

VM5000
Automatic Video Measurement Set
Quick Start User Manual

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- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

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Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Connect and Disconnect Properly. De-energize the circuit under test before connecting or disconnecting the current probe.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

Do not connect a current probe to any wire that carries voltages above the current probe voltage rating.

Power Disconnect. The power switch disconnects the product from the power source. See instructions for the location. Do not block the power switch; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in this Manual

These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



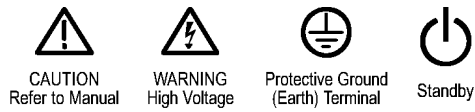
CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbols may appear on the product:



Preface

This manual describes the installation and basic operation of the VM5000 Automatic Video Measurement Set. For more detailed information, see the online help on your instrument and the *VM5000 Automatic Video Measurement Set User Manual*.

Key Features

The VM5000 Automatic Video Measurement Set is a high-performance automated video measurement system based on an oscilloscope platform. Key features include:

- Fast, accurate, and reliable video measurements
- Comprehensive component analog signal analysis
- Automated testing of PC and DTV consumer video devices
- Automated VESA compliance testing for PC graphics devices
- Support for SD, HDTV, and RGBHV component analog video formats via options
- Picture, Vector, and Waveform Displays
- Integrated Pass-Fail limit testing
- Companion Test Signal Packages
- GPIB Remote Control and LAN Connectivity
- Complete Oscilloscope Functionality

Documentation

To read about	Use these documents
Installation and operation (overviews)	<i>VM5000 Automatic Video Measurement Set Quick Start User Manual</i> . The quick start user manual contains general information about how to put your instrument into service, guides to user interface controls, and application examples.
In-depth operation and user interface help	<i>VM5000 Automatic Video Measurement Set User Manual</i> . The user manual contains detailed information about how to operate the instrument, including how measurements are calculated, and specifications. <i>VM5000 Online Help</i> . Access the online help from the VM5000 software Help menu for information on controls and elements on the display.
Programming Commands	<i>VM5000 Automatic Video Measurement Set Programmer Manual</i> . The programming commands that apply specifically to the VM5000 are located in a PDF file located on the VM5000 product software CD. The programmer manual for the TDS5000B is a PDF file on the TDS5000B product software CD.
Oscilloscope Usage	Refer to the TDS5000B documentation for full information on using the oscilloscope features of the VM5000.
User Service and Performance Verification	Refer to the service manual for the TDS5000B Series.

Software Upgrades

Periodic software upgrades may become available. The software is only operational if you have a valid option key for the specific oscilloscope model and serial number.

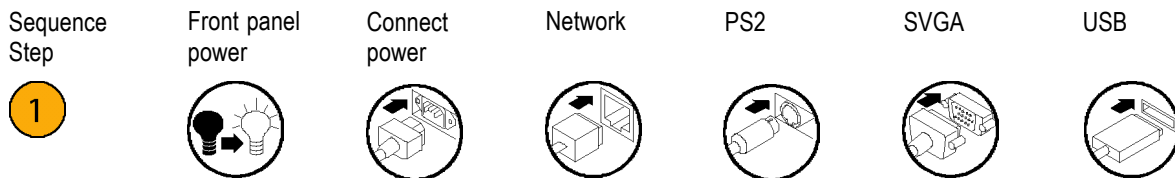
To check for upgrades:

1. Go to the Tektronix Web site (www.tektronix.com).
2. Select **Software and Drivers** to link to the **Software and Firmware Finder** Web page.
3. Enter the product name (VM5000) to find available software upgrades.

Conventions Used in this Manual

This manual describes how to operate VM5000 Options SD, HD, and VGA. Although the methods of operation are identical in all three options, there are some differences in features; most notably the available measurements. Where there are differences in configuration or application, they are identified in the text by the option to which they apply. Where there are differences in the screen display, both versions are shown (Option SD/HD and Option VGA).

The following icons are used throughout this manual.



Installing Your Instrument

This section contains information on installing and getting acquainted with your instrument.

Unpacking the Instrument

Carefully unpack your instrument and verify that it includes the standard accessories.

VM5000 Standard Accessories

Accessory	Part number
VM5000 Automatic Video Measurement Set Quick Start User Manual in English, and French, German, Spanish, Traditional Chinese, Simplified Chinese, or Japanese translation if a language option was ordered	071-1573-XX
VM5000 Automatic Video Measurement Set User Manual	071-1522-XX
VM5000 Automatic Video Measurement Set Programmer Manual in PDF format on VM5000 Product Software CD	071-1574-XX
VM5000 DVD Signal Set (Option SD only)	020-2610-XX
VM5000 MPEG and Baseband Signal Set (Option SD/HD only)	020-2611-XX
VM5000 PC Bitmap Graphics Test Signal Files (Option VGA only)	020-2634-XX
TDS5000B Series Digital Phosphor Oscilloscopes Quick Start User Manual	071-1355-XX
Oscilloscope Analysis and Connectivity Made Easy manual with software	020-2449-XX
VM5000 Product Software CD-ROM that includes VM5000 product software with online help, VM5000 User Manual PDF, VM5000 Quick Start User Manual PDF, and release notes	020-2565-XX
TDS5000B Series Product Software CD-ROM that includes TDS5000B product software including online help, TDS5000B Programmer Guide (GPIO online help and PDF), Performance Verification PDF, release notes, and VISA information	063-3692-XX
TDS5000B Series OS Restore CD-ROM	063-3579-XX
TDS5000B Series Optional Applications Software CD-ROM	020-2450-XX
P5050 10X, 500 MHz, Passive Voltage Probe	P5050
Getting Started with OpenChoice™ book and Software Developer's Kit CD-ROM	020-2513-XX
30-day evaluation copy of LabVIEW	020-2476-XX
Calibration certificate documenting NIST traceability, Z540-1 compliance, and ISO9001 registration	— —
U.S. power cord	161-0104-00
Mouse	119-6936-XX
Mini-keyboard	118-9402-XX
Front cover	200-4651-XX
Accessory pouch	016-1935-XX
Blank CDR / CDRW	020-2434-XX
Click'N Burn CD	063-3575-XX
Precision 75 Ω terminations (4)	011-0102-XX
BNC female-to-female connector	103-0028-XX

VM5000 Standard Accessories (cont.)

Accessory	Part number
BNC male-to-male connector	103-0029-XX
BNC "T" connectors (4)	103-0030-XX
Sync pickoff cable (Option SD/HD only)	012-1680-XX
VGA to 5X BNC cable (6 in. long) (Option VGA only)	174-5147-XX
VGA to 5X BNC cable (3 ft. long) (Option VGA only)	174-5126-XX
RGBHV Measurement Interface Unit (Option VGA only)	012-1685-XX
RS-232 RGBHV MIU Control Cable (Option VGA only)	012-1692-XX
BNC-to-Binding Post Adapters (2) (Option VGA Only)	011-0183-00
2.21 k Ω resistor	322-3226-00
301 Ω resistor	322-3143-00
VGA Sync Combiner cable	012-1664-XX

Your instrument may also include optional accessories. Verify that the optional accessories you ordered are included with your instrument.

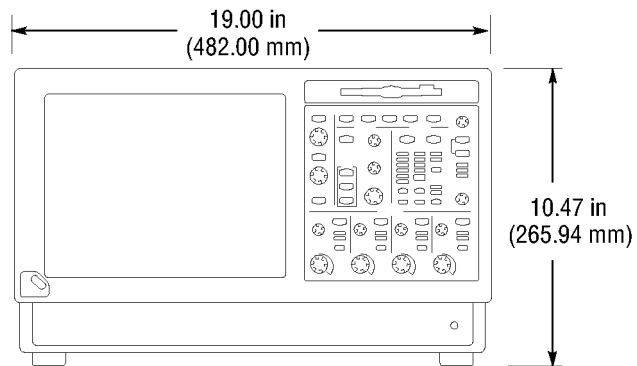
VM5000 Recommended Accessories ¹

Accessory	Part number
<i>TDS5000B Series Digital Phosphor Oscilloscopes Service Manual</i>	071-1362-XX
Transit case	016-1937-XX
Probe calibration, compensation, and deskew adapter	067-0405-XX
Power deskew fixture	067-1478-00
Video display clamp	013-0278-XX
P5050 500 MHz 10x passive probe	P5050
GPIOB cable (3.3 ft. or 1 m)	012-0991-01
GPIOB cable (6.6 ft. or 2 m)	012-0991-00
Centronics (printer) cable	012-1214-00

¹ For the current list of accessories, upgrades, and options, including service options, available for your VM5000, visit the Tektronix Web site, www.tektronix.com.

Operating Requirements

- Place the instrument on a cart or bench, observing clearance requirements:
 - Top, Rear, Front, and Right Side: 0 in (0 mm)
 - Left Side: 3 in (76 mm)
 - Bottom: 0.75 in (19 mm) minimum or 0 in (0 mm) standing on feet, flip stand down
- Before operating, ensure that the ambient temperature is between +41 °F and +113 °F (+5 °C to +45 °C).



CAUTION. To ensure proper cooling, keep the bottom and sides of the instrument clear of obstructions.

Powering On the Instrument

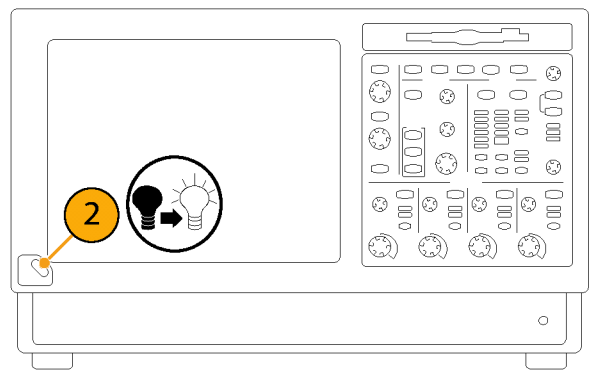
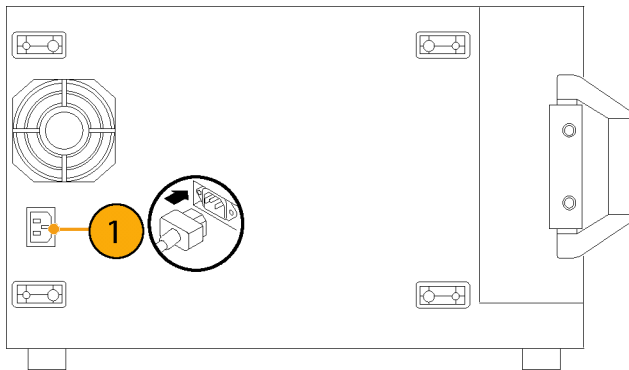
Power Supply Requirements

Source voltage and frequency

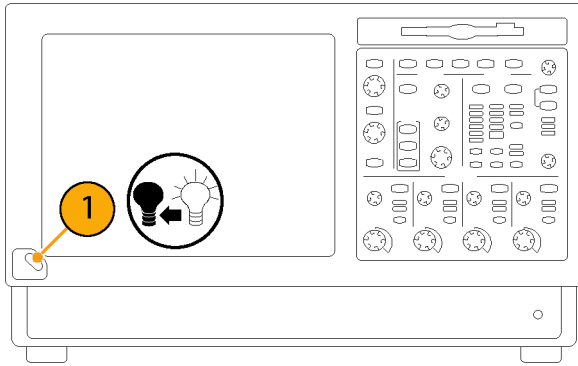
100-240 V_{RMS} ±10%, 47-63 Hz or 115 V_{RMS} ±10%,
360-440 Hz

Power consumption

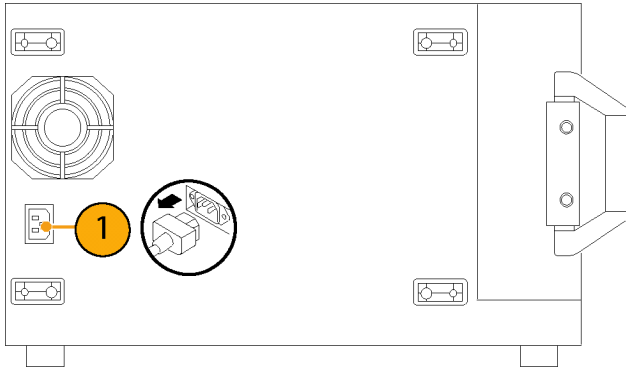
< 220 watts



Powering Off the Instrument

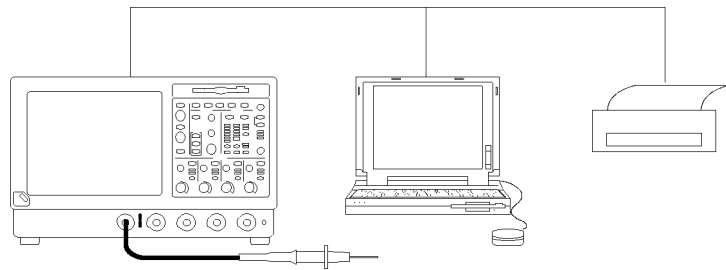


Removing the Power



Connecting to a Network

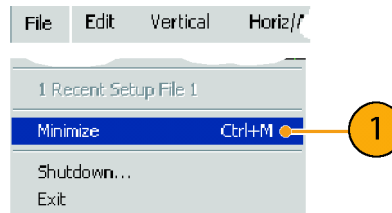
You can connect your instrument to a network for printing, file sharing, internet access, and other functions. Consult with your network administrator and use the standard Windows utilities to configure the instrument for your network.



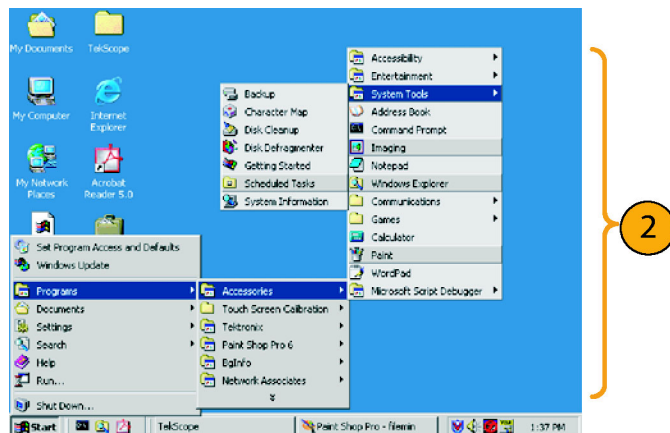
Creating an Emergency Startup Disk

Create an emergency startup disk that you can use to restart your instrument in case of a major hardware or software failure. Store this disk in a safe place.

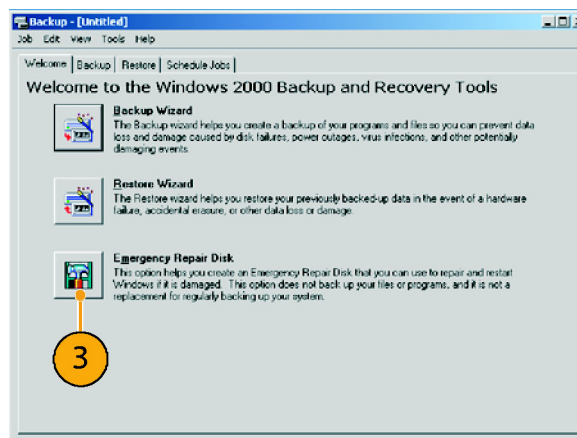
1. If the TekScope software is running, select **File > Minimize**.



2. Select **Start > Programs > Accessories > System Tools > Backup**.

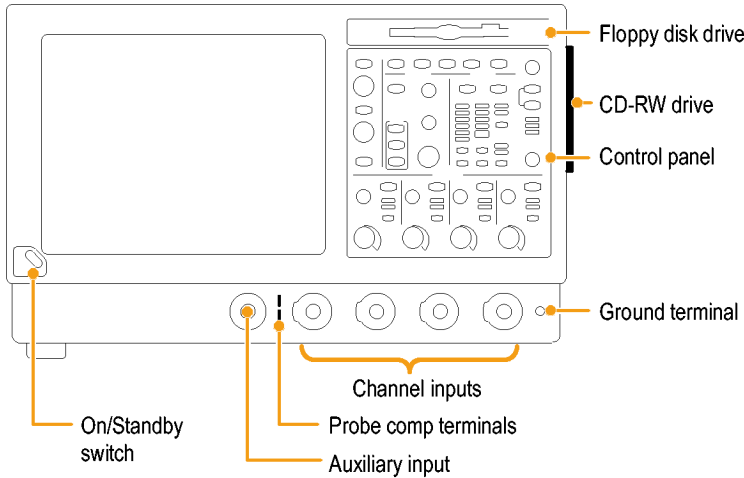


3. Select **Emergency Repair Disk** and follow the on-screen instructions.

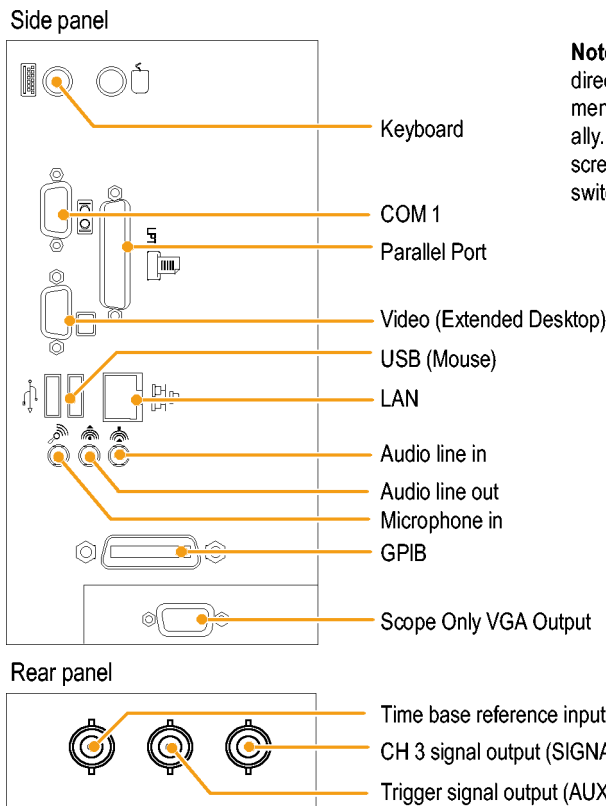


Getting Acquainted with Your Instrument

Front Panel



Side and Rear Panels

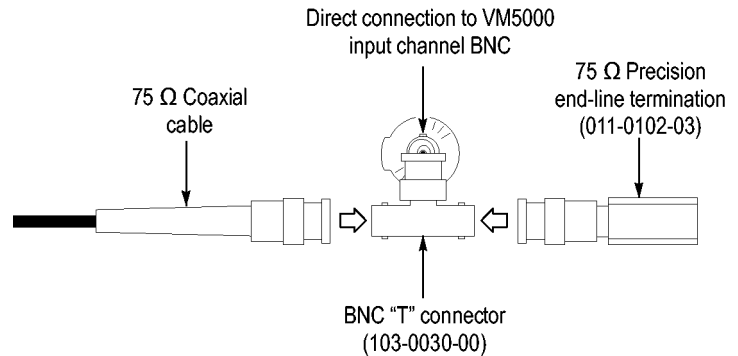


Note. To improve reliability, plug USB devices directly into the USB connectors on the instrument rather than connecting the devices serially. If the instrument front panel and /or touch screen do not respond, press the On/Standby switch for 5 seconds to cycle power.

