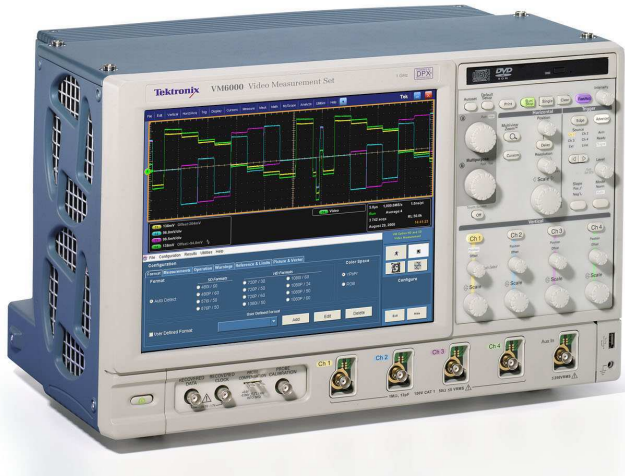# Automated Video Measurement Set
VM6000 Data Sheet

Features & Benefits

- Automates Test of Consumer HDTV Video Devices

- Automates VESA Compliance Test for PC Graphics Devices

- Automates Testing of Multimedia 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 in. XGA Touch Screen Display

- GPIB 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 USB 2.0 Compliance Testing

Applications

- Design Validation

- Standards Compliance Testing

- Quality Control

- Installation and Troubleshooting

- Automated Manufacturing Test

- Off-air Video Systems Test

The VM6000 automates video testing of consumer HDTV and PC graphics devices such as digital set-top boxes, multimedia 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.

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Summary Pass/Fail Test Results Display.

Signal Format Configuration Menu (Option SD and HD).

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 640×480p though 2048×1536p, and pervasive refresh rates from 60 Hz through 120 Hz.

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 using 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. Users can easily navigate through logically arranged menus and make selections using 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 multiformat video devices. Users wanting to make manual measurements can exit the automated measurement application and then access a full-featured oscilloscope.

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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 Format allows users to test nonstandard 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 nonstandard HD formats supported by User-defined Format menu. User-defined Format supports nonstandard SD formats, if SD is enabled.		X	X	X	X	X
VGA	640×480p	60, 72, 75, 85, 100, 120 Hz	X	X	X	X	X
	800×600p	60, 72, 75, 85, 100, 120 Hz	X				X
	1024×768p	60, 72, 75, 85, 100, 120 Hz	X	X	X	X	X
	1280×1024p	60, 70, 75, 85, 100, 120 Hz	X				X
	1600×1024p	60, 70, 75, 76, 85, 100 Hz	X	X	X	X	X
	1920×1080p	50, 60, 75, 85, 100 Hz	X				X
	1920×1200p	60, 75, 76, 85, 100 Hz	X				X
	1920×1440p	60, 75, 85 Hz	X				X
	2048×1536p	60, 75, 85 Hz	X				X
	2048×2048p	60 Hz	X				X
	Other progressive RGBHV formats and vertical frequencies supported by User-defined Format.		X				X

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

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 4 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.

H Sync Measurement Results (Option VGA)

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 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.

VM6000 Automated Measurements

Measurement Parameters	
TV Signals Options SD and HD	PC Graphics Signals Option VGA
Color Bars Levels (1-8 Pedestals)	Color Bars Luma Levels*1
HV Sync H Sync Jitter	HV Timing*1 HV Sync*1 H Sync Jitter*1
Noise	Noise Injection Ratio*1
Nonlinearity	Integral and Differential Linearity, Monotonicity*1
Interchannel Timing	Channel-Channel Mismatch Channel-Channel Skew*1
Transient Response, K2T	Video Transient Response
Multiburst	—
Frequency Response	—
—	Resolution*1
Spatial Distortion	—

*1 VESA parameters.

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 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.

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Multiburst Measurement Results 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 a run command. While functioning in Auto mode, the instrument automatically selects the appropriate test signal line, utilizes preset measurement configurations and averaging selected by the user, and completes each measurement. Auto mode also includes multiline 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 requirement 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 3 channel levels for 1-8 individual pedestals on a line, such as can be found with ARIB signals, MacBeth Charts, or other noncolor 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.

