (HD)
Spatial Distortion					
V Cropping, First Active Line, Last Active Line		±1 line	—	±1 line	—
V Scaling		±1%	—	±1%	—
V Offset		±1 line	—	±1 line	—
H Cropping		±6 pixel of the smaller pattern (VM5000HD, TDS5054, TDS5104) ±3 pixel of the smaller pattern (VM5000, TDS5054B, TDS5104B)	—	±1 pixel of the smaller pattern	—
H Start, H End		±6 pixel of the smaller pattern (VM5000HD, TDS5054, TDS5104) ±3 pixel of the smaller pattern (VM5000, TDS5054B, TDS5104B)	—	±1 pixel of the smaller pattern	—
H Scaling		±1%	—	±1%	—
H Offset		±6 pixel of the smaller pattern (VM5000HD, TDS5054, TDS5104) ±3 pixel of the smaller pattern (VM5000, TDS5054B, TDS5104B)	—	±1 pixel of the smaller pattern	—

^{*10} RL: Record Length.

▶ Option VGA Video Measurements*11

Characteristic	Description	VM5000HD, VM5000, TDS5104, TDS5104B	VM6000, DPO7104	DPO7254
Amplitude Measurements				
Luma Level, Max and Min	VESA 6.1 (Typical)	±5 mv ±0.9% of reading	±5 mv ±0.6% of reading	±5 mv ±0.6% of reading
Color Bars	Channel voltage levels measured relative to back porch (typical)	±3 mv ±0.9% of reading	±3 mv ±0.6% of reading	±3 mv ±0.6% of reading
Ch-Ch Mismatch (mV)	32-step staircase signal. VESA 6.5 Channel voltage levels measured relative to back porch (typical)	±5 mv ±1.3% of reading	±5 mv ±0.9% of reading	±5 mv ±0.9% of reading
Ch-Ch Mismatch (%)		±0.7% ± (1.3%)xLuma Level/Max Luma Level; maximum of ±2.0%	±0.7% ±(0.9%)x(Luma Level/Max Luma Level); maximum of ±1.6%	±0.7% ± (0.9%)x(Luma Level/Max Luma Level); maximum of ±1.6%
H & V sync Logic "0" and "1"	VESA 7.1 (pk-pk sync amplitude)=(logic 1 voltage)–(logic 0 voltage) (typical)	±[8mv ±(0.01) x (pk-pk sync amplitude)] ±0.8% of reading	±[8mv ±(0.01) x (pk-pk sync amplitude)] ±0.5% of reading	±[8mv ± (0.01) x (pk-pk sync amplitude)] ±0.5% of reading
Linearity, Resolution, Monotonicity				
Integral Linearity (%)	VESA 6.4. Requires step response compliant to VESA limits for overshoot/undershoot, amplitude and settle time	±1.0% (typical)	±1.0% (typical)	±1.5% (typical)
Differential Linearity	(Typical)	±0.25 LSB (8 bit) ±0.5 LSB (10 bit)	±0.25 LSB (8 bit) ±0.5 LSB (10 bit)	±0.5 LSB (8 bit) ±1.0 LSB (10 bit)
RGB Video Monotonicity	Monotonicity checks every step on the ramp to ensure signal is always rising. (Typical)	±0.25 LSB (8 bit) ±0.5 LSB (10 bit)	±0.25 LSB (8 bit) ±0.5 LSB (10 bit)	±0.5 LSB (8 bit) ±1.0 LSB (10 bit)
Resolution Measurement Range	Resolution measured in bits	5 to 10 bits	5 to 10 bits	5 to 10 bits
H & V Sync Monotonic Rise and Fall	Checks sync for always rising and always-falling characteristic Requires VESA compliant amplitude, noise, rise and fall	Detects monotony as small as 1% of pk-pk sync amplitude (typical)	Detects monotony as small as 1% of pk-pk sync amplitude (typical)	Detects monotony as small as 2% of pk-pk sync amplitude (typical)
Noise				
Noise (mV) Measurement Range 8 to 15 mV	Measurement of RGB noise on constant pedestal, 0 to 700 mV	±5.25 mV	±5.25 mV	±5.25 mV
Noise (mV) Measurement Range 15 to 25 mV	Output in m _{r-p} , dB below 700 mV, VESA Sec 6.6. Displayed value corrected for instrument noise.	The lesser of ±7 mV or ±35%	The lesser of ±7 mV or ±35%	The lesser of ±7 mV or ±35%
Noise Injection Ratio (%) Measurement Range 1.1% to 2.1%	Specification applies with 500 MHz bandwidth filter and 10 averages selected	±0.75%	±0.75%	±0.75%
Noise Injection Ratio (%) Measurement Range 2.1% to 3.6%		±1%	±1%	±1%
Timing				
Channel Skew Measurement Range ±35 ns	Alternate implementation of VESA 6.7; any two channels	±500 ps	±550 ps	±600 ps
H Timing (ns) – Front and Back Porch, Left and Right, Border, Addressable Video		360 ps ±15 ppm x Reading	360 ps ±2.5 ppm x Reading	360 ps ±2.5 ppm x Reading
		360 ps ±15 ppm x Reading	360 ps ±2.5 ppm x Reading	360 ps ±2.5 ppm x Reading
H Sync Period, H & V Sync Pulse width (ns)		80 ps ±15 ppm x Reading	80 ps ±2.5 ppm x Reading	80 ps ±2.5 ppm x Reading