Input Connection Requirements – Options SD/HD

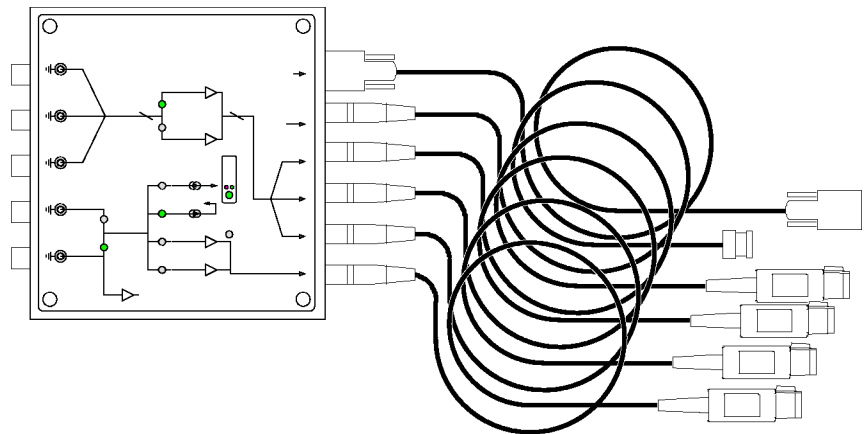
Use only 75 Ω coaxial cables to connect the video device under test to the VM5000 instrument.

Install the included 75 Ω terminations between the end of the coaxial cables and the instrument input channels, using the included BNC T connectors. To achieve accurate frequency response measurements, it is important to attach the T connectors directly to the input channel BNCs.

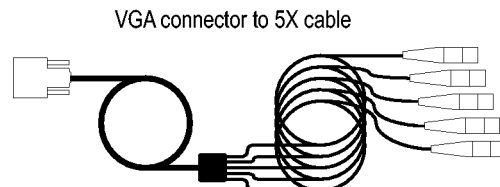


Input Connection Requirements – Option VGA

The preferred method of connecting the video device under test to the VM5000 instrument is to use the RGBHV Measurement Interface Unit. The Measurement Interface Unit contains an impedance-matching circuit to ensure accurate measurement results. For some measurements, a low-frequency path is used and for other measurements a wideband path is used. The VM5000 selects which path is used through an RS-232 connection to the Measurement Interface Unit.



You can also connect the video device under test to the VM5000 by using the supplied VGA connector to 5X cable. If you use this method, you will need to connect the cable to the VM5000 using the supplied precision terminations and you may need to manually change terminations while taking measurements, depending on which measurements you take.



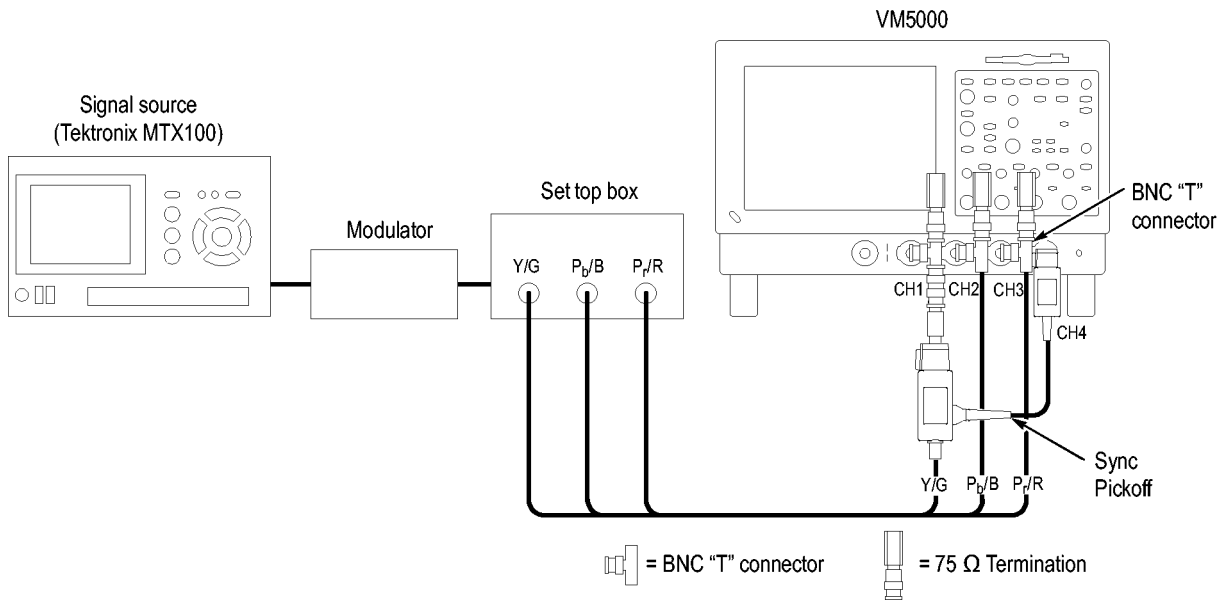
Connecting Input Signals

Option SD/HD Setup 1

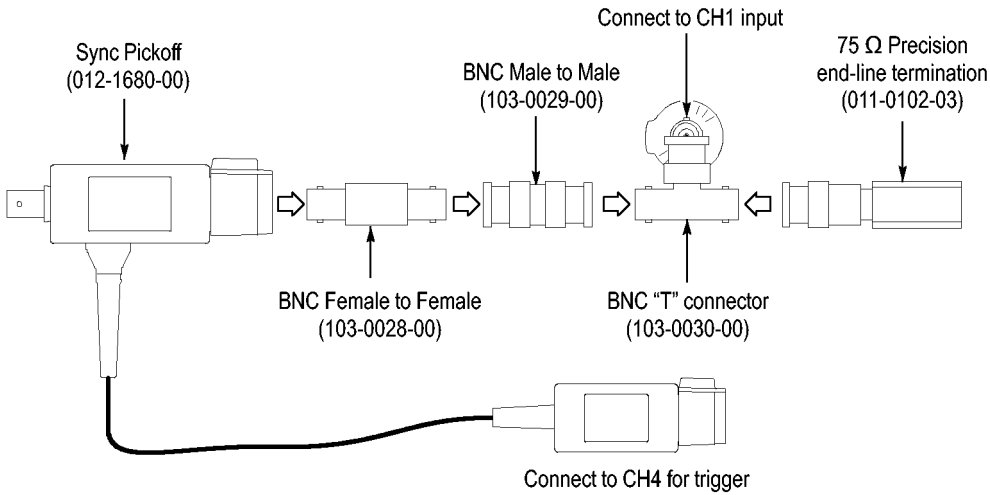
Setup 1 is the preferred setup for testing 3-wire component analog video signals (Y/G, Pb/B, Pr/R) with the composite sync signal on Y/G. This setup uses the sync pickoff accessory to derive the trigger signal from the Y/G signal on CH1. The triggering source is set to Channel 4. This configuration provides more accurate low-level noise measurements (below -60 dB at 30 MHz bandwidth) than setup 2.

This type of connection allows you to make more accurate noise measurements on CH1 while triggering on CH4, without adding additional cabling between CH1 and CH4. The additional cabling could adversely impact frequency response and multiburst measurements.

To achieve the best frequency response and multiburst measurements, the 75 Ω termination should be connected as close to the input connector as possible, as shown in the setup illustration.



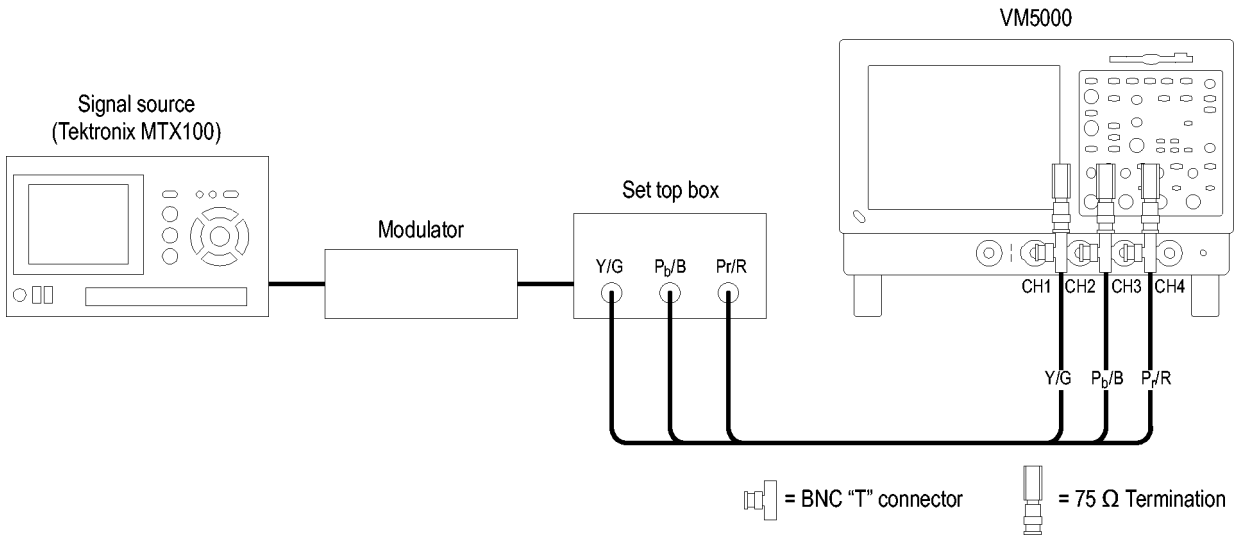
The following illustration shows how to connect the Sync Pickoff to the CH1 input.



NOTE. Verify that the trigger channel is set to channel 4 (the default setting). If the trigger setting (Configuration > Operation) is not set to CH4, you will see signal warning messages and be unable to take measurements.

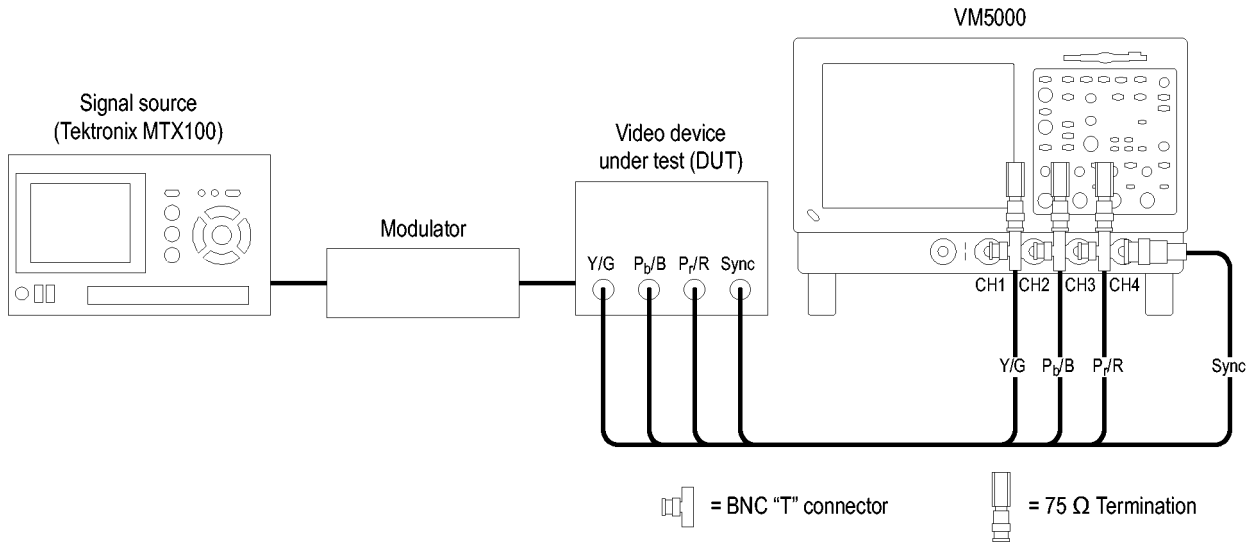
Option SD/HD Setup 2 - Three-Wire Analog Video with Composite Sync

Use this setup for testing 3-wire component analog video signals (Y/G, Pb/B, Pr/R) with the composite sync signal on Y/G. Set the triggering on the instrument to channel 1 (the default trigger setting is CH4). This setup is simpler than the others mentioned in this section, but limits noise measurement on Y/G to -65 dB (30 MHz noise bandwidth).



Option SD/HD Setup 3 - Four-Wire Analog Video with Separate Composite Sync

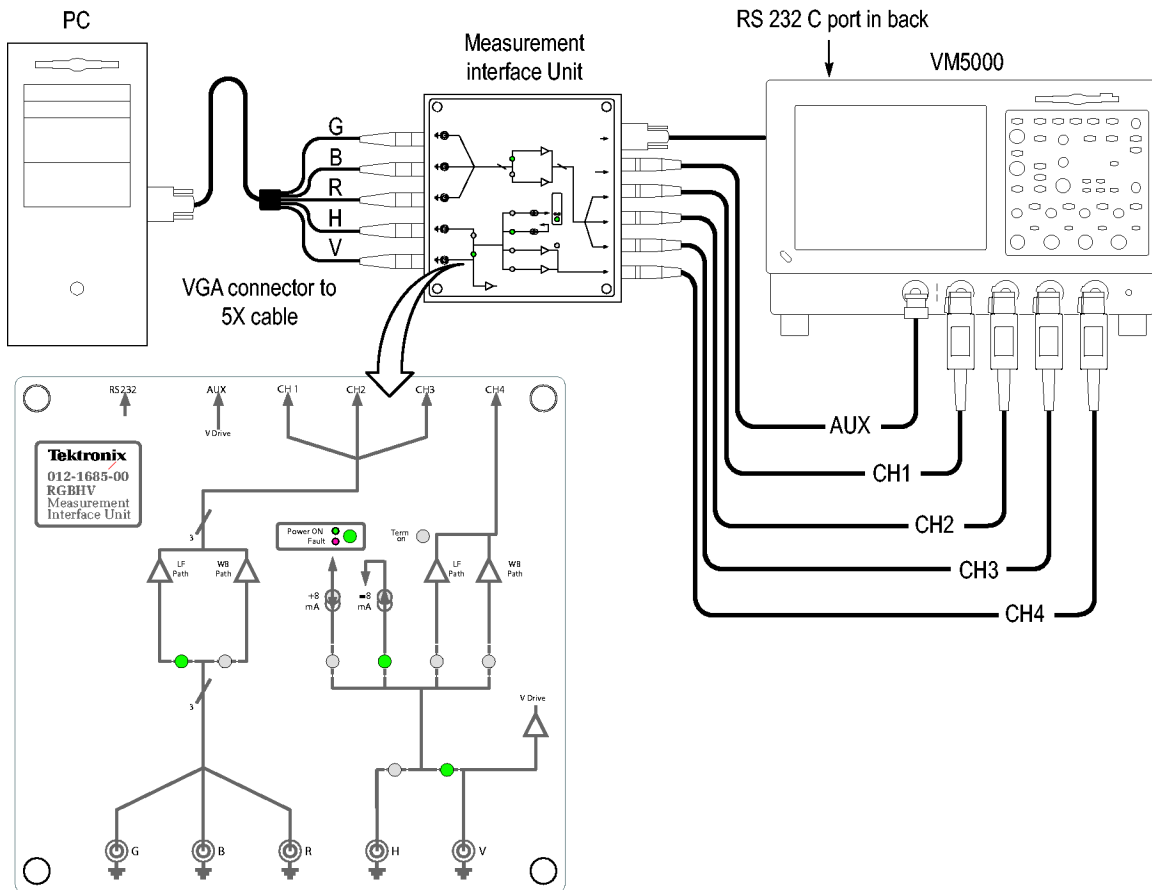
Use this setup for testing 4-wire component analog video signals (Y/G, Pb/B, Pr/R) with the composite sync signal on a separate output line. For CH4 only, you can connect the signal without using a termination or you can use a 75 Ω termination of lower accuracy than the 75 Ω terminations that are provided with the instrument.