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

V Sync Display (Option SD and HD).
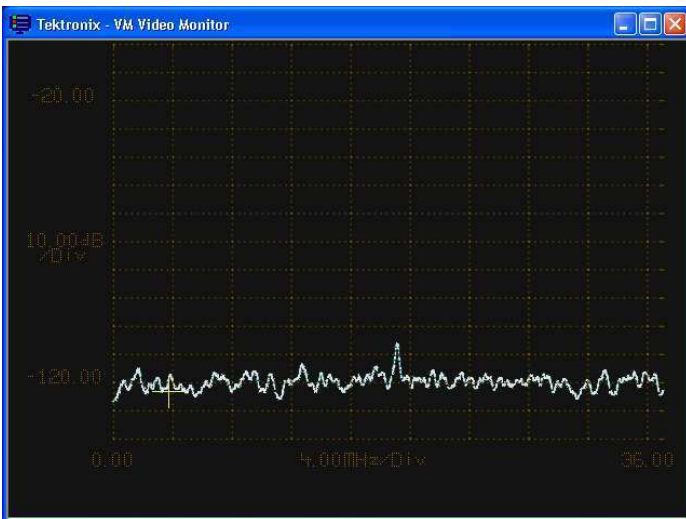
Noise Spectrum Display (Option SD and HD).

H Sync Jitter and Wander Display (Option SD and HD).

New Measurements on V3.X – Options for SD and HD on V3.X 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, Frequency Offset, and Frequency Drift Rate for wander measurements that support IEEE 1521-2003. The user-definable demarcation frequency and probability/jitter readout help to search for the root cause during debugging. The spatial distortion measurement measures the size of the video image and detects 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 letterbox or side-panel modes.

Spatial Distortion Display (Option SD and HD).

Format Configuration Menu (Option VGA).

Measurement Selection Menu (Option VGA).

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 systems.

Option VGA supports pervasive analog RGBHV signal formats typically communicated through VGA, DVI-I, or DVI-A interfaces. Automated measurement is possible for 10 standard signal resolutions spanning from 640×480p (VGA) through 2048×2048p (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 standard (VESA) test procedures, enabling

RGB Transient Response Measurement Results (Option VGA).

easy comparison against the requirements of the Video Signal Standard (VSIS) and applicable DMT, GTF, or CVT timing standards. Convenient averaging and configuration controls deliver the flexibility to perform either speedy or precise measurements in accordance with VESA sampling requirements. A full suite of comprehensive RGBHV video parameters can be measured in less than 5 minutes. Preloaded 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.

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An innovative set of PC graphics matrix test signals have 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.

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. The 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 prequalified the matrix test signal for each native video format.

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

Parts Number	Description	Formats
020-2770-xx	Signal Sources DVD	480i, 576i
020-2771-xx[2]	Standard Definition Elementary Streams	480i, 480p, 576i, 576p
020-2772-xx	Advanced Definition Elementary Streams	720P, 1080i, 1080p
020-2773-xx[3]	ATSC Transport Streams	480i, 480p, 720P, 1080i, 1080p
020-2774-xx[4, 5, 6]	Baseband Test Signals	525i, 525p, 625i, 625p, 720p, 1080i, 1080p,
020-2775-xx[7]	PC Bitmap Graphics	620×480, 800×600, 1024×768, 1280×1024, 1600×1024, 1600×1200, 1920×1080, 1920×1200, 1920×1440, 2048×1536, 2048×2048
020-2776-xx[8]	H.264 SD and HD Streams	480i, 480p, 576i, 576p, 720p, 1080i, 1080p

[2] 480i, 480p ES Stream provided by 704×480, 720×480 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, AWVG7, DVG7, and/or HDVG7).
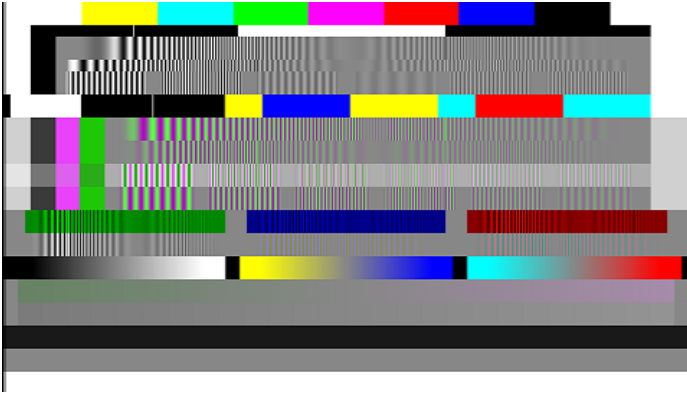
[5] SDI signal generation not supported for 525P, 576p format.