*11 Specifications apply with use of Measurement Interface Unit (MIU)

Automated Video Measurement Set

► VM6000

► Option VGA Video Measurements*¹¹ (continued)

Characteristic	Description	VM5000HD, VM5000, TDS5104, TDS5104B	VM6000, DPO7104	DPO7254
Noise				
V Sync Period (μ s)	Read out (precision) is 1 μ s	20 ns \pm 15 ppm x reading	20 ns \pm 2.5 ppm x Reading	20 ns \pm 2.5 ppm x Reading
V Timing (lines) – Front and Back Porch, Top and Bottom Border, Addressable Lines	Read out (precision) is 1 line. Functions within \pm 10 lines of VESA reference value			
Frequency				
H and V Sync, Pixel Clock Frequency		\pm 0.01% of reading	\pm 0.01% of reading	\pm 0.01% of reading
Transient Response				
Video Rise and Fall Time Measurement Range >1.3 ns	VESA 6.8 (typical)	\pm 5.0% of reading	\pm 5.0% of reading	\pm 5.0% of reading
Video Rise and Fall Time Measurement Range 800 ps to 1.3 ns		\pm 10% of reading	\pm 10% of reading	\pm 10% of reading
Video Rise and Fall Time Measurement Range 450 ps to 800 ps	Video Transient Response: Utilizes Course grille, VESA Section 6.2, 6.3, 6.8 Displayed results corrected for RGB measurement system bandwidth limitations (typical)	\pm 20% of reading	\pm 20% of reading	\pm 20% of reading
RGB System Rise Time	Typical	350 ps	350 ps	225 ps
Sync Rise and Fall Time Measurement Range >5 ns	VESA Section 7.1-7.4 Displayed results corrected for H/V measurement system bandwidth limitations (typical)	\pm 5.0%	\pm 5.0%	\pm 5.0%
Sync Rise and Fall Time Measurement Range 2 ns to 5 ns	Typical	\pm 11%	\pm 11%	\pm 11%
RGB and HV Sync Overshoot and Undershoot Amplitude %, Settle Time: 0 to 1 ns	Typical	\pm 2% of reading	\pm 2% of reading	\pm 2% of reading
RGB and HV Sync Overshoot and Undershoot Amplitude %, Settle Time: 1 to 10 ns	Typical	\pm 1% of reading	\pm 1% of reading	\pm 1% of reading
RGB and HV Sync Overshoot and Undershoot Settling, Time, Amplitude >5%	VESA 6.3 (typical)	\pm T rise	\pm T rise	\pm T rise
Jitter				
H Sync Jitter (ns)	VESA 7.5 Requires VESA-compliant amplitude, noise, rise and fall characteristics	100 ps \pm 15 ppm x H sync period	100 ps \pm 2.5 ppm x H sync period	100 ps \pm 2.5 ppm x H sync period
H Sync Jitter (% of Pixel Clock Period) Measurement Range: <200 MHz PCF		<4%	<3%	<3%
H Sync Jitter (% of Pixel Clock Period) Measurement Range: 200 to 400 MHz PCF		<7.5%	<5%	<5%