NOTE. Verify that the trigger channel is set to channel 4 (the default trigger channel). If the trigger setting is not set to CH4 (Configuration > Operation), you will see signal warning messages and be unable to take measurements.

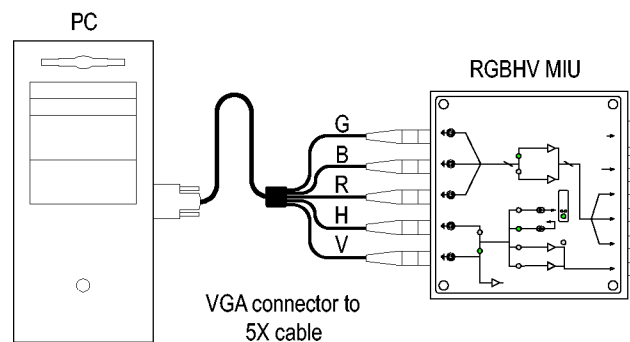
Option VGA Setup 1 - RGBHV Measurement Interface Unit

This is the preferred setup for testing PC and play-out device video. Use the RGBHV Measurement Interface Unit to connect the PC video card to the VM5000. Using the RGBHV MIU provides the most accurate measurement results.

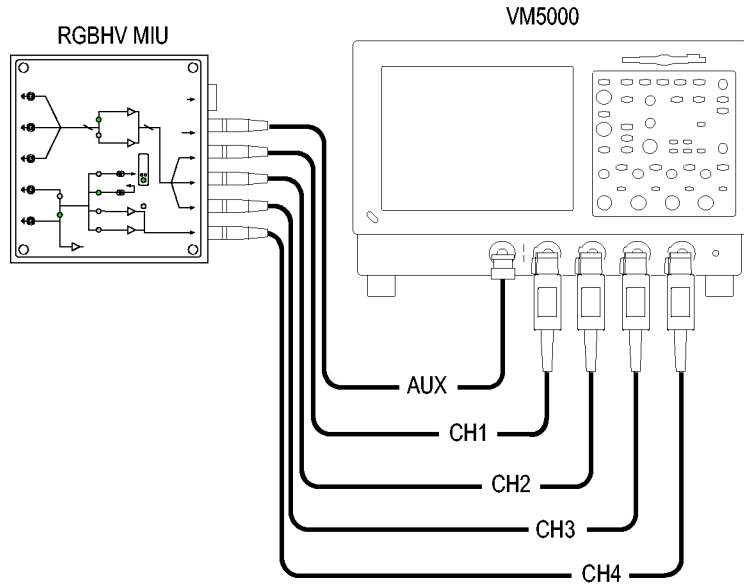


To connect the RGBHV Measurement Interface Unit:

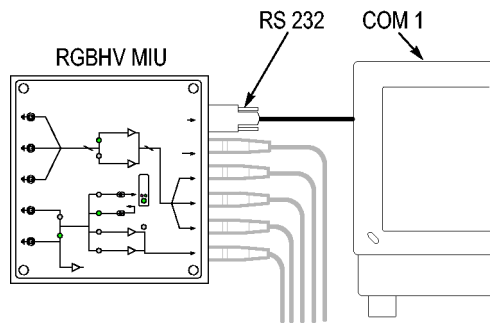
1. Connect the device-under-test (DUT) to the input side of the RGBHV Measurement Interface Unit using one of the VGA-to-BNC adapter cables supplied with your VM5000.



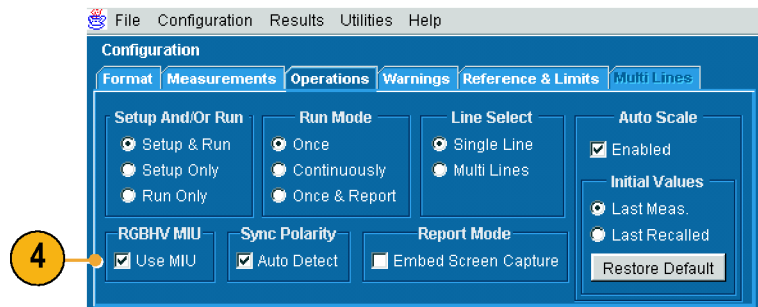
2. Connect the outputs (Aux, CH1–CH4) of the RGBHV Measurement Interface Unit to same inputs on the VM5000 (that is, connect the CH1 output to the CH1 input).



3. Connect the RS-232 cable between the RGBHV Measurement Interface Unit and the COM1 port on the VM5000.



4. Verify that the **Use MIU** checkbox on the Configuration > Operations tab is selected.

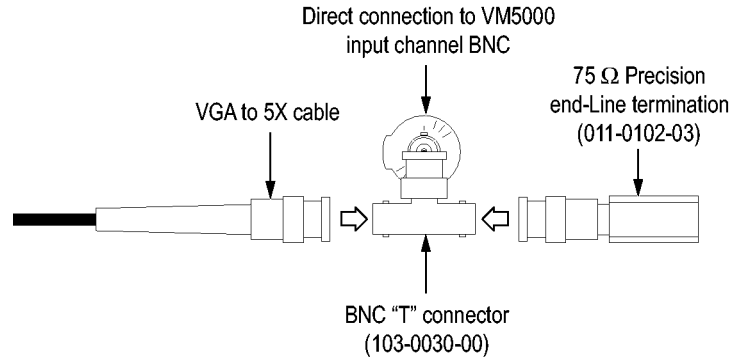


Option VGA Setup 2 - VGA Connector to 5X Cable

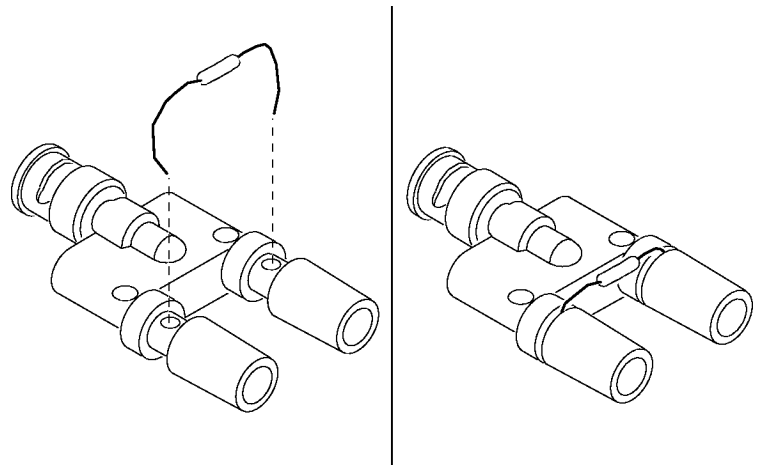
Use this setup for testing PC and play-out device video when it is not convenient to use the RGBHV Measurement Interface Unit. To ensure accurate measurements, connect the signals to the VM5000 using the T-connectors and precision terminations on CH1-CH4. You must use $75\ \Omega$ terminations on CH1-CH3 (used for GBR) and $2.21\ \text{k}\Omega$ and $301\ \Omega$ terminations on CH4 (used for H Sync and V Sync measurements). This method requires you to change the signal and termination connections on CH4 for certain horizontal and vertical measurements. The VM5000 displays a dialog box prompting you to make these changes when necessary (the RGBHV Measurement Interface Unit performs these connection and termination changes internally).

To connect the DUT to the VM5000 using a VGA to 5X cable:

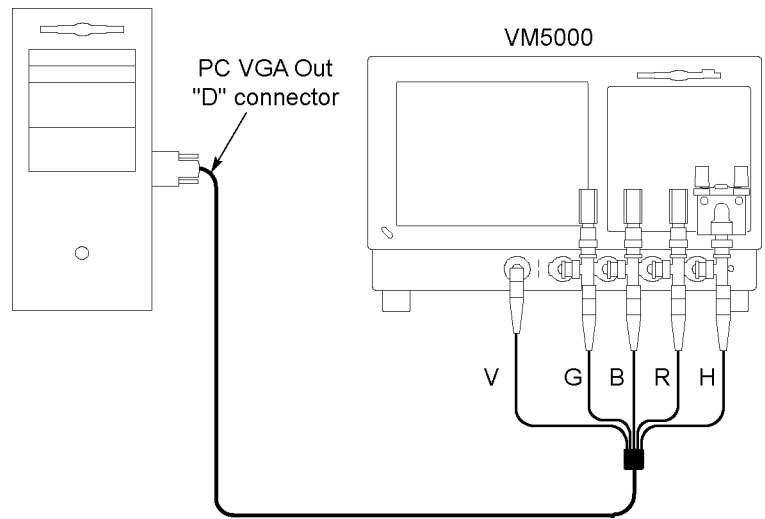
1. Install the included $75\ \Omega$ terminations between the end of the BNC cables and the instrument input channels 1 through 3, using the included BNC T-connectors. To achieve accurate measurements, it is important to attach the T-connectors directly to the input channel BNCs.



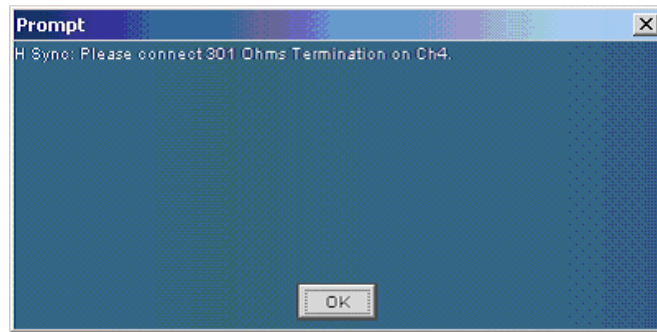
2. If you will be making H Sync, V Sync, or V Timing measurements, you will need to make $2.21\ \text{k}\Omega$ and $301\ \Omega$ terminations using the BNC-to-Binding Post adapters and resistors supplied as standard accessories. Attach each resistor to an adapter as shown.



3. Connect the VGA signals to the VM5000 as shown. Connect the H Sync signal using the 2.21 k Ω termination to begin with. The VM5000 will prompt you to change it to the 301 Ω termination as necessary.



A pop-up warning prompts you to change signal termination on CH4 when making an H Sync measurement.



The following table identifies which signal from the DUT should be connected to which input connector on the VM5000 and which termination should be used for each signal.

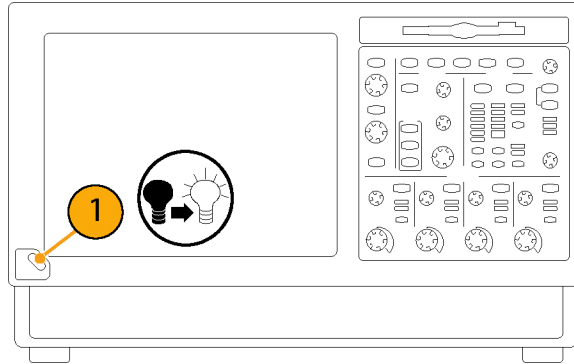
VGA signal	VM5000 input connector	Termination
Green	CH 1	75 Ω
Blue	CH 2	75 Ω
Red	CH 3	75 Ω
H Sync	CH 4 ¹	2.21 k Ω and 301 Ω
V Sync	AUX	None

¹ V Sync signal is connected to this channel when making a V Timing or V Sync measurement. The VM5000 will prompt you for this connection change if necessary.

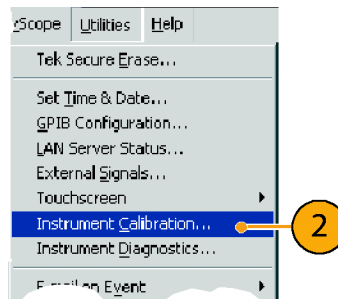
Signal Path Compensation

Use this procedure if the temperature has changed more than 5 °C since the last signal path compensation. Perform the signal path compensation once a week. Failure to do so may result in the instrument not meeting warranted performance levels at those volts/div settings.

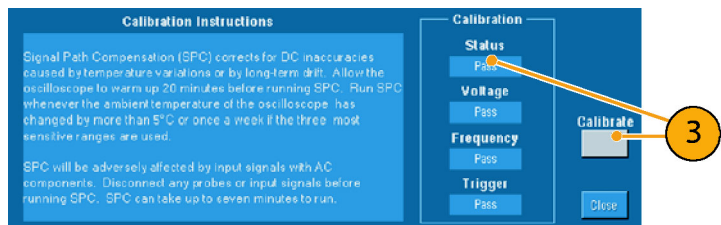
1. Prerequisites: instrument powered on for 20 minutes and all input signals removed.



2. Select Instrument Calibration.

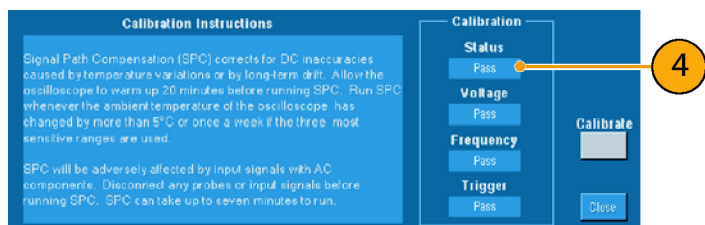


3. When Status reads Temp, click Calibrate to start the calibration. Calibration may take 10 to 15 minutes.



NOTE. Signal Path Compensation is the only available calibration.

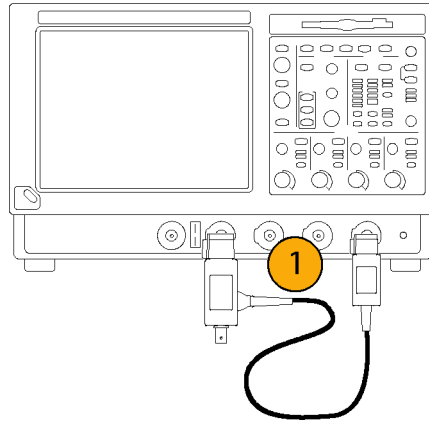
4. After calibration, if the status indicator does not display Pass, recalibrate the instrument or have the instrument serviced by qualified service personnel.



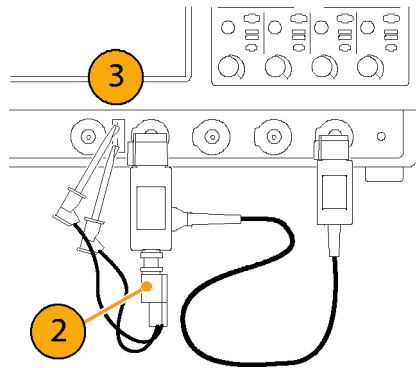
Sync Pickoff Compensation – Options SD/HD Only

To properly compensate the sync pickoff:

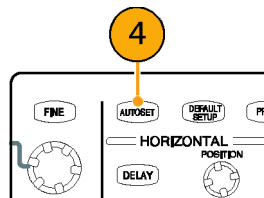
1. Connect the sync pickoff cable to channel 1.



2. Attach the sync pickoff BNC connector to a BNC-to-minigrabbers connector (Pomona Electronics model number 3789).
3. Connect the minigrabbers to the PROBE COMP connector.



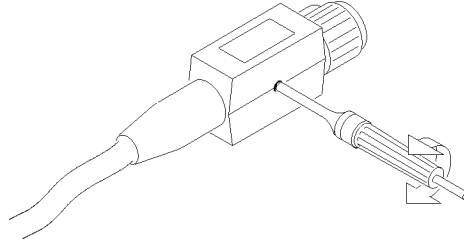
4. Push **AUTOSET**.



5. Check the shape of the displayed waveform to determine if the sync pickoff is compensated correctly.

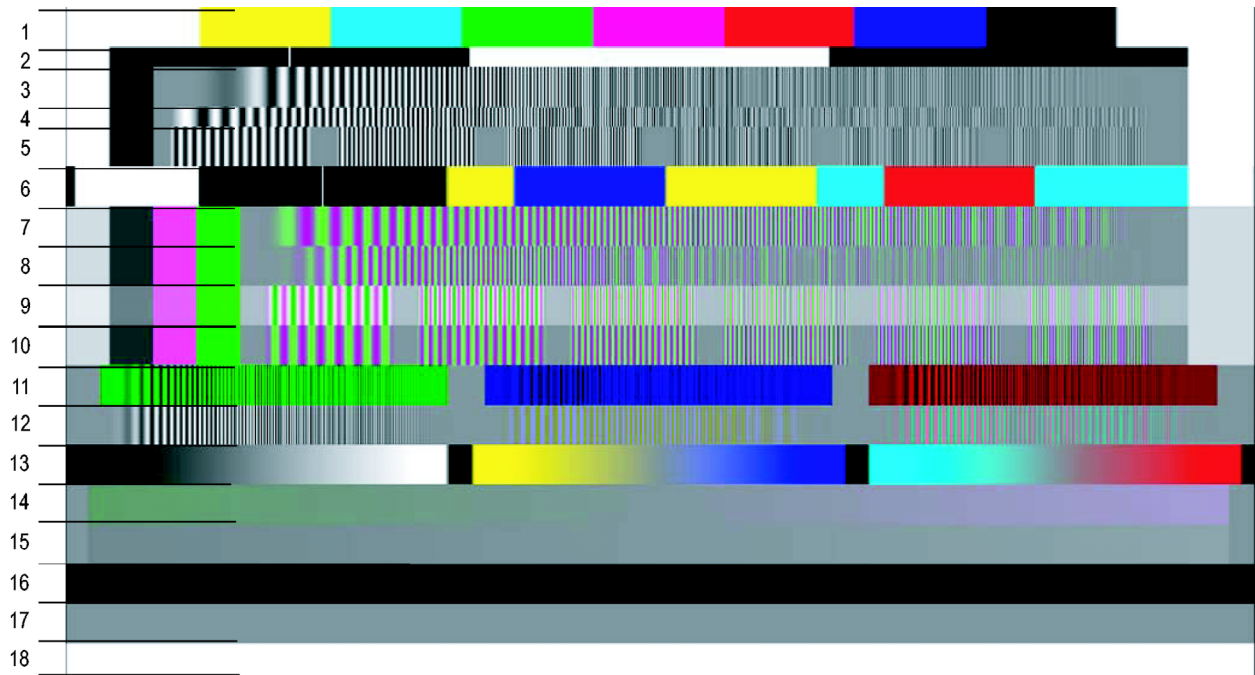


6. If necessary, adjust the sync pickoff. Repeat as needed.



About the Matrix Test Signal

The Matrix test signal is supplied on the accessory signal source disks included with this product. There is a Matrix signal for Options SD and HD and a Matrix signal for Option VGA. The Matrix signal incorporates all analog video signal requirements into different line numbers within one test pattern field. Using a single test pattern eliminates the need to change test signals when doing different measurements. All you need to do is specify line numbers on which measurements are taken. Use the setup file (.vmset) that matches the format of the Matrix test signal you are using; this provides appropriate line numbers as default settings for each measurement type. See the *VM5000 Automatic Video Measurement Set User Manual* for a full description of the files on the signal source disks.