[6] TG700 DNL files not provided for 1080p/50 and 1080p/60 formats.

[7] Includes PC Matrix and Full Field VESA signals.

[8] Main profile / Level 3 for 480i, 580p, 576i, and 576P. Main profile / Level 4 for 720P, 1080i, and 1080P.

HDTV Matrix Test Signal in 16×9 Aspect Ratio.

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.

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 playout on a Tektronix MPEG player such as the RTX100B, RTX130B, or MTX100B.

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

PC Graphics Matrix Test Signal (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.

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 measurements to be made without the border artifacts potentially introduced by bitmap files.
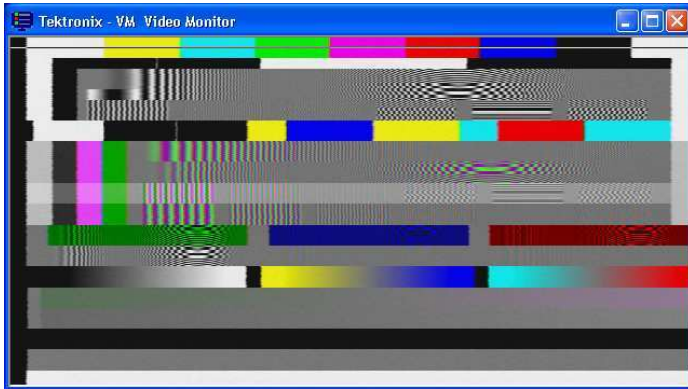
Picture Mode.

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 the screen from the connected subsampled and down-converted signals to the available picture area and resolution. Pictures appear in an appropriate 16×9 or 4×3 aspect ratio by default; 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 1-2 fps.

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.
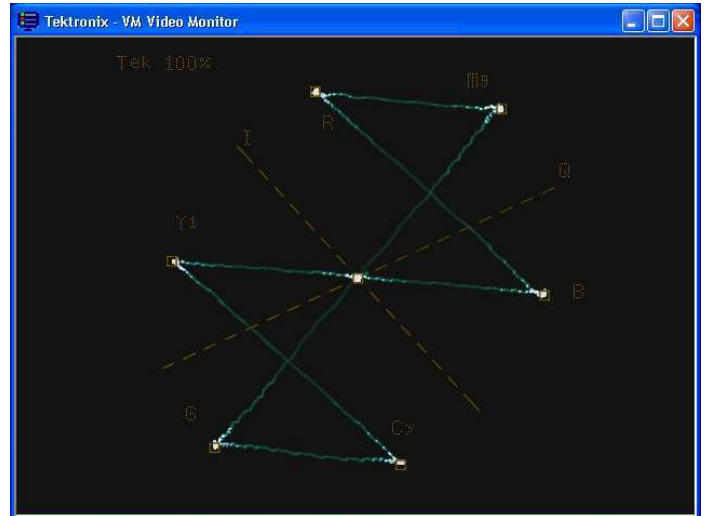
Vector Display.

Full-screen Waveform Display.

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Summary Test Results Display with Pass/Fail Indication.

Color Bar Relative Results Display with Limit Testing enabled.

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

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.

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, numerical measurement results for failed parameters are displayed in an intuitive red color and passed parameters are displayed in green for easy identification of acceptable/unacceptable or nonconforming signal conditions.

Reference and Limit Test Configuration Menu.

RTF Format

CSV Format

VM6000 Test Report.

Preloaded and User-definable Reference and Limit Files

Tektronix supplies a set of default reference and limit files for the supported video formats to provide "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 using preset 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, nonconforming test results are highlighted in red, readily highlighting signal distortions for further analysis.