*¹¹ Specifications apply with use of Measurement Interface Unit (MIU).

Hardware Accessory Specifications**▶ RGBHV Measurement Interface Unit (MIU)**

Characteristic	Specification Wideband Mode	Specification Precision LF Mode	Reference Information
DC Gain			
RGB Channels	0.1 ±3% (typical)	1.0 ±0.002%	VM6000 automatically compensates for Wideband mode gain
HV Channels	0.01 ±5% (typical)	1.0 ±0.002%	
DC Termination			
RGB Channels	75 Ω nominal	75 Ω ±0.3%	
HV Channels	2.2 kΩ ±3%	2.2 kΩ ±1.5%	
Bandwidth			
RGB Channels	<3 dB down at 1,500 MHz	DC to 10 MHz (typical)	
HV Channels	<3 dB down at 320 MHz	DC to 10 MHz (typical)	
RGB Channels Input Return Loss			
1 MHz to 100 MHz	>27 dB		27 dB RL is equivalent to ±7.5 Ω variation from 75 Ω
100 MHz to 250 MHz	>21 dB		21 dB RL is equivalent to ±15 Ω variation from 75 Ω
H & V Channels Input Capacitance	3 pF (typical)		
Current Source Loads (H & V channels)		+8 mA ±2.5% -8 mA ±2.5%	Current sources provide loads for VOH and VOL testing of H & V sync signals

▶ HDTV Matrix Test Signal Details

Signal	Format	Signal Details
Color Bars	All	100% color bars with 100% white
Multiburst	720p, 1080i and 1080p	5, 10, 15, 20, 25, 30 MHz for Y, G, B, R 2.5, 5, 7.5, 10, 12.5, 15 MHz for Pb & Pr
	480p and 576p	2, 4, 6, 8, 10, 12 MHz for Y, G, B, R 1, 2, 3, 4, 5, 6 MHz for Pb & Pr
	480i and 576i	1, 2, 3, 4, 5, 6 MHz for Y, G, B, R 0.5, 1, 1.5, 2, 2.5, 3 MHz for Pb & Pr
Sweep	720p, 1080i and 1080p	5 to 35 MHz for Y, G, B, R 2.5 to 15 MHz for Pb & Pr
	480p and 576p	2 to 12 MHz for Y, G, B, R 1 to 6 MHz for Pb & Pr
	480i and 576i	0.5 to 6 MHz for Y, G, B, R 0.5 to 3 MHz for Pb & Pr
Sweep Parade	All	Windowed areas (chirp)
Flat Field – Black	All	Near black – 7.5 mV
Flat Field – Gray	All	Gray – 350 mV on RGB
Flat Field – White	All	White – 700 mV on RGB
Valid Ramp	All	Ramp 0 to 700 mV on RGB
Shallow Ramp	All YPbPr	Ramp 350 mV ±35 mV on Y, G, B, R Ramp 0 mV ±35 mV on Pb & Pr
Pulse and Bar	YPbPr and RGB	2T Pulse Response with equivalent bar rise and bar fall Pb & Pr are twice the duration of Y, G, B, R

Automated Video Measurement Set

► VM6000

Display Characteristics

Display Type – Liquid crystal active-matrix color display.

Display Size – Diagonal: 307.3 mm (12.1 in.).

Display Resolution – XGA 1024 horizontal x 768 vertical pixels.

Waveform Styles – Vectors, Dots, Variable Persistence, Infinite Persistence.