Option SD/HD Matrix signal

Elements of Option SD/HD Matrix signal

Signal name	Format	Signal name	Format	Signal name	Format
1. Color bars	All	7. YPbPr sweep time	YPbPr	13. Valid ramp	All
2. RGB pulse bars	RGB	8. YPbPr sweep Frequency	YPbPr	14. YPbPr shallow ramp	YPbPr
3. RGB frequency sweep	RGB	9. YPbPr multiburst	YPbPr	15. RGB shallow ramp	RGB
4. RGB time sweep	RGB	10. YPbPr multiburst	YPbPr	16. Flat field 7.5%	All
5. RGB multiburst	YPbPr	11. RGB crosstalk	RGB	17. Flat field 50%	All
6. YPbPr pulse bars	YPbPr	12. YPbPr crosstalk	YPbPr	18. Flat field 100%	All



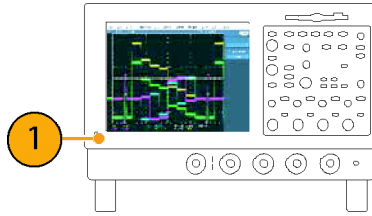
Option VGA Matrix Signal

Elements of Option VGA Matrix signal

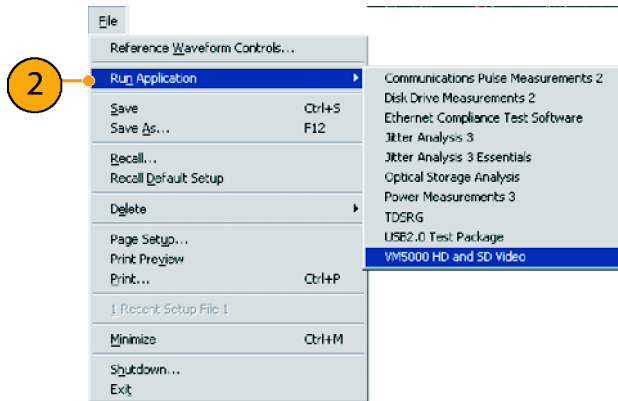
Signal name	Signal name
1. Half white and half black	5. Black / white / black
2. Nine colorbars	6. Full white
3. 32 steps	7. Ramp
4. Alternate white and black	8. Half white and half black

Starting the VM5000 Software

1. Power on the instrument.

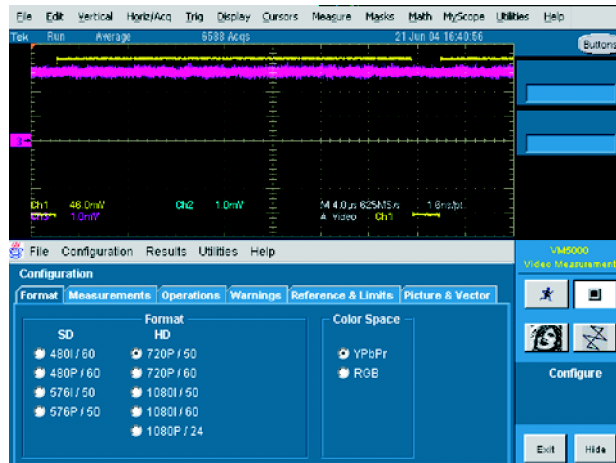


2. Select File > Run Application > VM5000 HD and SD Video or File > Run Application > VM5000 VGA Video.

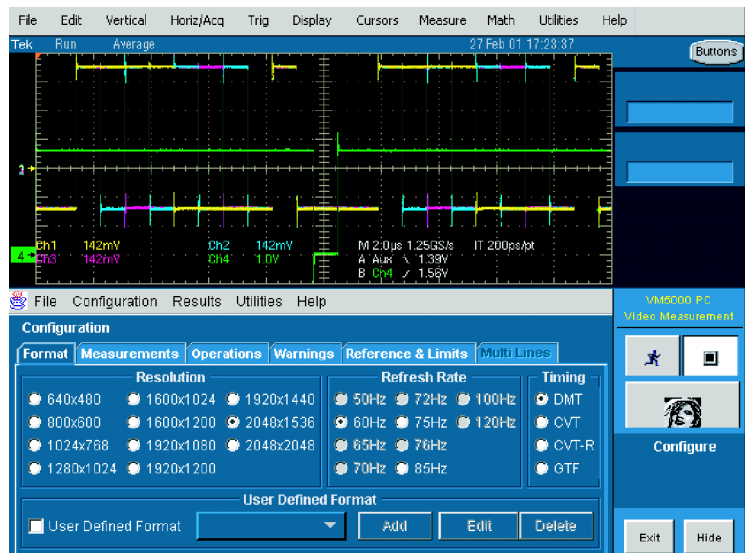


Option SD/HD

The instrument reduces the waveform area to the upper half of the display and opens the VM5000 application in the lower half of the display.



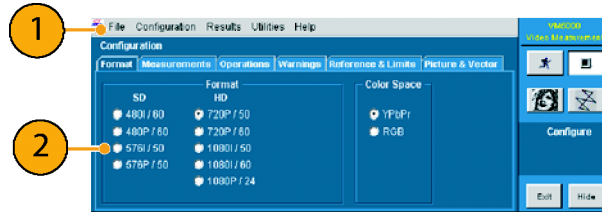
Option SD/HD



Option VGA

The VM5000 Software User Interface

1. Menu bar: Selects setting controls and results information to display in the Application view.
2. Application view: Displays configuration controls and measurements results.



3. Run button: initiates set up, starts taking measurements, and displays results.



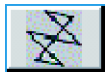
4. Stop button: Halts measurements.



5. Picture button: Displays the signal as a picture.



6. Vectorscope button: Displays the signal in vectorscope format. (Option SD/HD only)



7. Hide button: Restores the main display to full-screen and hides the application window behind the main display.



To access the Windows desktop (for viewing reports), select **Hide**. In the main display, select **File > Minimize**, and then select the application **Hide** button again.

8. App button: Select the **App** button in the main display to restore the VM5000 application window after hiding it.



9. Exit button: Exits the VM5000 application and returns the instrument to the default main display.



Procedure for Taking Measurements

1. Set the input signal format parameters using **Configuration > Format**.
2. Select one or more measurements to take using **Configuration > Measurements**.
3. Set the measurement run operations using **Configuration > Operation**.

4. Select the Run button to take and view the measurements.
5. Save measurement results using **Utilities > Generate Report**.

Configuring the DUT — Option VGA

To perform measurements on the DUT, you must provide an appropriate video signal to the VM5000. You accomplish this by displaying a bitmap file on the PC in which the DUT is operating. The preferred bitmap file, when taking multiple measurements, is the Matrix signal. If you need to take only one measurement, you can use a full-field test pattern rather than the Matrix signal. All the necessary Matrix signal and full-field test pattern bitmaps required to test for compliance to the VESA Test Procedure – Evaluation of Display Graphics Subsystems (Version 1 Rev. 1), are located on the *PC Bitmap Graphics Test Signal Files* CD-ROM.

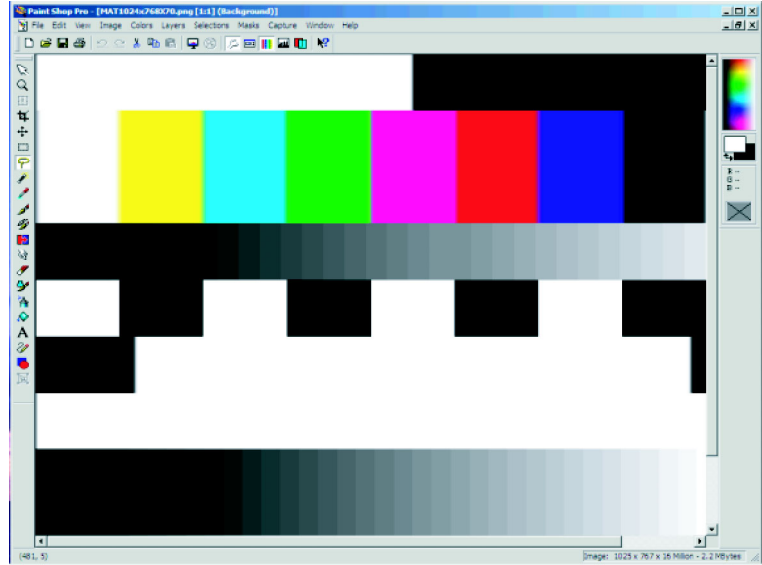
1. Set the resolution and refresh rate of the DUT to the required values.
2. On the PC containing the DUT, display the contents of the *PC Bitmap Graphics Test Signal Files* CD-ROM.
3. Display the contents of either the Matrix or Full Field folder.
 - If you plan to take multiple measurements, open the Matrix folder.
 - If you plan to take only one measurement, open the Full Field folder and select the appropriate test pattern using the following table.

Matching measurements to the appropriate Full Field test pattern

Measurement	Appropriate test pattern(s)
Ch-Ch Mismatch	32 Step Staircase
Ch-Ch Skew	Alternate White and Black
Color Bars	Nine Color Bars
H Sync	Any pattern
H Sync Jitter	Any pattern
H Timing	Black / White / Black
Linearity	Staircase
Luma Levels	Alternate White and Black
Noise Inj. Ratio	Full White
Video Transient	Alternate White and Black
V Sync	Any pattern
V Timing	Half White and Half Black

Whether you choose a single test pattern or take multiple measurements, you must select the bitmap file that you will display to generate the video test signal. The file you select depends on the format you want to test. Suppose you want to test a 1280X1024 resolution format (the refresh rate is not considered when selecting a bitmap file) . Within the appropriate folder, look for a filename that matches the format of the test you want to perform. If you want to test Linearity, you would need to choose either full-field Staircase test pattern or use the Matrix test pattern. Within the Staircase folder, you would look for a file named STEP1280X1024.bmp . Within the Matrix folder, look for a file named MAT1280X1024.bmp.

4. Select the bitmap file that fits your requirements and open the file with a program such as Paint Shop Pro.
If you set up the DUT to drive a second display, you can set the background of the second display to the bitmap file rather than opening the file with a bitmap editor.



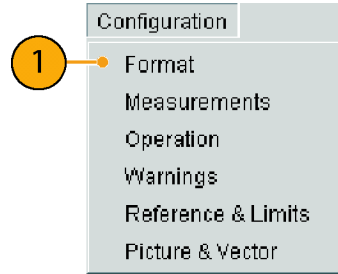
5. From the View menu, select **View > Full Screen Preview**.
This displays the bmp file in full screen mode without any borders.



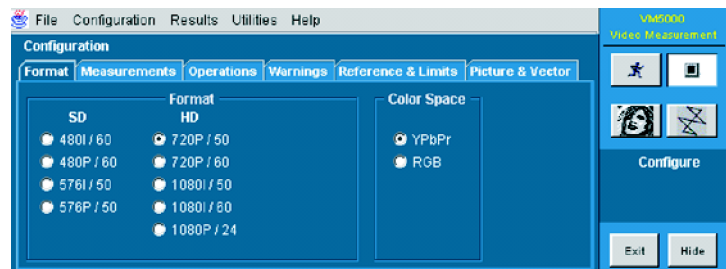
6. Disconnect the output of the DUT from the monitor and connect the output of the DUT to the VM5000.

Setting the Input Signal Format – Options SD/HD

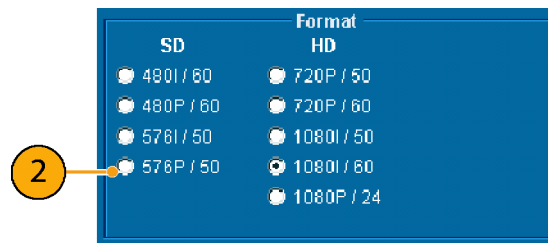
1. Select **Configuration > Format**.



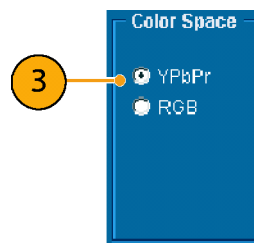
The application displays the Format view.



2. Select the appropriate video format for the signal you are measuring.

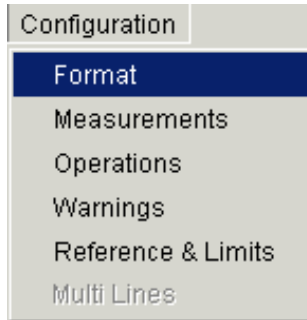


3. Select the appropriate color space for the signal you are measuring.

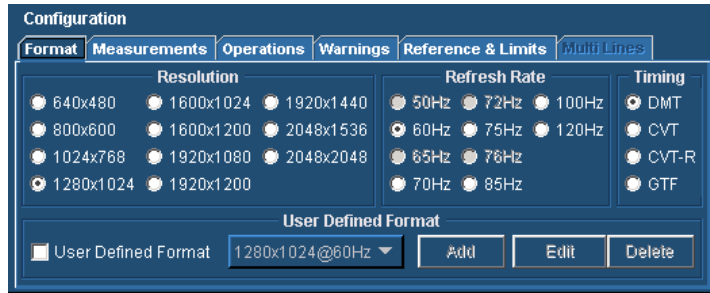


Setting the Input Signal Format – Option VGA

1. Select **Configuration > Format**.



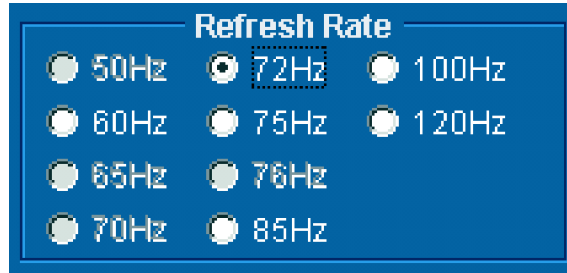
The application displays the Format tab view.



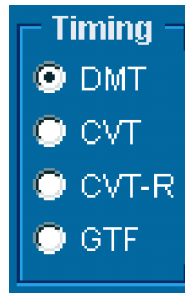
2. Select the appropriate resolution for the signal you are measuring.



3. Select the refresh rate for the signal you are measuring. Depending on the Resolution selected, some refresh rates will not be selectable.



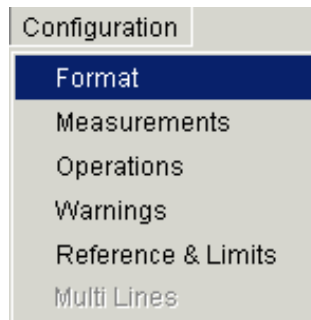
4. Select the Timing standard for your signal.



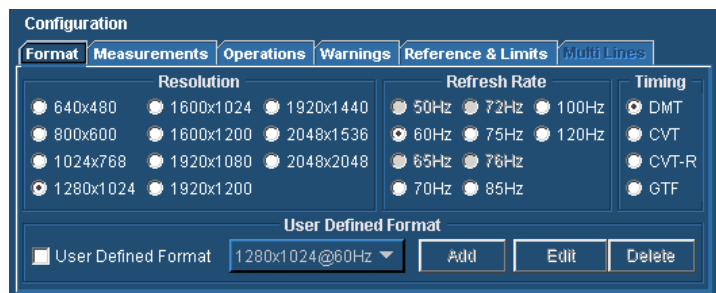
Creating a Custom Format

If you need to test a format that is not listed on the Format tab, you can create a User-Defined Format.

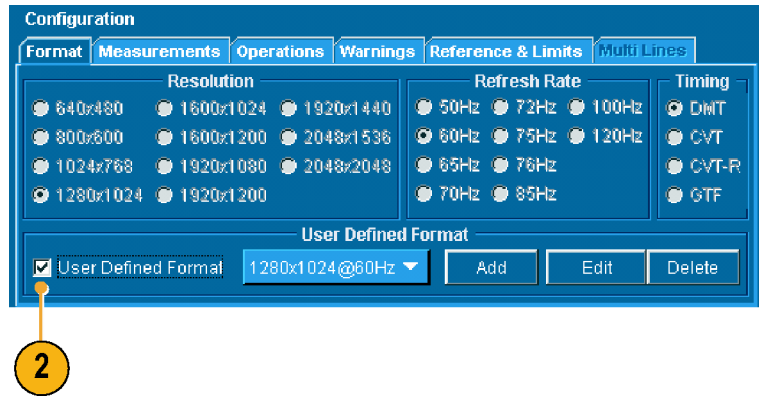
1. Select **Configuration > Format**.