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 setup 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 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. The option to insert an embedded waveform screen in .rtf format provides the detail of the results to the reviewers. For data analysis, reports can be output in the form of a .csv file, easily imported into spreadsheet programs.
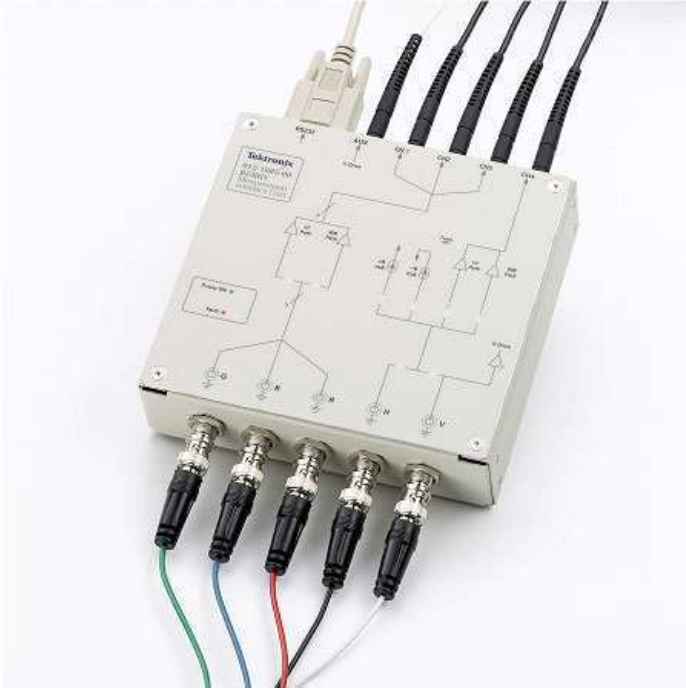
Option VGA – Analog RGBHV Measurement Interface Unit (MIU).

Oscilloscope Measurement Menu.

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 within 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 through the user interface to be automated through 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 through the network. TekVISA™ is functional for LAN remote control of the oscilloscope commands.

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, or 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).

Performance You Can Count On

Depend on Tektronix to provide you with performance you can count on. In addition to industry-leading service and support, this product comes backed by a one-year warranty as standard.

Characteristics*9

Video Measurement Specifications

Options SD and HD Video Measurements

Characteristic	Description	VM5000HD, VM5000, TDS5054, TDS5054B, TDS5104, TDS5104B		VM6000, DPO7054, DPO7104, DPO7254, DPO7354	
		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	Multiburst (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)	—	±0.4 dB (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					
Nonlinearity	(Typical)	±3%	±0.3%	±3%	±0.3%
Transient					
Rise and Fall	(Typical)	±5 ns (SD) ±2 ns (HD)	±3.5 ns (SD) ±2 ns (HD)	±6.2 ns (SD, DPO7354) ±2 ns (HD, DPO7354) ±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, DPO7354) ±2 ns (HD, DPO7354) ±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%	—

Characteristic	Description	VM5000HD, VM5000, TDS5054, TDS5054B, TDS5104, TDS5104B		VM6000, DPO7054, DPO7104, DPO7254, DPO7354	
		Absolute	Relative to Reference	Absolute	Relative to Reference
Sync					
Amplitude	(Typical)	±3 mV ±0.8% of reading	±4 mV	±3 mV ±0.5% of reading	±4 mV
Timing	—	±1 ns	—	±1 ns	—
Rise and Fall Time[*10]	(Typical)	±2 ns (SDi) ±1 ns (SDp) ±1 ns (HD)	±2 ns (SDi) ±1 ns (SDp) ±1 ns (HD)	±3.5 ns (SDi, DPO7354) ±3.5 ns (SDi, DPO7254) ±3.0 ns (SDi, DPO7104, VM6000) ±2.5 ns (SDi, DPO7054) ±3.5 ns (SDp, DPO7354) ±3.5 ns (SDp, DPO7254) ±3.0 ns (SDp, DPO7104, VM6000) ±2.5 ns (SDp, DPO7054) ±2 ns (HD)	±2.6 ns (SDi, DPO7354) ±2.6 ns (SDi, DPO7254) ±2.2 ns (SDi, DPO7104, VM6000) ±2 ns (SDi, DPO7054) ±2.6 ns (SDp, DPO7354) ±2.6 ns (SDp, DPO7254) ±2.2 ns (SDp, DPO7104, VM6000) ±2 ns (SD,p DPO7054) ±2 ns (HD)
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[*11]	—	±40 ppm Hz/s (480i, Min 0.65 Hz, VM5000HD/TDS5104) ±40 ppm Hz/s (480i, Min 0.32 Hz, VM5000/TDS5104B)	—	±40 ppm Hz/s (RL: 40 MS, Min 0.25 Hz) ±40 ppm Hz/s (RL: 200 MS, Min 0.05 Hz)	—
Frequency Offset[*11]	—	±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)	—