Color Palettes – Normal, Green, Gray, Temperature, Spectral and User-defined.

Display Format – YT, XY.

Computer System and Peripherals

Operating System – Windows XP.

CPU – Intel Pentium 4, 3.4 GHz processor.

PC System Memory – 2 GB.

Hard Disk Drive – Rear-panel, removable hard disk drive, 80 GB capacity.

CD-R/W Drive – Front-panel CD-R/W drive with CD creation software application.

DVD Drive – Read only.

Mouse – Optical wheel mouse, USB interface.

Printer (optional) – Thermal printer; fits in accessories pouch provided with instrument.

Keyboard – 119-7083-00 for small keyboard (fits in pouch); USB interface and hub.

Input/Output Ports

Front Panel

Video Input – Front panel BNC connectors (3) for 3-wire CAV. A fourth BNC for separate composite sync or H sync input on RGBHV signals. A fifth BNC (auxiliary input) for V sync on RGBHV signals. Trigger level range is adjustable from +8 V to –8 V. The maximum input voltage is ± 20 V (DC + peak AC) and input resistances ≥ 1.5 k Ω .

Probe Compensator Output – Front panel pins. Amplitude 1 V $\pm 20\%$ into a ≥ 50 Ω load; 500 mV from base to top into a 50 Ω load, frequency 1 kHz $\pm 5\%$.

USB 2.0 Port – One front panel and four side panel-mounted USB 2.0 connectors.

Aux Trigger Input – TekVPI interface; ± 5 V (50 Ω); 150 V CAT I, derate at 20 dB/decade to 9 V_{RMS} above 200 KHz (1 M Ω).

Side Panel

Parallel Port – IEEE 1284, DB-25 connector.

Audio Ports – Miniature phone jacks for stereo microphone input and stereo line output.

Keyboard Port – PS-2 compatible.

Mouse Port – PS-2 compatible.

LAN Port – RJ-45 connector, supports 10Base-T, 100Base-T and Gigabit Ethernet.

Serial Port – DB-9 COM1 port.

VGA Video Port – DB-15 female connector; connect a second monitor to use dual-monitor display mode. Supports basic requirements of PC99 specifications.

Oscilloscope VGA Video Port – DB-15 female connector, 31.6 kHz sync, EIA RS-343A compliant, connect to show the oscilloscope display, including live waveforms on an external monitor or projector.

Rear Panel

Power – 90 to 264 V_{RMS} , $\pm 10\%$, 47 to 63 Hz; CAT II, <400 VA.

Analog Signal Output – BNC connector provides a buffered version of the signal that is attached to the Ch 3 input when Ch 3 is selected as trigger source. Amplitude: 50 mV/div $\pm 20\%$ into a 1 M Ω load, 25 mV/div $\pm 20\%$ into a 50 Ω load.

Bandwidth: 100 MHz into a 50 Ω load.

External Time Base Reference In – BNC connector, time base system can phase-lock to external 10 MHz reference.

Time Base Reference Out – BNC connector accepts TTL-compatible output of internal 10 MHz reference oscillator.

Aux Trigger Output – BNC connector provides a TTL-compatible, polarity switchable pulse when the oscilloscope triggers.

GPIB Port – IEEE 488.2 standard.

Physical Characteristics

Benchtop Configuration

Dimensions	mm	in.
Height	292	11.48
Width	451	17.75
Depth	265	10.44
Weight	kg	lbs.
Net	15	32
Shipping	28.9	63.75

Rackmount Configuration

Dimensions	mm	in.
Height	323	12.25
Width	479	18.85
Depth (from rack-mounting ear to back of instrument)	231.75	9.12
Weight	kg	lbs.
Net	17.4	37.5
Kit	2.5	5.5

Mechanical

Cooling – Required Clearance

	mm	in.
Top	0	0
Bottom	0	0
Left side	0	0
Right side	76	3
Front	0	0
Rear	0	0

Environmental

Temperature

Operating – +10 °C to +45 °C.

Non-operating – –40 °C to +71 °C.