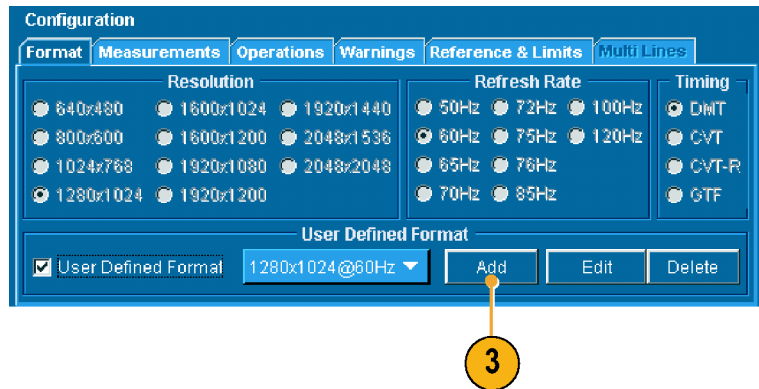
The application displays the Format tab view.



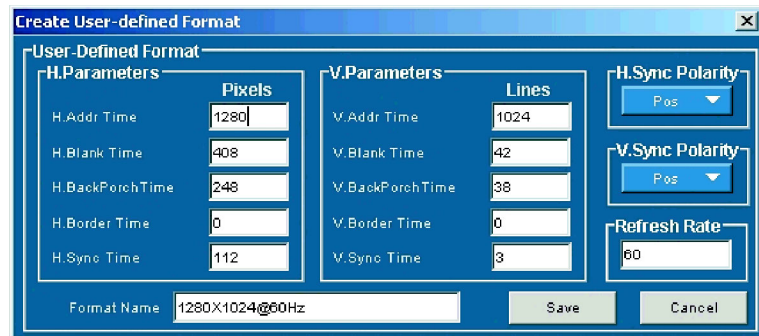
- To create a custom format, select the **User-Defined Format** checkbox.



- To add a new format, select **Add**.



- Enter values for both the horizontal and vertical parameters that specify your format.
Set the sync polarity.
Enter a value for the refresh rate.



5. Enter a format name and select **Save** to save the new format.

The 'Create User-defined Format' dialog box contains the following fields and options:

- H.Parameters (Pixels):**
 - H.Addr Time: 1280
 - H.Blank Time: 408
 - H.BackPorchTime: 248
 - H.Border Time: 0
 - H.Sync Time: 112
- V.Parameters (Lines):**
 - V.Addr Time: 1024
 - V.Blank Time: 42
 - V.BackPorchTime: 38
 - V.Border Time: 0
 - V.Sync Time: 3
- H.Sync Polarity:** Pos
- V.Sync Polarity:** Pos
- Refresh Rate:** 60
- Format Name:** 1280X1024@60Hz
- Buttons:** Save, Cancel

6. Once you have saved a new format, you can select it from the list box.

The 'Configuration' dialog box shows the following configuration options:

- Format:** 1280x1024@60Hz (selected)
- Measurements:** Resolution, Refresh Rate, Timing
- Operations:** (empty)
- Warnings:** (empty)
- Reference & Limits:** (empty)
- Multi Lines:** (empty)

The 'Format' list includes:

- 640x480
- 800x600
- 1024x768
- 1280x1024
- 1600x1024
- 1600x1200
- 1920x1080
- 1920x1200
- 1920x1440
- 2048x1536
- 2048x2048

The 'Refresh Rate' options are: 50Hz, 60Hz, 65Hz, 70Hz, 72Hz, 75Hz, 76Hz, 85Hz, 100Hz, 120Hz.

The 'Timing' options are: DMT, CVT, CVT-R, GTF.

The 'Format' list also includes:

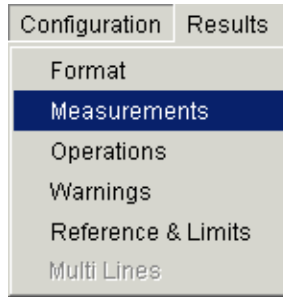
- 1280x1024@60Hz
- 1280x1024@75Hz
- 1280x1024@60Hz

The 'Format' list is checked as 'User Defined Format' and has 'Add', 'Edit', and 'Delete' buttons.

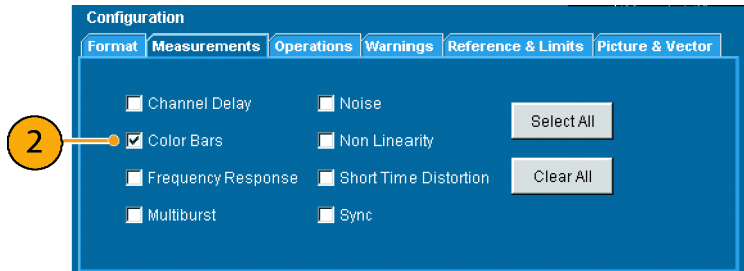
6

Selecting Measurements

1. Select **Configuration > Measurements**.



2. Select the desired measurements on the Measurements tab. You can select one measurement or any combination of measurements.



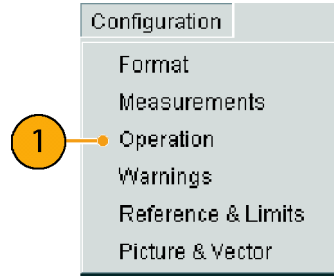
Option SD/HD



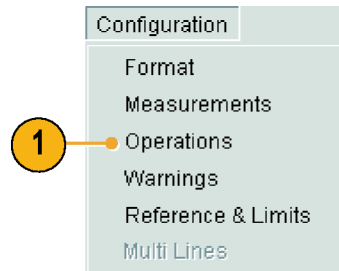
Option VGA

Setting the Measurement Run Operations

1. Select **Configuration > Operation**.

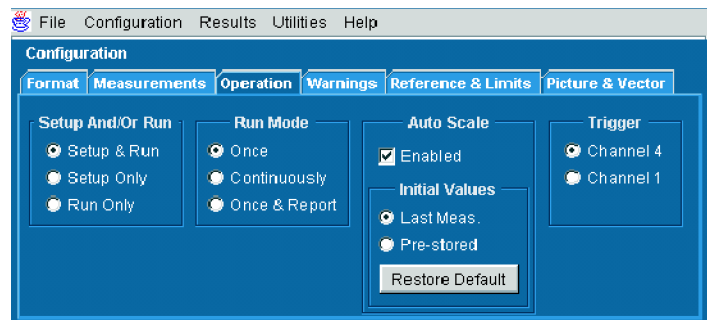


Option SD/HD

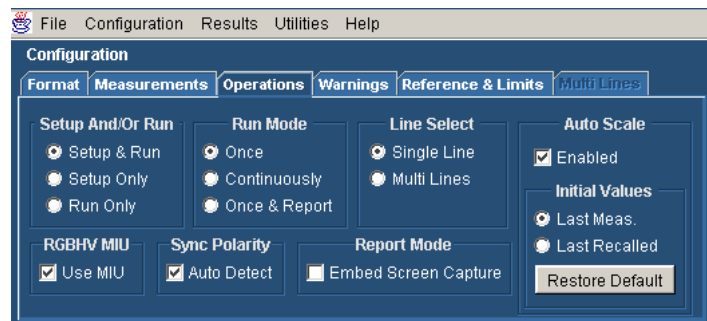


Option VGA

The instrument displays the Operation view. These settings control how the instrument sets up and acquires measurements when you select the Run button.



Option SD/HD



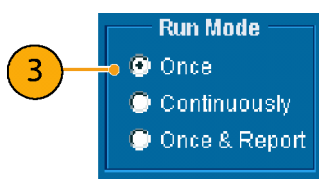
Option VGA

2. Select how the instrument sets up and runs measurements.



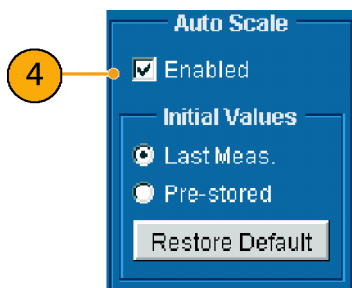
- **Setup & Run** configures the instrument settings and takes a measurement for each selected measurement and for each measurement acquisition. Use this when taking multiple measurements that require different instrument setups.
- **Setup Only** configures the instrument for a measurement but does not take the measurement. Use this to set up customized settings. Try out your settings by pressing the Run button, make adjustments as needed (for example, change the horizontal scale), and then select the Run button again. Once you are satisfied with your customization, use the Run Only setting to collect results.
- **Run Only** takes a measurement using the existing instrument configuration. Use this setting for taking measurements with custom settings (see Setup Only description above).

3. Select how the application acquires measurements (run mode).

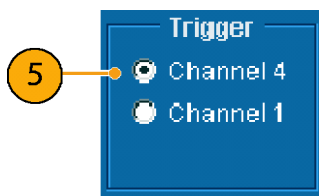


- **Once** takes each selected measurement the number of times determined by the averaging setting, then stops taking measurements. This is the default setting.
- **Continuously** continually takes measurements. You must select the Stop button to stop measurements.
- **Once & Report** takes each selected measurement the number of times determined by the averaging setting, then stops taking measurements and generates a report.

4. Enable or disable waveform Auto Scale. Auto Scale adjusts the vertical scale units so that the input signals fill the graticule as much as possible. Auto Scale occurs once for each selected measurement.

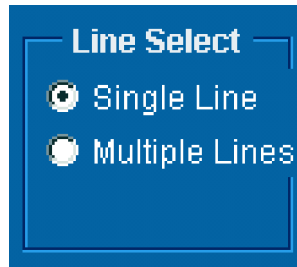


5. Option SD/HD: Select which instrument channel has the sync signal for triggering. If you use the wrong trigger channel, you will get a signal warning (if Signal Warnings is on). (See page 8, *Connecting Input Signals*.)



Option SD/HD

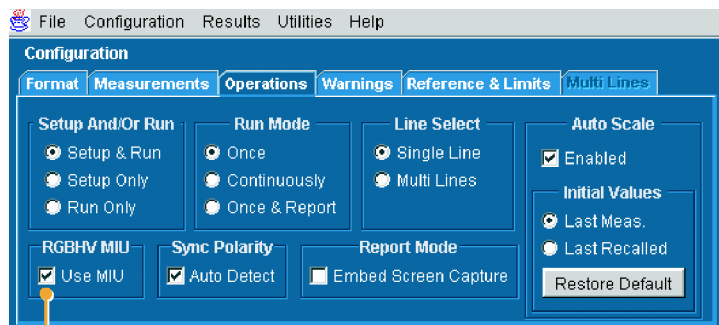
6. Option VGA: Choose the Line Select setting as appropriate. In Single Line mode, each measurement is made on a single line (for example, line 153). In Multiple Lines mode, measurements are made across a range of lines (for example, lines 153–185).



Option VGA

When you select Multiple Lines, a report is automatically saved to a file.

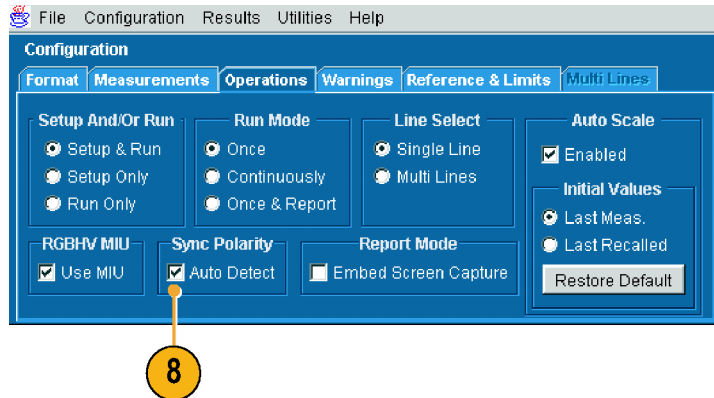
7. Option VGA: If you are using the RGBHV Measurement Interface, you must select the **Use MIU** checkbox.



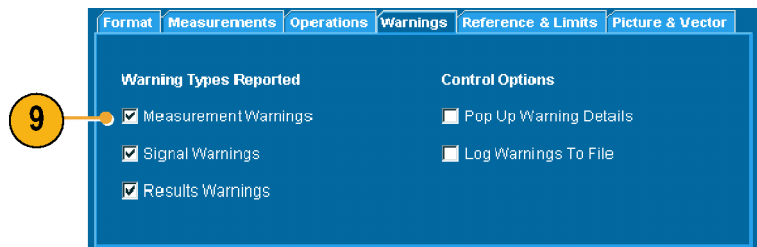
7

Option VGA

8. Option VGA: If you are using the MIU, you can ignore the Sync Polarity setting. Because the specified polarities for the H Sync and V Sync signals vary between the timing standards, the VM5000 will prompt you to connect the H and V Sync signals to automatically determine their polarities. Once the sync signal polarities are determined, the measurement cycle begins. This “polarity test” is performed at the beginning of every measurement cycle. To prevent this test from running at the beginning of every measurement cycle, take any measurement once with Auto Detect selected. Once a measurement cycle has been completed with Auto Detect selected, you can deselect Auto Detect and you will not be prompted to change signals for the polarity test again (the VM5000 will remember the polarity of the sync signals). Of course, any time you change the format set-up for the device-under-test, you should complete a measurement cycle with Auto Detect selected.




9. Select which warning messages to display. See the *VM5000 Automatic Video Measurement Set User Manual* for more information on warnings.



Taking and Viewing Measurements

Before taking a measurement, remember to select a signal format, select the desired measurements, and configure the run options.

1. Select the Run button. The instrument begins taking measurements and displays the measurement results view for the most recently-selected measurement result.

1 

Results: ColorBars

Measured	Relative	Reference		Limits
		Y / G	Pb / B	
Unit: mV				
White	697.05	-0.01	-0.36	
Yellow	647.77	-350.24	31.07	
Cyan	550.02	77.89	-350.04	
Green	499.11	-270.15	-318.7	
Magenta	198.88	265.83	314.51	
Red	147.93	-79.82	347.32	
Blue	49.71	347.46	-32.03	
Black	-0.54	1.0	-0.32	

Line Number: 37

Average: 1

Option SD/HD

Results: Color Bars

Measured	Relative	Reference			Limits
		G	B	R	
Unit: mV					
White	715.444	725.148	713.268		
Yellow	717.359	0.867	715.251		
Cyan	717.908	728.743	1.575		
Green	719.182	0.959	0.152		
Magenta	1.15	727.276	715.094		
Red	0.641	0.721	717.694		
Blue	0.348	723.694	1.765		
Black	-0.117	0.902	0.57		

Line Number: 153


Average: 1

Option VGA

2. To view the results of other measurements, select the measurement from the Results menu. For example, to view the Sync measurement results (Option SD/HD only), select **Results > Sync**.

Results

- Summary
- Channel Delay
- Color Bars
- Frequency Response
- Multiburst
- Noise
- Non Linearity
- Short Time Distortion
- Sync

2 

Results: Sync

Measured	Relative	Reference		Limits
		T(ns)	T(us)	
Front Porch	648.4	Total Line Time	29.66	
Neg. Sync Fall	53.18	Start of AV	2.63	
Neg. Sync Width	592.8	End of AV	28.42	
Sync Rise	51.45			
Pos. Sync Width	592.0	Front Porch Level	0.36	
Pos. Sync Fall	51.82	Neg. Sync Level	-294.14	
Back Porch	2038.8	Pos. Sync Level	293.83	

Line Number: 485

Average: 1

Measured on CH1

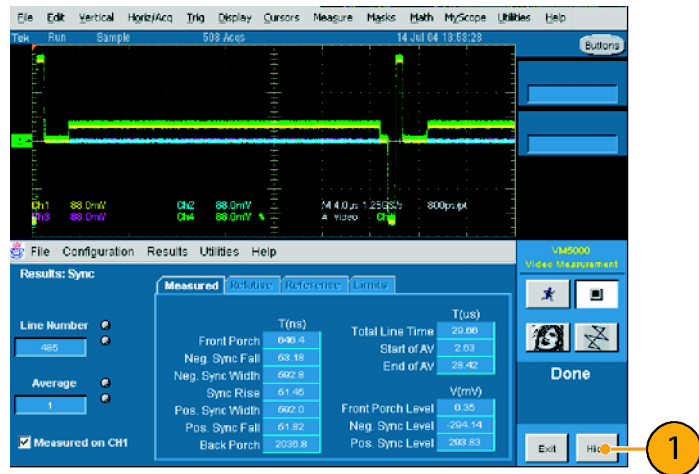
3. If you set the run operation to Continuously, press the Stop button to stop taking measurements.

3 

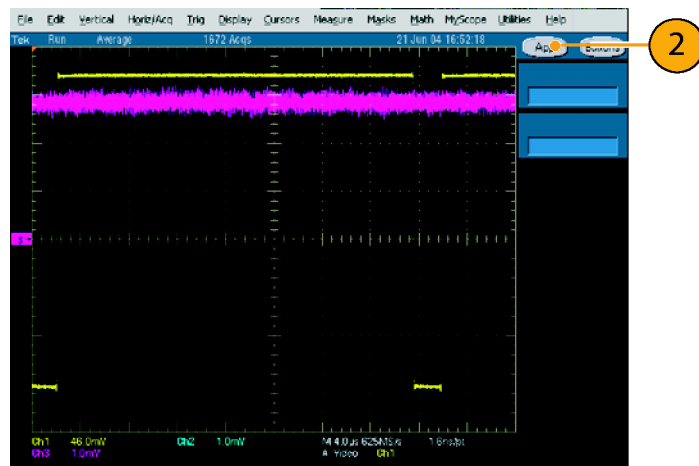
Using the Oscilloscope

To use the standard oscilloscope capabilities of the VM5000 to take measurements or view features of a signal, just hide the VM5000 software. You do not have to quit the VM5000 software.