Characteristic	Description	VM5000HD, VM5000, TDS5054, TDS5054B, TDS5104, TDS5104B		VM6000, DPO7054, DPO7104, DPO7254, DPO7354	
		Absolute	Relative to Reference	Absolute	Relative to Reference
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	(Typical, with the compressed Matrix Test signal)	—	—	—	—
V Cropping, First Active Line, Last Active Line	—	±1 lines	—	±1 lines	—
V Scaling	—	±1%	—	±1%	—
V Offset	—	±1 lines	—	±1 lines	—
H Cropping	—	±6 pixels of the smaller pattern (VM5000HD, TDS5054, TDS5104) ±3 pixels of the smaller pattern (VM5000, TDS5054B, TDS5104B)	—	±1 pixel of the smaller pattern	—
H Start, H End	—	±6 pixels of the smaller pattern (VM5000HD, TDS5054, TDS5104) ±3 pixels of the smaller pattern (VM5000, TDS5054B, TDS5104B)	—	±1 pixel of the smaller pattern	—
H Scaling	—	±1%	—	±1%	—
H Offset	—	±6 pixels of the smaller pattern (VM5000HD, TDS5054, TDS5104) ±3 pixels of the smaller pattern (VM5000, TDS5054B, TDS5104B)	—	±1 pixel of the smaller pattern	—

*9 For VM6000 Instrument Characteristics, please refer to the DPO7104 data sheet.

*10 SDi = SD Interlace, SDp = SD Progressive.

*11 RL = Record Length.

Option VGA Video Measurements*12

Characteristic	Description	VM5000HD, VM5000, TDS5104, TDS5104B	VM6000, DPO7104	DPO7254	DPO7354
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	±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	±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	±5 mV ±0.9% of reading
CH-CH Mismatch (%)		±0.7% ± (1.3%)×(Luma Level / Max Luma Level); Maximum of ±2.0%	±0.7% ± (0.9%)×(Luma Level / Max Luma Level); Maximum of ±1.6%	±0.7% ± (0.9%)×(Luma Level / Max Luma Level); Maximum of ±1.6%	±0.7% ± (0.9%)×(Luma Level / Max Luma Level); Maximum of ±1.6%
HV Sync Logic "0" and "1"	VESA 7.1 (P-P sync amplitude) = (logic 1 voltage) – (logic 0 voltage) (typical)	±[8 mV ± (0.01) × (P-P sync amplitude)] ±0.8% of reading	±[8 mV ± (0.01) × (P-P sync amplitude)] ±0.5% of reading	±[8 mV ± (0.01) × (P-P sync amplitude)] ±0.5% of reading	±[8 mV ± (0.01) × (P-P 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)	±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)	±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)	±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	5 to 10 bits
HV 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 P-P sync amplitude (typical)	Detects monotony as small as 1% of P-P sync amplitude (typical)	Detects monotony as small as 2% of P-P sync amplitude (typical)	Detects monotony as small as 2% of P-P sync amplitude (typical)
Noise					
Noise (mV) Measurement Range 8-15 mV	Measurement of RGB noise on constant pedestal, 0 to 700 mV. Output in mV$_{p-p}$, dB below 700 mV, VESA Sec 6.6. Displayed value corrected for instrument noise. Specification applies with 500 MHz bandwidth filter and 10 averages selected	±5.25 mV	±5.25 mV	±5.25 mV	±5.25 mV
Noise (mV) Measurement Range 15-25 mV		The lesser of ±7 mV or ±35%	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%		±0.75%	±0.75%	±0.75%	±0.75%
Noise Injection Ratio (%) Measurement Range 2.1% to 3.6%		±1%	±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	±600 ps
H Timing (ns) – Front and Back Porch, Left and Right Border, Addressable Video	—	360 ps ±15 ppm × Reading	360 ps ±2.5 ppm × Reading	360 ps ±2.5 ppm × Reading	360 ps ±2.5 ppm × Reading
H Sync Period, H and V Sync Pulse Width (ns)	—	80 ps ±15 ppm × Reading	80 ps ±2.5 ppm × Reading	80 ps ±2.5 ppm × Reading	80 ps ±2.5 ppm × Reading
V Sync Period (µs)	Readout (precision) is 1 µs	20 ns ±15 ppm × Reading	20 ns ±2.5 ppm × Reading	20 ns ±2.5 ppm × Reading	20 ns ±2.5 ppm × Reading
V Timing (Lines) – Front and Back Porch, Top and Bottom Border, Addressable Lines	Readout (precision) is 1 line. Functions within ±10 lines of VESA reference value	—	—	—	—