Humidity

Operating – 5% to 95% relative humidity (RH) with a maximum wet bulb temperature of +29 °C at or below +50 °C, non-condensing. Upper limit derated to 45% RH above +30 °C up to +50 °C.

Non-operating – 5% to 95% relative humidity (RH) with a maximum wet bulb temperature of +29 °C at or below +60 °C, non-condensing. Upper limit derated to 45% RH above +30 °C up to +50 °C.

Altitude

Operating – 10,000 ft. (3,048 m).

Non-operating – 40,000 ft. (12,190 m).

Random Vibration

Operating – 0.000125 G²/Hz from 5 to 350 Hz. –3 dB/octave from 350 to 500 Hz.

0.0000876 G²/Hz at 500 Hz.

Overall level of 0.27 G_{RMS}.

Non-operating – 0.0175 G²/Hz from 5 to 100 Hz.

–3 dB/octave from 100 to 200 Hz.

0.00875 G²/Hz from 200 to 350 Hz.

–3 dB/octave from 350 to 500 Hz.

0.006132 G²/Hz at 500 Hz.

Overall level of 2.28 G_{RMS}.

Regulatory

Electromagnetic Compatibility – 93/68/EEC;

EN61326:1997 +A1 1998+A2:2000.

Certifications – UL 3111-1, CSA1010.1, ISO11469, EN61010-1, IEC 61010-1.

► Ordering Information

VM6000

Automatic Video Measurement Set: 1 GHz Digital Phosphor Oscilloscope, accessory pouch, front cover, mouse, quick start user manual (071-173x-xx), Probe calibration and deskew fixture (067-0405-xx), DPO7000 Series product software CD-ROM, DPO7000 Series operating system restoration CD-ROM, Optional applications software CD-ROM, performance verification procedure PDF file, GPIB programmer's reference (on product software CD-ROM), calibration certificate documenting NIST traceability, Z 540-1 compliance and ISO9001, power cord, one year warranty. Please specify language and power cord options when ordering.

Video Measurement Accessory Kit (VM):

Sync pick-off accessory (012-1680-01)

75 Ω BNC Termination (Qty 4) (011-0102-03)

BNC T's (Qty 4), (103-0030-00)

TPA-BNC Adapter, Sync combiner (012-1664-00)

VM6000 User Manual (071-2103-00)

VM6000 Product software CD-ROM (020-2767-00)

VM6000 Programmers manual (071-2104-00)

Requires at least one of Option SD, HD or VGA with each new instrument ordered.

User to specify quick start user manual language, and power plug when ordering.

Option HD – Option key enabling HD format support. TPA-BNC adapter (013-0355-02).

Option SD – Option key enabling SD format support. TPA-BNC adapter (013-0355-02).

Option VGA – Option key enabling VGA option. RGBHV Measurement Interface Unit (012-1685-00). TPA-BNC Adapter (Qty. 4) (013-0355-02).

Option SS – Signal Sources package (Single Instrument License) (020-2769-00).

VM5HDUP, VM5UP, VM6UP**Video Measurement Accessory Kit (VM):**

VM Series User Manual (071-2103-00).
VM Series Product software CD-ROM (020-2767-00).
User to specify quick-start user manual language and power plug when ordering.

Option VM – Terminations 75 BNC (Qty 4) (103-0030-00), BNC T's (Qty 4) (103-0030-00).
Sync combiner (012-1664-00).

Option HD – Option key enabling HD format support.
Sync pick-off accessory (012-1680-01).
TPA-BNC adapter (0010-0753-00) for VM6UP.

Option SD – Option key enabling SD format support.
Sync pick-off accessory (012-1680-01), TPA-BNC adapter (010-0753-00) for VM6UP.

Option VGA – Option key enabling VGA option.
RGBHV Measurement Interface Unit (012-1685-00).
TPA-BNC Adapter (Qty. 4) (010-0753-00) for VM6UP.

Option SS – Signal Sources package (Single Instrument License) (020-2769-00).