1. To hide the VM5000 software, select **Hide**.



2. When the VM5000 software is hidden, an **App** button appears on the display.



3. To return to the VM5000 software, select **App**.



Troubleshooting Signal Problems

If you have problems taking measurements, you may receive warning or error messages that can help you determine the source of the problem. The following tables describe the messages and the possible causes.

Option SD/HD Warning messages

Number	Text	Possible causes	Operation where it may occur
1	Acquisition Problem	The instrument cannot trigger or the signal levels are out of range.	All measurements
2	Bar Measurements Inconclusive	The instrument cannot find a proper sync, the wrong format is selected, or the signal is distorted.	Measuring Short Time Distortion
3	Channel Delay: Channel <x> & <y>, Correlation Too Low	The line number is set incorrectly, a distorted signal, or an inappropriate input signal with too few transitions.	Measuring Channel Delay
4	Channel Delay: Disjoint Correlations Among Channels...	There is a group delay mismatch among channels or an inappropriate signal source.	Measuring Channel Delay
5	Color Bars: <Color> Bar Not Found	The line number is set incorrectly, a distorted signal, an incorrect format is specified, channels connected are in the wrong order, the wrong colorimetry, or excessive cropping of the signal.	Measuring Color Bars
6	Color Bars: Back Porch Reference Questionable	The signal is distorted.	Measuring Color Bars
7	Frequency Response: Signal Change: <freq1> ³ <freq2> MHz	Signal level is too low, an incorrect signal, or a change in the signal.	Measuring Frequency Response
8	Frequency Response Individual Channel Errors: Channel <x>	The signal is distorted or a flag is missing in the signal.	Measuring Frequency Response
9	Frequency Response: Invalid results for all channels	The line number is set incorrectly, an inappropriate input signal, or an incorrect configuration.	Measuring Frequency Response
10	Multiburst: Signal Change: <freq1> ³ <freq2> MHz	Signal level is too low, an incorrect signal, or a change in the signal.	Measuring Multiburst
11	Multiburst: Individual Channel Errors: Channel <x>: Flag <= 0 mV	The signal is distorted or a flag is missing in the signal.	Measuring Multiburst
12	Multiburst: Individual Channel Errors: Channel <x>: burst <n>: not detected	Signal level is too low, distorted signals, an input signal with less than six frequency packets, or excessive cropping of the signal.	Measuring Multiburst
13	Multiburst: Invalid results for all channels	The line number is set incorrectly, an inappropriate input signal, or an incorrect configuration.	Measuring Multiburst
14	Noise: Signal Change: Chan <x>	The signal changed during measurement.	Measuring Noise

Option SD/HD Warning messages (cont.)

Number	Text	Possible causes	Operation where it may occur
15	Noise: Invalid results for all channels.	The line number is set incorrectly, inappropriate input signal, or incorrect configuration.	Measuring Noise
16	Nonlinearity: Invalid Results: Channel <x>: No ramp or step signal found	The line number is set incorrectly or inappropriate input signal.	Measuring NonLinearity
17	Nonlinearity: Signal Change: Channel <x>:	The signal changed during measurement.	Measuring NonLinearity
18	Short Time Distortion: Bar Start Not Found	The line number is set incorrectly, distorted signal, or incorrect format selected.	Measuring Short Time Distortion
19	Short Time Distortion: Bar End Not Found	The line number is set incorrectly, distorted signal, or incorrect format selected.	Measuring Short Time Distortion
20	Short Time Distortion: Invalid results for Channel<x>.	The line number is set incorrectly, inappropriate input signal, or incorrect configuration.	Measuring Short Time Distortion
21	Sync Measurements Inconclusive	The instrument cannot find a proper sync, the wrong format is selected, or the signal is distorted.	Measuring Sync
22	Sync Measurement: <n> Not Found	The instrument cannot find a proper sync.	Measuring Sync
23	2T pulse not found in luminance component of signal	The line number is set incorrectly, inappropriate input signal, or incorrect configuration.	Measuring Short Time Distortion
24	Writing over file <filename>	The instrument is writing over an existing file.	Recalling settings; Generating a report
25	Sync Acquisition Problem: Either cannot trigger or the signal levels are out of range.		Triggering

Option VGA Warning messages

Number	Text	Possible causes	Operation where it may occur
1	Sync edge locations questionable. Make sure that the selected format is correct.	The format is set incorrectly.	Measuring H Sync, V Sync, and V Timing
2	H Timing: Incorrect signal in Channel <1–3>. Use Black-White-Black signal. Sync edge locations questionable. Make sure that the selected format is correct.	The format is set incorrectly.	Measuring H Timing
3	H Timing: Incorrect signal in Channel <1–3>. Use Black-White-Black signal.	Black-White-Black signal is not being used.	Measuring H Timing

Option VGA Warning messages (cont.)

Number	Text	Possible causes	Operation where it may occur
4	Invalid Results: Acquisition Problem: Either cannot trigger or the signal levels are out of range or acquired less than the requested samples.	Acquisition failed: Trigger missing, format wrong or other cause of failure to acquire signal.	All measurements
5	Linearity: Signal Change: Channel <x>:	Stability problem while running continuously: ramp went away or number of steps changed.	Measuring Linearity
6	Linearity: Signal Fidelity Problem: Channel <x> Resolution mismatch: Line A<x> bits, Line B <y> bits: Steps not found	For two-line ramps (lower portion of ramp on one line and upper portion of ramp on second line), the bit resolution of the LSB staircase ramps does not match or the total number steps is not equal to $(2^n - 1)$.	Measuring Linearity
7	Linearity: Error occurred in switch accessory	The RGBHV Measurement Interface Unit is not responding properly.	Measuring Linearity
8	Sync edge locations questionable. Make sure that the selected format is correct.	The format is set incorrectly.	Measuring Color Bars, Video Channel Mismatch, Ch-Ch Skew, Luma Levels, Video Channel Mismatch, V Sync, V Timing, and Video Transient.
9	Color Bars: Yellow/Cyan/Green/Magenta/Red/Blue/Black Bar not found.	Color Bars signal is not being used.	Measuring Color Bars.
10	Ch-Ch Skew: Incorrect signal in Channel <1–3>. Use the Alternate White and Black bar signal.	The format is set incorrectly.	Measuring Ch-Ch Skew.
11	Luma Levels: Incorrect signal in Channel <1–3>. Use the Alternate White and Black bar signal.	Alternate White and Black signal is not being used.	Measuring Luma Levels.
12	Video Transient: Incorrect signal in Channel <1–3>. Use the Alternate White & Black signal.	Alternate White and Black signal is not being used.	Measuring Video Transient.
13	H Sync Jitter: Sync edge locations questionable. Make sure the selected format is correct.	The format is set incorrectly.	Measuring H Sync Jitter
14	Noise: Invalid results for some channels.	The line number is set incorrectly, inappropriate input signal, or incorrect configuration.	Measuring Noise
15	Ch-Ch Mismatch: Incorrect signal in Channel <1–3>. Use the 32-step Staircase signal in true color mode.	32-step Staircase signal not being used	Measuring Ch-Ch Mismatch.

Error messages

Number	Text	Possible causes	Operation where it may occur
1	File Name Error: File doesn't exist: <filename>	The selected .vmset file does not exist. (You need to specify the full path if the file is not in the folder C:\VM5000TV.)	Recalling settings
2	Cannot write file: file already exists: <filename>	You need to rename <filename> so that the file can be written.	Saving settings; Generating a report
3	File Name Error. Invalid character(s) in file name	Invalid characters in the filename. Invalid characters are: " ", ":", "/", " ", " "< ", "> ", "**", "\", and "?".	Saving settings; Generating a report
4	No Measurement Selected	No measurements selected in the Configuration > Measurements menu.	Executing a measurement; Generating a report
5	Cannot create Report. Not all selected measures have been Run	Need to run a measurement and wait until it completes before generating a report.	Generating a report.
6	Invalid Filename	The file doesn't exist or the path is incorrect. You need to specify the full path if the file is not in the folder C:\VM5000TV.	RecallSettings; SaveSettings; ReportGenerate (only when called via GPIB)
7	Invalid Argument	Inappropriate argument used for the particular GPIB command.	All GPIB commands
8	Command Overflow	GPIB commands were sent too rapidly. Increase the delay time between commands to prevent this problem (100 milliseconds interval recommended), or use handshaking with OPComplete.	When GPIB commands are sent too rapidly.
9	Command Missed	This error indicates that a command sent in the last second may not have been processed, so you should return to a recent (known) configuration and resend the most recent commands.	Sending a GPIB command
10	Error occurred in configuring MIU	Improper serial connection to MIU or one of the CH1/CH2/CH3/CH4 connector cables are disconnected from the VM5000.	Running any measurement using the MIU.

Applications

Simple Color Bars Measurement – Options SD/HD

Amplitude measurements are typically performed using the color bars test signal, which switches the R'G'B' components on and off to produce all eight possible color combinations (White, Yellow, Cyan, Green, Magenta, Red, Blue, and Black). There are a variety of different forms of the color bar test signal, typically either using a maximum dynamic range of 700 mV = 100% or at 75% with an R'G'B' amplitude of 525 mV. In the following tables, the amplitude ranges for the component Y'P'bP'r are given for the various standards of 100% and 75% color bars.

Amplitude ranges for various 100% color bar signal formats

Color bar	R' (mV)	G' (mV)	B' (mV)	480p/576p			1080/720		
				Y' (mV)	P'b (mV)	P'r (mV)	Y' (mV)	P'b (mV)	P'r (mV)
White	700	700	700	700.0	0.0	0.0	700.0	0.0	0.0
Yellow	700	700	0	620.2	-349.8	56.9	649.5	-350.0	32.1
Cyan	0	700	700	490.7	118.0	-349.9	551.2	80.2	-350.0
Green	0	700	0	410.9	-231.7	-293.0	500.6	-269.8	-317.9
Magenta	700	0	700	289.1	231.7	293.0	199.4	269.8	317.9
Red	700	0	0	209.3	-118.0	349.9	148.8	-80.2	350.0
Blue	0	0	700	79.8	349.8	-56.9	50.5	350.0	-32.1
Black	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0

Amplitude ranges for various 75% color bar signal formats

Color bar	R' (mV)	G' (mV)	B' (mV)	480p/576p			1080/720		
				Y' (mV)	P'b (mV)	P'r (mV)	Y' (mV)	P'b (mV)	P'r (mV)
White	700	700	700	700.0	0.0	0.0	700.0	0.0	0.0
Yellow	525	525	0	465.2	-262.3	42.7	487.1	-262.5	24.1
Cyan	0	525	525	368.0	88.5	-262.4	413.4	60.2	-262.5
Green	0	525	0	308.2	-173.8	-219.7	375.5	-202.3	-238.4
Magenta	525	0	525	216.8	173.8	219.7	149.5	202.3	238.4
Red	525	0	0	157.0	-88.5	262.4	111.6	-60.2	262.5
Blue	0	0	525	59.9	262.3	-42.7	37.9	262.5	-24.1
Black	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0

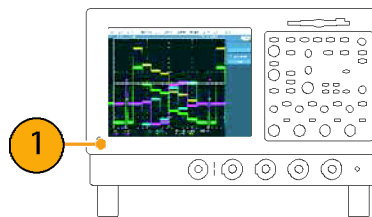
Depending on the type of equipment being tested, a variance in the actual values is allowed. For example, the progressive outputs of DVD players can introduce setup to their outputs that can vary the overall measured results. Variations in the level of the components can introduce different hue and saturation in the displayed picture. The color bar test signal lets you check for gain inequalities between the channels and to ensure that the signal is not distorted, which could produce severe clipping of the signal.

The Tektronix Matrix pattern uses a 100% color bar signal to test the full dynamic range of each component. The color bar pattern is located at or near the top of the matrix pattern; the line numbers at which it occurs are different for each standard. The line numbers specified are the default values used to generate the test matrix but some systems under test may shift lines in the image to a different location.

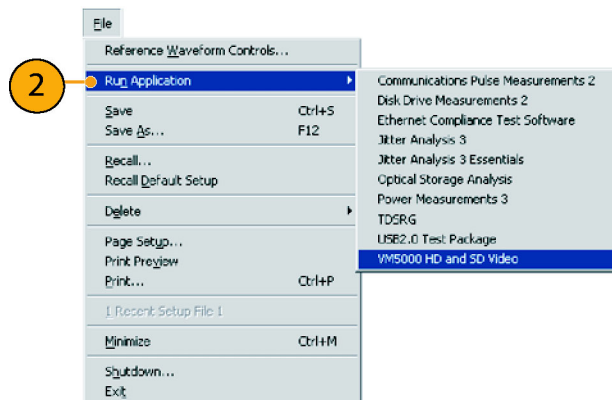
Format	1080i	720p	480p	576p
Line	21 - 84	26 - 153	43 - 106	45 - 108
Location	584 - 647			

The VM5000 performs the color bar measurements by first identifying the relative amplitudes of each of the three channels. Eight amplitude measurements are made on each channel, giving a total of 24 measurements in less than half a second; the following steps show the typical measurement results performed on a 1080i signal. The amplitude level of each of the bar levels is measured relative to the back porch. Amplitudes are calculated using waveform averaged values within each identified bar. Therefore, it is important to ensure that the full video is displayed in the capture window of the instrument if manual setup has been performed on the unit.

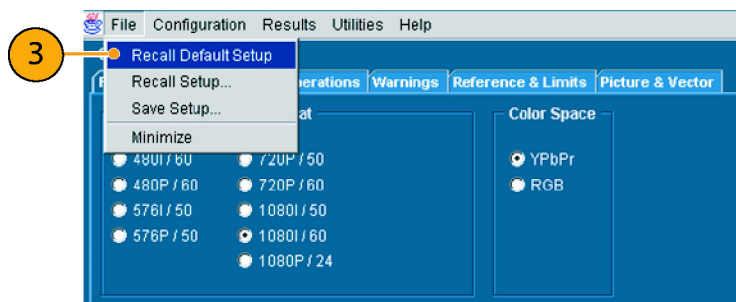
1. Power on the instrument.



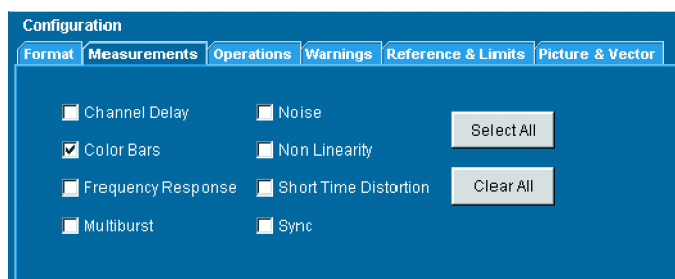
2. Select **File > Run Application > VM5000 HD and SD Video**.



- In the VM5000 application, select **File** > **Recall Default Setup** to return all settings to the factory default values.



- Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)
- Set the input signal format. (See page 25, *Setting the Input Signal Format – Options SD/HD*.)
- Select **Configuration > Measurements**. Note that Color Bars is selected by default.



- Click the Run button.



When the measurements are complete, the results screen is displayed.



Simple Color Bars Measurement – Option VGA

Amplitude measurements are typically performed using the color bars test signal, which switches the RGB components on and off to produce all eight possible color combinations (White, Yellow, Cyan, Green, Magenta, Red, Blue, and Black). There are a variety of different forms for the color bar test signal, typically either using a maximum dynamic range of 700 mV = 100% or at 75% with an RGB amplitude of 525 mV. The following table shows the amplitude for the RGB signal at 100% and 75%.

Amplitude for 100% color bar signal

Color bar	R (mV)	G (mV)	B (mV)
White	700	700	700
Yellow	700	700	0
Cyan	0	700	700
Green	0	700	0
Magenta	700	0	700
Red	700	0	0
Blue	0	0	700
Black	0	0	0

Amplitude for 75% color bar signal formats

Color bar	R (mV)	G (mV)	B (mV)
White	700	700	700
Yellow	525	525	0
Cyan	0	525	525
Green	0	525	0
Magenta	525	0	525
Red	525	0	0
Blue	0	0	525
Black	0	0	0

The Tektronix Matrix pattern uses a 100% color bar signal to test the full dynamic range of each component. The color bar pattern is located near the top of the matrix pattern; the line numbers at which it occurs are different for each format. The following tables show the line numbers on which the different patterns in the Matrix signal are located for a 60 Hz refresh rate. For other refresh rates, the actual starting line number can be noticeably different than the 60 Hz rate. To view the active video line number location for a specific pattern at another refresh rate, locate the Microsoft Excel file, Matrix.xls, located on the VM5000 software CD. This file that lists the actual Active Video line numbers for all supported refresh rates.

Active Video Line Number Location of Patterns at 60 Hz Refresh Rate (640x480 to 1280x1024)

Pattern	640x480	800x600	1024x768	1280x1024
Half White and Half Black	36 – 83	28 – 87	36 – 112	42 – 143
Nine Colorbars	84 – 179	88 – 207	113 – 265	144 – 348
32 Steps	180 – 227	208 – 267	266 – 342	349 – 450
Alternate White and Black	228 – 275	268 – 327	343 – 419	451 – 552
Black White Black	276 – 323	328 – 387	420 – 496	553 – 654
Full White	324 – 371	388 – 447	497 – 572	655 – 756

Active Video Line Number Location of Patterns at 60 Hz Refresh Rate (640x480 to 1280x1024) (cont.)