Characteristic	Description	VM5000HD, VM5000, TDS5104, TDS5104B	VM6000, DPO7104	DPO7254	DPO7354
Frequency					
H and V Sync, Pixel Clock Frequency	—	±0.01% of reading	±0.01% of reading	±0.01% of reading	±0.01% of reading
Transient Response					
Video Rise and Fall Time Measurement Range >1.3 ns	VESA 6.8 (typical)	±5.0% of reading	±5.0% of reading	±5.0% of reading	±5.0% of reading
Video Rise and Fall Time Measurement Range 800 ps to 1.3 ns		±10% of reading	±10% of reading	±10% of reading	±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)	±20% of reading	±20% of reading	±20% of reading	±20% of reading
RGB System Rise Time	(Typical)	350 ps	350 ps	225 ps	210 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)	±5.0%	±5.0%	±5.0%	±5.0%
Sync Rise and Fall Time Measurement Range 2 ns to 5 ns	(Typical)	±11%	±11%	±11%	±11%
RGB and HV Sync Overshoot and Undershoot Amplitude %, Settle Time: 0-1 ns	(Typical)	±2% of reading	±2% of reading	±2% of reading	±2% of reading
RGB and HV Sync Overshoot and Undershoot Amplitude %, Settle Time: 1-10 ns	(Typical)	±1% of reading	±1% of reading	±1% of reading	±1% of reading
RGB and HV Sync Overshoot and Undershoot Settling Time, Amplitude >5%	VESA 6.3 (typical)	±T rise	±T rise	±T rise	±T rise
Jitter					
H Sync Jitter (ns)	VESA 7.5. Requires VESA compliant amplitude, noise, rise, and fall characteristics	100 ps ±15 ppm × H Sync period	100 ps ±2.5 ppm × H Sync period	100 ps ±2.5 ppm × H Sync period	100 ps ±2.5 ppm × H Sync period
H Sync Jitter (% of Pixel Clock Period) Measurement Range: <200 MHz PCF		<4%	<3%	<3%	<3%
H Sync Jitter (% of Pixel Clock Period) Measurement Range: 200 to 400 MHz PCF		<7.5%	<5%	<5%	<5%

*12 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
HV Channels Input Capacitance	3 pF (typical)	—	—
Current Source Loads (HV channels)	—	+8 mA ±2.5% –8 mA ±2.5%	Current sources provide loads for V0H and V0L testing of HV 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 and 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 and 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 and Pr
Sweep	720p, 1080i, and 1080p	5 to 35 MHz for Y, G, B, R 2.5 to 15 MHz for Pb and Pr
	480p and 576p	2 to 12 MHz for Y, G, B, R 1 to 6 MHz for Pb and Pr
	480i and 576i	0.5 to 6 MHz for Y, G, B, R 0.5 to 3 MHz for Pb and 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 and Pr
Pulse and Bar	YPbPr and RGB	2T Pulse Response with equivalent bar rise and bar fall. Pb and Pr are twice the duration of Y, G, B, R

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General

Display Characteristics

Characteristic	Description
Display Type	Liquid-crystal active-matrix color display
Display Size	Diagonal: 307.3 mm (12.1 in.)
Display Resolution	XGA 1024 (H) × 768 (V) 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

Characteristic	Description
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-xx for small keyboard (fits in pouch); USB interface and hub