Options**User Manual Options**

- Opt. L0** – English manual.
- Opt. L1** – French manual.
- Opt. L3** – German manual.
- Opt. L5** – Japanese manual.
- Opt. L7** – Simplified Chinese manual.
- Opt. L8** – Standard Chinese manual.
- Opt. L9** – Korean manual.
- Opt. L10** – Russian manual.

Power Plug Options

- Opt. A0** – North America.
- Opt. A1** – Universal European Union.
- Opt. A2** – UK.
- Opt. A3** – Australia.
- Opt. A5** – Switzerland.
- Opt. A6** – Japan.
- Opt. A10** – China.
- Opt. A11** – India.
- Opt. A99** – No power cord.

Service Options

- Opt. CA1** – Provides a single calibration event or coverage for the designated calibration interval, whichever comes first.
 - Opt. C3** – Calibration Service 3 years.
 - Opt. C5** – Calibration Service 5 years.
 - Opt. D1** – Calibration Data Report.
 - Opt. D3** – Calibration Data Report 3 years (with Opt. C3).
 - Opt. D5** – Calibration Data Report 5 years (with Opt. C5).
 - Opt. R3** – Repair Service 3 years.
 - Opt. R5** – Repair Service 5 years.
- VM6UP IF, VM5UP IF, VM5HDUP IF** – Upgrade installation service.

► VM6000 Instrument Options**Video Measurement Options**

SD ^{*12}	SD component analog video measurements and format support
HD ^{*12}	HD Component analog video measurements and format support
VGA ^{*12}	RGBHV Video Measurements and VESA Compliance Tests
SS	Signal Sources

Record Length Options

2RL	80 MSamples max, 20 MSamples/ch
5RL	200 MSamples max, 50 MSamples/ch

Hardware Options

2SR	Double maximum real-time sample rate: 40 GS/s (1 channel) 20 GS/s (2 channels) 10 GS/s (3 or 4 channels)
1P	Thermal printer in the porch
Software Options	LSA, JE3, ET3, ^{*13} JA3, USB, ^{*14} MTM, PWR

^{*12} At least one of Option SD, HD or VGA is mandatory for each VM6000 instrument.

^{*13} Requires Ethernet Test Fixture.

^{*14} Requires TDSUSBF (USB Test Fixture).

Recommended Accessories**Probes**

- TAP2500** – 2.5 GHz TekVPI™ active single-ended probe.
 - TAP1500** – 1.5 GHz TekVPI active single-ended probe.
 - P6158** – 3 GHz, 20x low C probe.
 - P6247^{*15}** – 1 GHz differential probe.
 - P6243^{*15}** – 1 GHz active probe.
 - P6245^{*15}** – 1.5 GHz active probe.
 - P6248^{*15}** – 1.5 GHz differential probe.
 - P5050** – 500 MHz, 10x passive probe.
 - P6246** – 400 MHz differential probe.
 - P6101B** – 1x passive probe 15 MHz.
 - TCPA300/TCPA400^{*15}** – Series current measurement systems.
 - P5200/P5205/P5210^{*15}** – High-voltage differential probes.
 - P5100/P6015A^{*15}** – High voltage probes.
 - TCP0030** – 100 MHz TekVPI AC/DC 30 A current probe.
- Cables**
- VGA to 5x BNC Cable, 6 in** – Order 174-5147-00.
 - VGA to 5x BNC Cable, 1 m** – Order 174-5126-00.
 - GPIB Cable (1 m)** – Order 012-0991-01.
 - GPIB Cable (2 m)** – Order 012-0991-00.
 - RS-232 Cable** – Order 012-1298-00 or 012-1692-00.
 - Centronics Cable** – Order 012-1214-00.

^{*15} Probe requires TPA-BNC adapter.