Pattern	640x480	800x600	1024x768	1280x1024
Ramp	372 – 467	448 – 567	573 – 726	757 – 962
Half White and Half Black	468 – 515	568 – 627	727 – 803	963 – 1065

Active Video Line Number Location of Patterns at 60 Hz Refresh Rate (1600x1024 to 1900x1200)

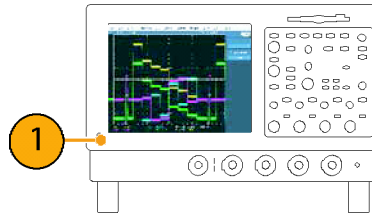
Pattern	1600x1024	1600x1200	1920x1080	1920x1200
Half White and Half Black	36 – 132	50 – 169	38 – 140	43 – 162
Nine Colorbars	143 – 337	170 – 409	150 – 356	163 – 402
Staircase	347 – 439	410 – 529	366 – 464	403 – 522
Alternate White and Black	450 – 542	530 – 649	474 – 572	523 – 642
Black White Black	552 – 644	650 – 769	582 – 680	643–762
Full White	655 – 747	770 – 889	690 – 788	763 – 882
Ramp	757 – 951	890 – 1129	798 – 1004	883 – 1122
Half White and Half Black	962 – 1059	1130 – 1249	1014 – 1117	1123 – 1242

Active Video Line Number Location of Patterns at 60 Hz Refresh Rate (1920x1440 to 2048x2048)

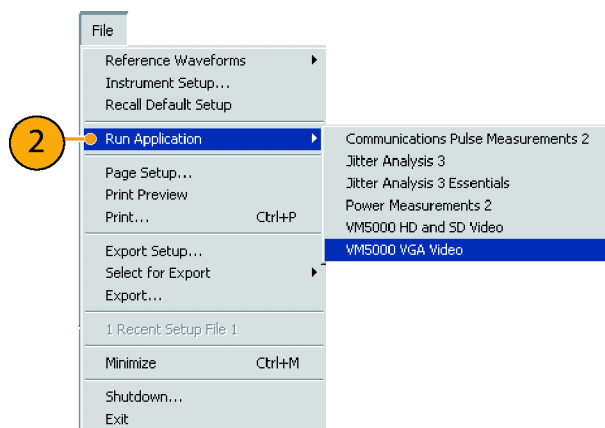
Pattern	1920x1440	2048x1536	2048x2048
Half White and Half Black	50 – 193	53 – 198	71 – 265
Nine Colorbars	194 – 481	213 – 505	285 – 674
Staircase	482 – 625	520 – 659	695 – 879
Alternate White and Black	626 – 769	674 – 812	899 – 1084
Black White Black	770 –913	828 – 966	1104 – 1289
Full White	914 – 1057	981 – 1120	1309 – 1493
Ramp	1058 –1345	1135 –1427	1514 – 1903
Half White and Half Black	1346 – 1489	1442 – 1588	1923 –2118

The VM5000 performs the color bars measurements by first identifying the relative amplitudes of each of the three channels. Eight amplitude measurements are made on each channel, giving a total of 24 measurements in less than half a second; the following steps show the typical measurement results performed on a 1024x768 signal. The amplitude level of each of the bar levels is measured relative to the back porch. Amplitudes are calculated using waveform averaged values within each identified bar. Therefore, it is important to ensure that the full video is displayed in the capture window of the instrument if manual setup has been performed on the unit.

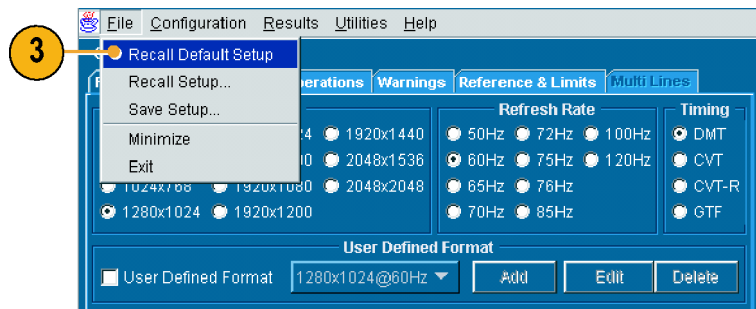
1. Power on the instrument.



2. Select **File > Run Application > VM5000 VGA Video**.



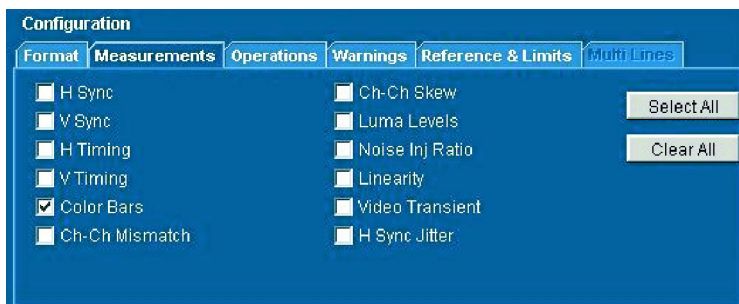
3. In the VM5000 application, select **File > Recall Default Setup** to return all settings to the factory default values.



4. Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)
5. Select the input signal format. (See page 26, *Setting the Input Signal Format – Option VGA*.)

6. Select **Configuration > Measurements**.

Note that Color Bars is selected by default.



7. Click the Run button.



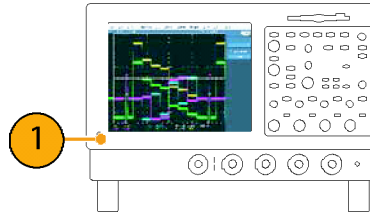
When the measurements are complete, the results screen is displayed.



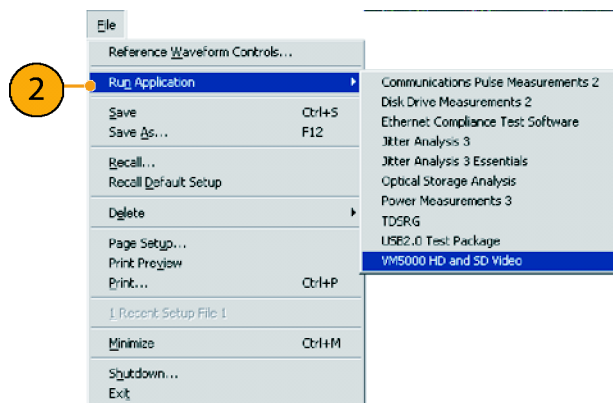
Displaying Relative to Reference Color Bar Measurements

The VM5000 displays measurement results two ways: as measured and relative to a reference value. The relative value is calculated by subtracting the measured value from a reference value. To display measurement results relative to a reference, you must select **Enable Relative Results** in the **Reference & Limits** tab of the Configuration screen. Reference values are specified in special comma-separated-value (CSV) text files. The VM5000 includes a set of template files that you can edit, so that you can specify the reference values appropriate to your application.

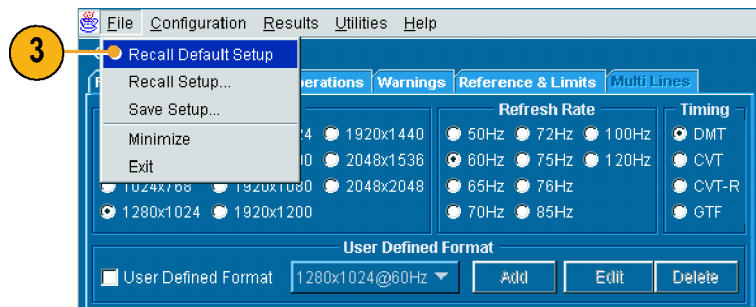
1. Power on the instrument.



2. Select **File > Run Application > VM5000 HD and SD Video or VM5000 VGA Video**.

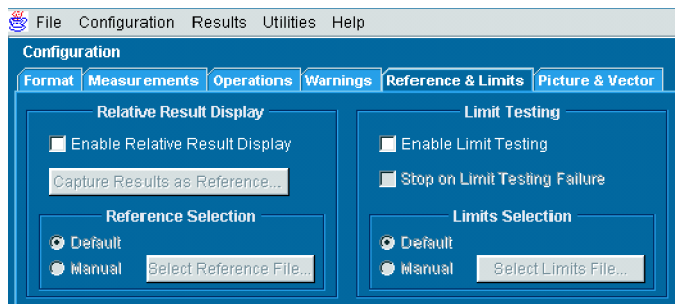


3. In the VM5000 application, select **File > Recall Default Setup** to return all settings to the factory default values.



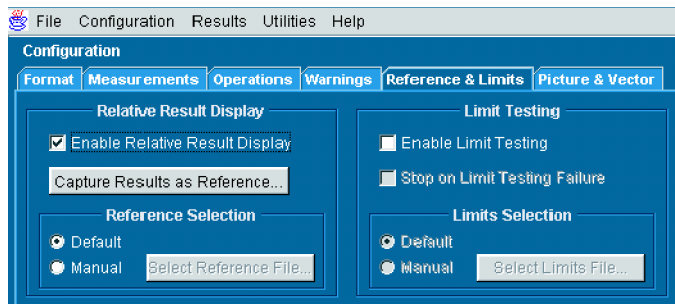
4. Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)
5. Select the input signal format. (See page 25, *Setting the Input Signal Format – Options SD/HD*.) (See page 26, *Setting the Input Signal Format – Option VGA*.)

6. Select **Configuration > Reference & Limits**.



7. Check **Enable Relative Result Display**.

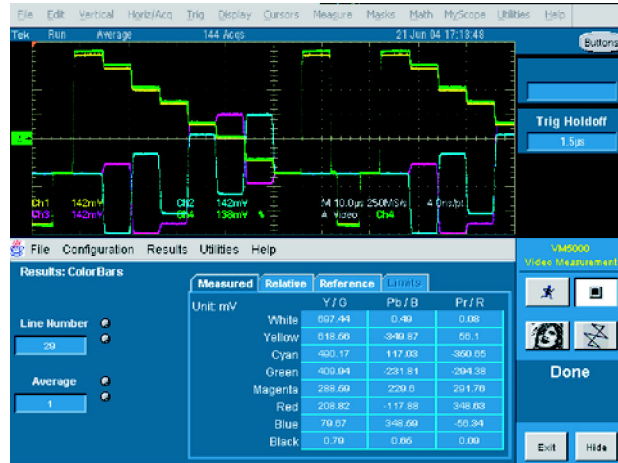
By default, the VM5000 application automatically selects a reference file from a set of supplied templates, matched to the selected signal format.



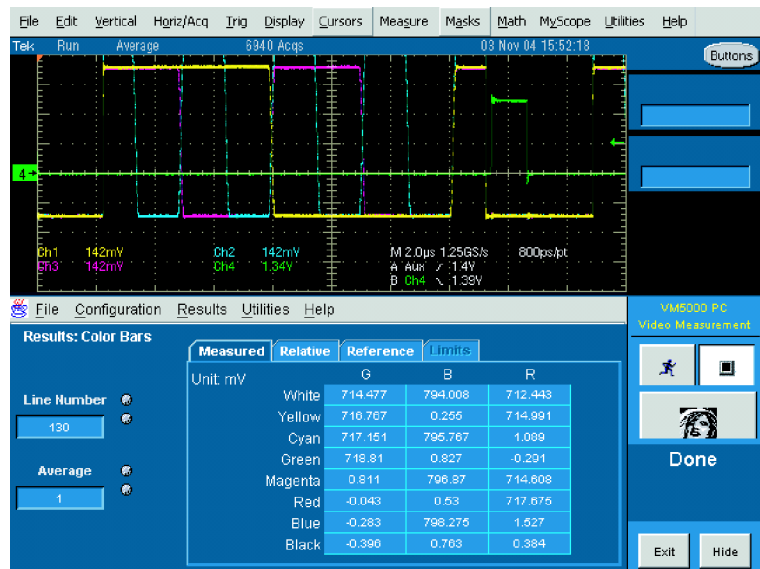
8. Click the Run button.



When the measurements are complete, the results screen is displayed. Note that the Relative and Reference tabs are now selectable.



Option SD/HD

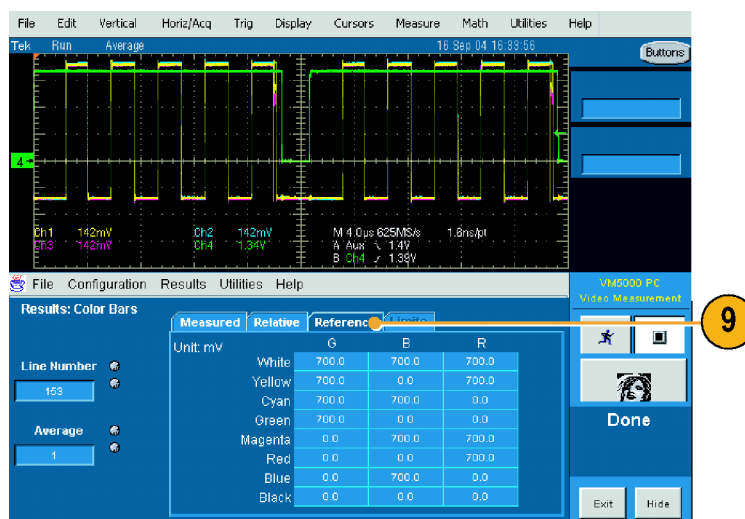


Option VGA

9. Select the **Reference** tab to display the Reference values used to calculate the Relative values.



Option SD/HD



Option VGA

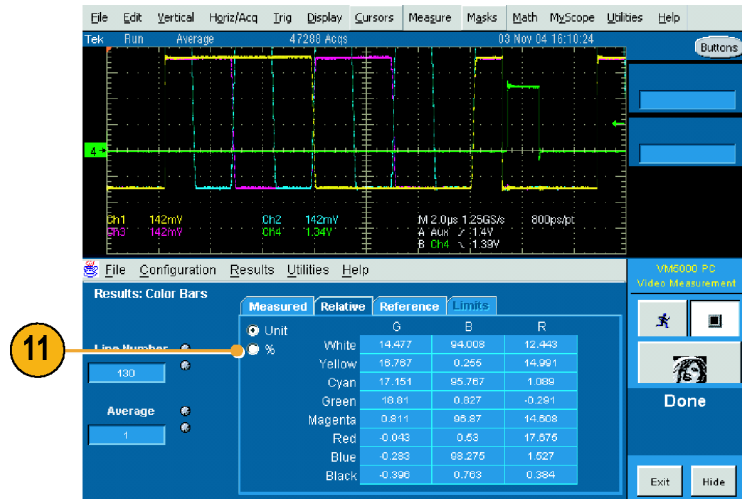
10. Select the **Relative** tab to display the calculated Relative values.



- Select the % option button to display the percent difference between the measured value and the reference value.



Option SD/HD

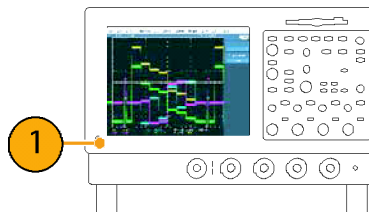


Option VGA

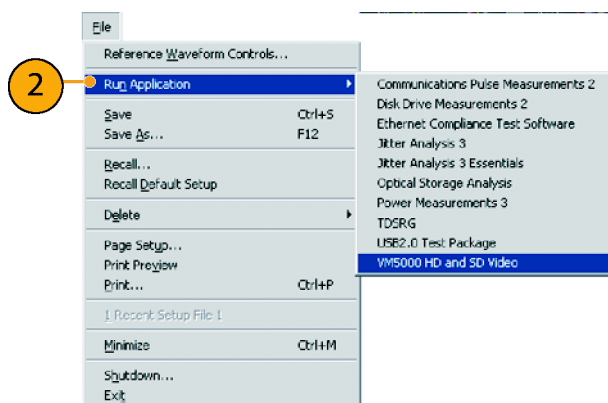
Displaying Color Bar Measurements with Limit Testing

The VM5000 can display measurement results compared to a limit value and with a pass/fail indication. As with the relative measurements, the limit value is specified in a CSV-format text file. The VM5000 includes a set of template files that you can edit, so that you can specify the limit values appropriate to your application. Limit values consist of a maximum and minimum. Measured values that fall between the maximum and minimum limit values are considered to have passed the limit test. Measured values that fall outside the maximum and minimum limit values are considered to have failed the limit test.

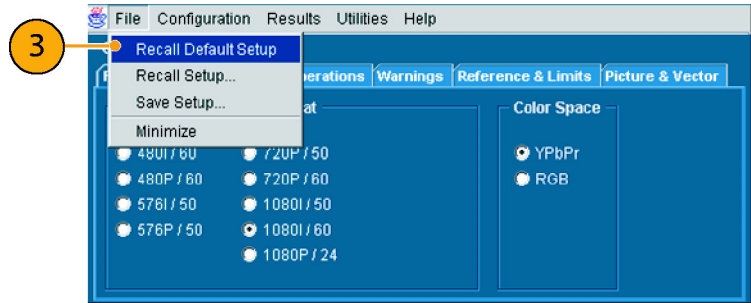
1. Power on the instrument.