Input/Output Ports

Characteristic	Description
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 resistance is ≥1.5 kΩ
Probe Compensator Output	Front-panel pins Amplitude: 1 V ±20% into a ≥50 Ω load; 500 mV from base to top into a 50 Ω load Frequency: 1 kHz ±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 MΩ)
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}, ±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 CH3 input when CH3 is selected as trigger source
Amplitude	50 mV/div ±20% into a 1 MΩ load 25 mV/div ±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

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

Rackmount Configuration

Dimension	mm	in.
Height	323	12.25
Width	479	18.85
Depth (from rackmounting ear to back of instrument)	231.75	9.12
Weight	**kg**	**lb.**
Net	17.4	37.5
Kit	2.5	5.5

Mechanical

Cooling – Required Clearance

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

Environmental

Characteristic	Description
Temperature	
Operating	+10 °C to +45 °C
Nonoperating	–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, noncondensing. Upper limit derated to 45% RH above +30 °C up to +50 °C
Nonoperating	5% to 95% relative humidity (RH) with a maximum wet bulb temperature of +29 °C at or below +60 °C, noncondensing. Upper limit derated to 45% RH above +30 °C up to +50 °C
Altitude	
Operating	10,000 ft. (3,048 m)
Nonoperating	40,000 ft. (12,190 m)
Random Vibration	
Operating	0.000125 G^2/Hz from 5 to 350 Hz
	–3 dB/octave from 350 to 500 Hz
	0.0000876 G^2/Hz at 500 Hz
	Overall level of 0.27 G_{RMS}
Nonoperating	0.0175 G^2/Hz from 5 to 100 Hz
	–3 dB/octave from 100 to 200 Hz
	0.00875 G^2/Hz from 200 to 350 Hz
	–3 dB/octave from 350 to 500 Hz
	0.006132 G^2/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

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Ordering Information

VM6000

Item/Option	Order Number / Description
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, 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. **Note**: Please specify language and power cord options when ordering.
Video Measurement Accessory Kit (VM)	
Sync Pick-off Accessory	012-1680-xx
75 Ω BNC Termination (Qty. 4)	011-0102-xx
BNC T's (Qty. 4)	103-0030-xx
TPA-BNC Adapter, Sync Combiner	012-1664-xx
VM6000 User Manual	071-2103-xx
VM6000 Product Software CD-ROM	020-2767-xx
VM6000 Programmer's Manual	071-2104-xx
Note: Requires at least one of Option SD, HD, or VGA with each new instrument ordered.	
Note: User to specify quick-start user manual language, and power plug when ordering.	
Opt. HD	Option key enabling HD format support
TPA-BNC Adapter	013-0355-xx
Opt. SD	Option key enabling SD format support
TPA-BNC Adapter	013-0355-xx
Opt. VGA	Option key enabling VGA option
RGBHV Measurement Interface Unit	012-1685-xx
TPA-BNC Adapter (Qty. 4)	013-0355-xx
Opt. SS	
Signal Sources Package (Single instrument license)	020-2769-xx

VM6UP

Item/Option	Order Number / Description
Video Measurement Accessory Kit (VM)	**Note**: User to specify quick-start user manual language, and power plug when ordering.
VM Series User Manual	071-2103-xx
VM Series Product Software CD-ROM	020-2767-xx
Option VM	
Sync Pick-off Accessory	012-1680-xx
75 Ω BNC Termination (Qty. 4)	011-0102-xx
BNC T's (Qty. 4)	103-0030-xx
Sync Combiner	012-1664-xx
Option HD	Option key enabling HD format support
Sync Pick-off Accessory	012-1680-xx
TPA-BNC Adapter	010-0753-xx
Option SD	Option key enabling SD format support
Sync Pick-off Accessory	012-1680-xx
TPA-BNC Adapter	010-0753-xx
Option VGA	Option key enabling VGA option
RGBHV Measurement Interface Unit	012-1685-xx
TPA-BNC Adapter (Qty. 4)	010-0753-xx
Option SS	
Signal Sources Package (Single instrument license)	020-2769-xx