Accessories

- Signal Sources on DVD** – Order 020-2770-00.
- Standard Definition Elementary Streams on CD-ROM** – Order 020-2771-00.
- Advanced Definition Elementary Streams on CD-ROM** – Order 020-2772-00.
- ATSC Transport Streams on CD-ROM** – Order 020-2773-00.
- Baseband Test Signals on CD-ROM** – Order 020-2774-00.
- PC Bit map Graphics on CD-ROM** – Order 020-2775-00.
- H.264 SD&HD Streams on CD-ROM** – Order 020-2776-00.
- BNC Elbow** – Order 103-0031-00.
- 75 Ω BNC Termination** – Order 011-0102-03.
- BNC T** – Order 103-0030-00.
- Mini Keyboard (USB interface)** – Order 119-7083-00.
- Service Manual** – Order 071-1740-xx.
- Transit Case** – Order 016-1522-00.
- Video Display Clamp Order** – Order 013-0278-xx.
- Rackmount Kit** – Order 016-1965-00.
- Oscilloscope Cart** – Order K420.

Software

- WSTRO** – WaveStar™ waveform capture and documentation software.

Automated Video Measurement Set

► VM6000

Test Fixtures

Sync Pick-off Accessory – Order 012-1680-01.

Sync Combiner Accessory – Order 012-1664-00.

RGBHV Measurement Interface Unit – Order 012-1685-00.

TDSUSBF – Test fixture for use with Opt. USB.

Power Deskew Fixture – Order 067-1478-00.

Ethernet Test Fixture – Order through Crescent Heart Software (<http://www.c-h-s.com>).

Adapters

TPA-BNC – TekVPI to BNC adapter.

AFTDS – Telecom differential electrical interface adapter (for line rates <8 Mb/s).

AMT75 – 1 GHz 75 Ω adapter.

P6701B – Optical/electrical converter (multi-mode).

P6703B – Optical/electrical converter (single-mode).

Instrument Upgrades

To Upgrade Your VM6000, Order Options as Noted – VM6UP with Options SD, HD, VGA, SS, RLO2, RLO5, RL25, ET3, USB, MTM, PWR, JA3, JE3, LSA, CP2, J2, HT3.

To upgrade VM5000, VM5000HD or other Tektronix oscilloscopes, please consult the following table for platform requirements, mandatory options, functionality and option availability.

Upgrade Kit		Options				
		VM	SD	HD	VGA	SS ^{*20}
TDS5054 ^{*18}	VM5HDUP	X ^{*16}	X	X	NA	X
TDS5104 ^{*18}		X ^{*16}	X	X	X	X
VM5000HD ^{*21}		NA ^{*17}	X	X	X	X
TDS5054B ^{*19}	VM5UP	X ^{*16}	X	X	NA	X
TDS5104B ^{*19}		X ^{*16}	X	X	X	X
VM5000 ^{*21}		NA ^{*17}	X	X	X	X
DPO7054 ^{*22, 23}	VM6UP	X ^{*16}	X	X	NA	X
DPO7104 ^{*22, 23, 24}		X ^{*16}	X	X	X	X
DPO7254 ^{*22, 23, 24}		X ^{*16}	X	X	X	X
VM6000		NA ^{*17}	X	X	X	X

NA = Not Available.

^{*16} Option VM is a mandatory option for all TDS and DPO oscilloscope upgrades (VM5HDUP, VM5UP and VM6UP), but it is not needed on purchasing second upgrade kit for the unit which has same serial number.

^{*17} Option VM is default enabled/included with each VM5000, VM5000HD and VM6000, not required for upgrade kits.

^{*18} Requires 2M, Windows 2000 OS.

^{*19} Requires 3M.

^{*20} Requires the indication of the serial number of the unit.

^{*21} The upgrade to V3.0 for the VM5000HD or VM5000 need to order the VM5HDUP or VM5UP kit.

^{*22} The other upgrade kit than Option VM, SD, HD, VGA, SS for DPO7054, DPO7104 and DPO7254 are provided from the DPO7UP kit.

^{*23} The application for DPO7000 needs V2.0.4 and above.

^{*24} S/N B020000 and above requires 2SR.

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Our most up-to-date product information is available at:

www.tektronix.com



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.

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12/06 DV/WOW

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