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Options

VM6000 Instrument Options

Option	Description
Video Measurement	
Opt. SD*13	SD component analog video measurements and format support
Opt. HD*13	HD component analog video measurements and format support
Opt. VGA*13	RGBHV Video Measurements and VESA Compliance Tests
Opt. SS	Signal sources
Record Length	
Opt. 2RL	80 MS max 20 MS/CH
Opt. 5RL	200 MS max 50 MS/CH
Hardware	
Opt. 2SR	Double maximum real-time sample rate: 40 GS/s (1 channel) 20 GS/s (2 channels) 10 GS/s (3 or 4 channels)
Opt. 1P	Thermal printer in the porch
Software	LSA, JE3, ET3*14,JA3, USB*15, MTM, PWR

*13 At least one of Option SD, HD, or VGA is mandatory for each VM6000 instrument.

*14 Requires Ethernet Test Fixture.

*15 Requires TDSUSBF (USB Test Fixture), supports USB 2.0 low-speed and full-speed compliance testing.

User Manual Options

Option	Description
Opt. L0	English Manual
Opt. L1	French Manual
Opt. L3	German Manual
Opt. L5	Japanese Manual
Opt. L7	Simple Chinese Manual
Opt. L8	Standard Chinese Manual
Opt. L9	Korean Manual
Opt. L10	Russian Manual

Power Plug Options

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

Service Options

Option	Description
Opt. CA1	Single Calibration or Functional Verification
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	Upgrade Installation Service

Recommended Accessories

Probes

Probe	Description
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*16	1 GHz differential probe
P6243*16	1 GHz active probe
P6245*16	1.5 GHz active probe
P6248*16	1.5 GHz differential probe
P5050	500 MHz, 10X passive probe
P6246	400 MHz differential probe
P6101B	1X passive probe 15 MHz
TCPA300/TCPA400*16	Series current measurement systems
P5200/P5205/P5210*16	High-voltage differential probes
P5100/P6015A*16	High-voltage probes
TCP0030	100 MHz TekVPI AC/DC 30 A current probe

*16 Probe requires TPA-BNC adapter.

Cables

Cable	Order Number
VGA to 5X BNC cable, 6 in.	174-5147-xx
VGA to 5X BNC cable, 1 m	174-5126-xx
GPIB Cable (1 m)	012-0991-xx
GPIB Cable (2 m)	012-0991-xx
RS-232 Cable	012-1298-xx or 012-1692-xx
Centronics Cable	012-1214-xx

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Accessories

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

Software

WSTRO – WaveStar™ waveform capture and documentation software.

Test Fixtures

Fixture	Order Number
Sync Pick-off Accessory	012-1680-xx
Sync Combiner Accessory	012-1664-xx
RGBHV Measurement Interface Unit	012-1685-xx
TDSUSBF	Test fixture for use with Opt. USB
Power Deskew Fixture	067-1478-xx
Ethernet Test Fixture	Order through Crescent Heart Software (http://www.c-h-s.com)

Adapters

Adapter	Order Number
TPA-BNC	TekVPI to BNC adapter
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, RL02, RL05, RL25, ET3, USB, MTM, PWR, JA3, JE3, LSA, CP2, J2, HT3. To upgrade other Tektronix oscilloscopes, please consult the following table for platform requirements, mandatory options, functionality, and option availability.

Product	Upgrade Kit	Option				
		VM	SD	HD	VGA	SS[19]
DPO7054[20, 21]	VM6UP	X[17]	X	X	NA	X
DPO7104[20, 21]		X[17]	X	X	X	X
DPO7254[20, 21]		X[17]	X	X	X	X
DPO7354[20, 21]		X[17]	X	X	X	X
VM6000		NA[18]	X	X	X	X

NA = Not Available

[17] Option VM is a mandatory option for all DPO oscilloscope upgrades (VM6UP), but it is not needed on purchasing 2nd upgrade kit for the unit which has same serial number.

[18] Option VM is default enabled/included with VM6000. Not required for upgrade kits.

[19] Requires the indication of the serial number of the unit.

[20] The other upgrade kit than Option VM, SD, HD, VGA, SS for DPO7054, DPO7104, DPO7254, and DPO7354 is provided from the DPO7UP kit.

[21] The application for DPO7000 needs V4.0.0, or above.

CE

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

GPIB
IEEE-488

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

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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**

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