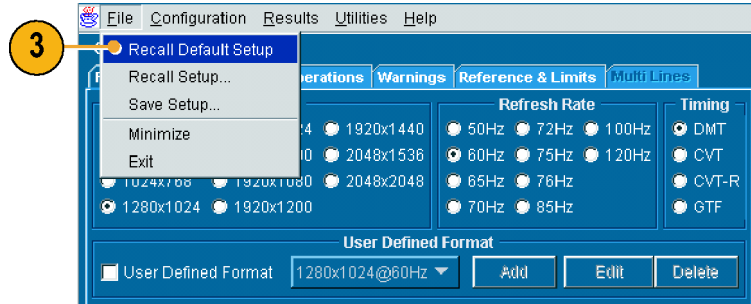
2. Select **File > Run Application > VM5000 HD and SD Video** or **VM5000 VGA Video**.



3. Select **File > Recall Default Setup** to return all settings to the factory default values.



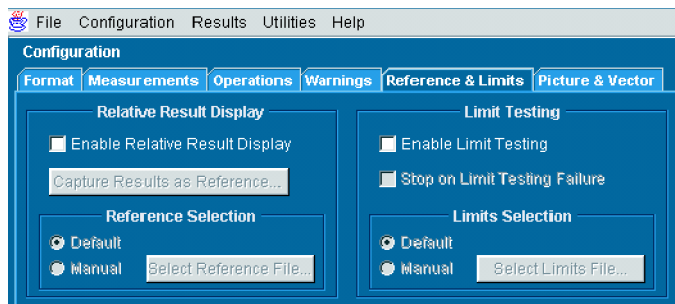
Option SD/HD



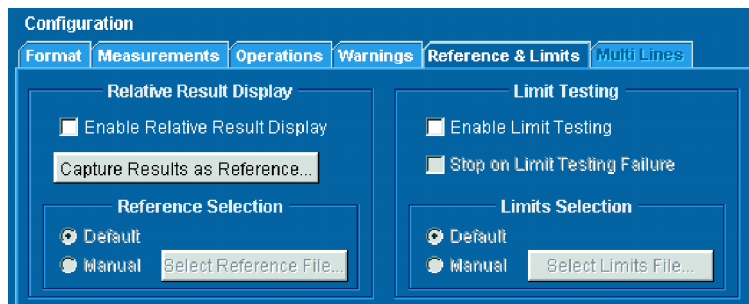
Option VGA

4. Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)
5. Select the input signal format. (See page 7, *Input Connection Requirements – Options SD/HD*.)(See page 7, *Input Connection Requirements – Option VGA*.)

6. Select Configuration > Reference & Limits.



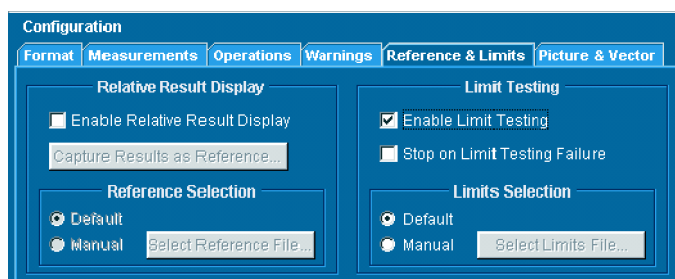
Option SD/HD



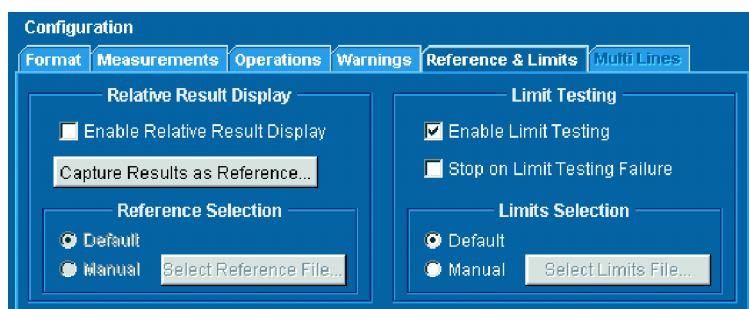
Option VGA

7. Select Enable Limit Testing.

By default, the VM5000 application automatically selects a limit file from a set of supplied templates, matched to the selected signal format.



Option SD/HD



Option VGA

8. Click the Run button.

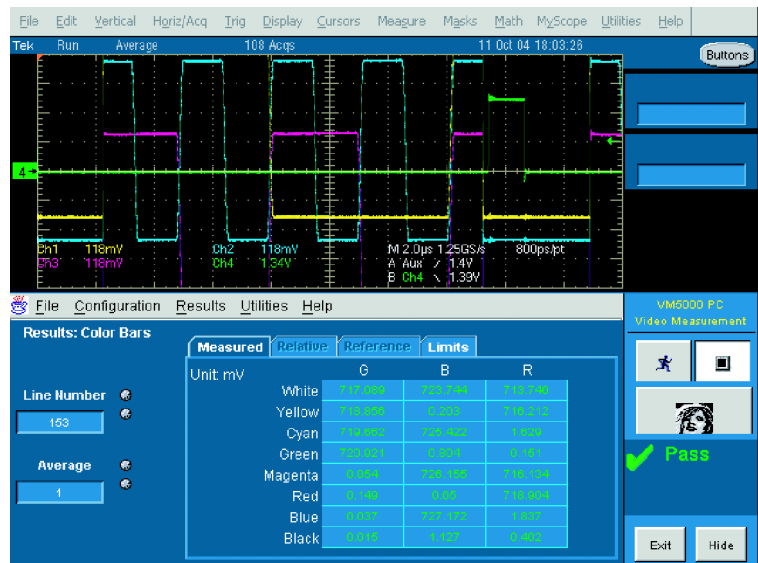


When the measurements are complete, the results screen is displayed. Note that the Limits tab is now selectable.

When limit testing is enabled, results are displayed in either green or red text. Green text indicates pass (the measured value did not exceed the limit values). Red text indicates failure (the measured value exceeded the max or min limit value).



Option SD/HD



Option VGA

9. Select the **Limits** tab to display the Limit values used.

Select either **min** or **max** to see the limits specified for the minimum and maximum acceptable values.



Option SD/HD

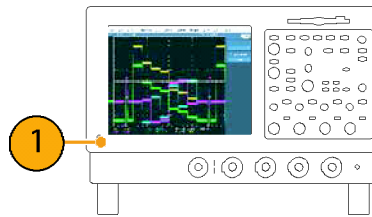


Option VGA

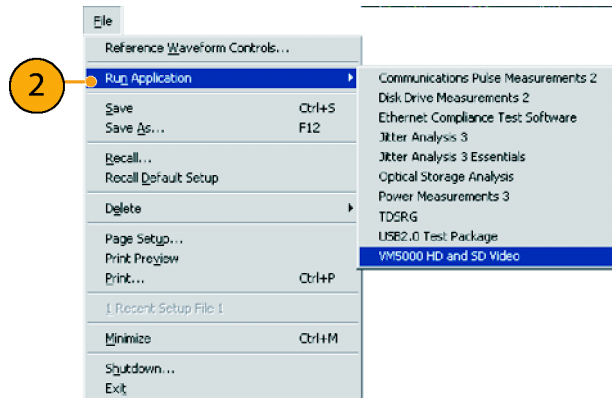
Performing Limit Testing with Two Measurements

The VM5000 can perform limit testing with more than one measurement at a time.

1. Power on the instrument.

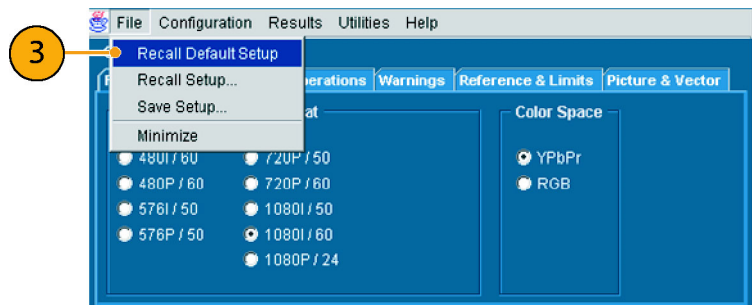


2. Select **File > Run Application > VM5000 HD and SD Video or VM5000 VGA Video**.

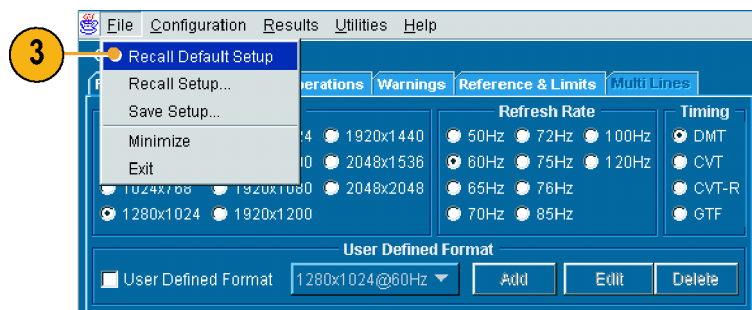


Option SD/HD

3. Select **File > Recall Default Setup** to return all settings to the factory default values.

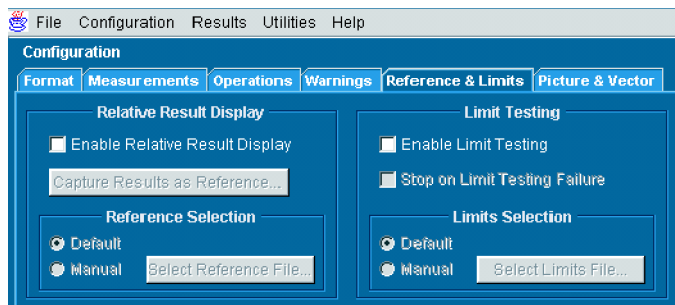


Option SD/HD

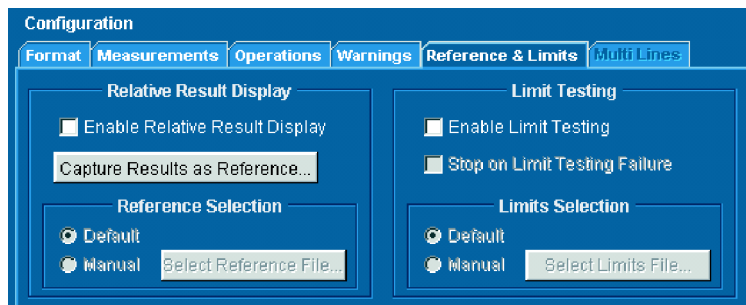


Option VGA

4. Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)
5. Select the input signal format. (See page 25, *Setting the Input Signal Format – Options SD/HD*.)(See page 26, *Setting the Input Signal Format – Option VGA*.)
6. Select **Configuration > Reference & Limits**.

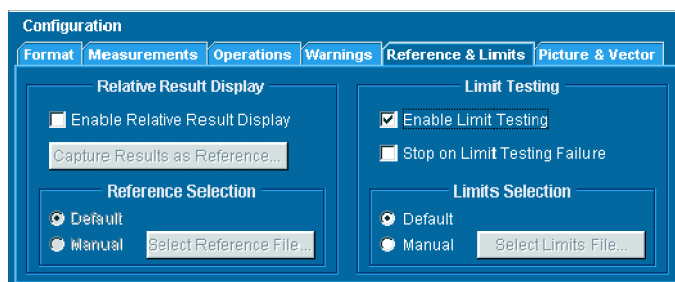


Option SD/HD

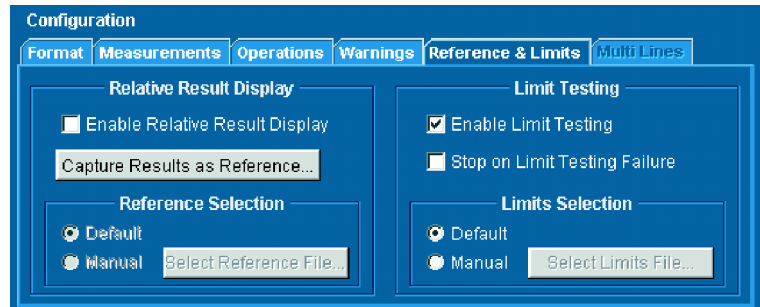


Option VGA

7. Select **Enable Limit Testing**.
By default, the VM5000 application automatically selects a limit file from a set of supplied templates, matched to the selected signal format.



Option SD/HD

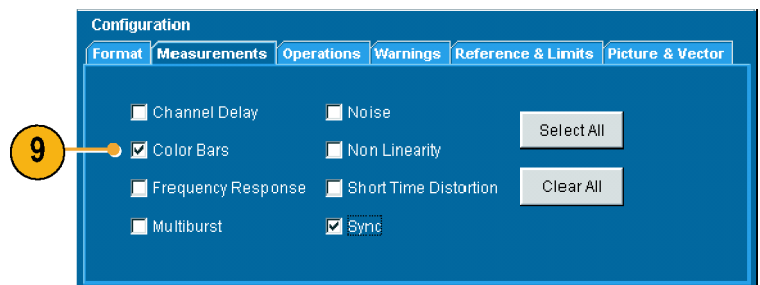


Option VGA

8. Click the **Measurements** tab to select the measurement to be performed.

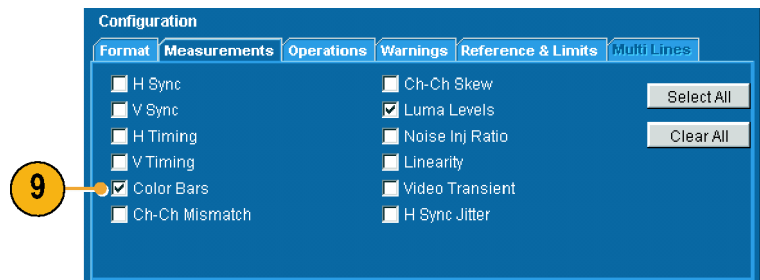
9. Select two measurements:

- Option SD/HD: Select **Color Bars** and **Sync**



Option SD/HD

- Option VGA: Select **Color Bars** and **Luma Levels**



Option VGA

10. Click the Run button.



When the measurements start, the measurement status screen appears. As the measurements are completed, Pass (or Fail) is displayed for the selected measurements.



Option SD/HD



Option VGA

- To display the results of each selected measurement, select the **Results** menu and select one of the selected measurements.

The results screen for the selected measurement is displayed.



Option SD/HD



Option VGA

12. To display the results of the other selected measurement, select the **Results** menu and select the other measurement.



Option SD/HD



Option VGA

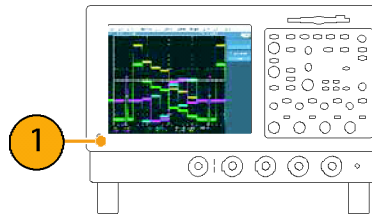
Taking Measurements Across Multiple Lines – Option VGA Only

When the VM5000 takes a measurement, where the measurement is taken (you could also say *when* the measurement is taken) is specified by the line number. (If you want to measure the Luma Level, you need to make sure the measurement is taken within the active video portion of the signal.) Sometimes you will need to take a measurement across more than one line. (For example, you might need to verify that the Luma Level is consistent from the top to the bottom of the display.) To do this, use the **Multiple Lines** setting under **Line Select** on the **Operations** tab.

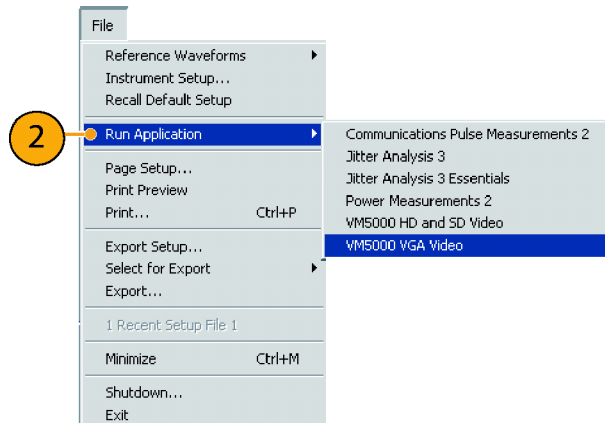
NOTE. Some measurements are not available in Multiple Lines mode.

Because you can specify that measurements are taken on every line, you can end up with a large number of measurement results. Therefore, the results of all measurements taken in Multiple Line mode are saved to a file rather than displayed on-screen. The results file can be saved in RTF, CSV, or PDF format. To view the review the results of a Multiple Lines measurement, you must use a program other than the VM5000 application, such as Microsoft Word, Excel, or Adobe Reader.

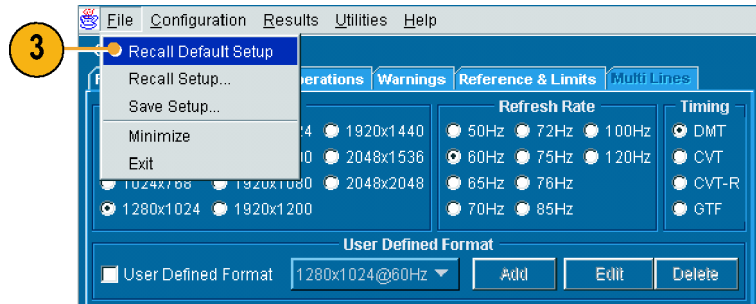
1. Power on the instrument.



2. Select **File > Run Application > VM5000 VGA Video**.

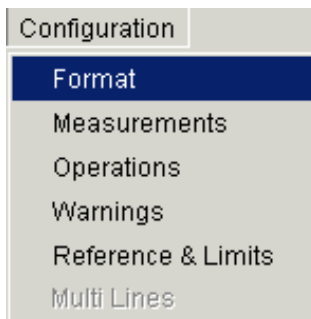


3. In the VM5000 application, select **File > Recall Default Setup** to return all settings to the factory default values.

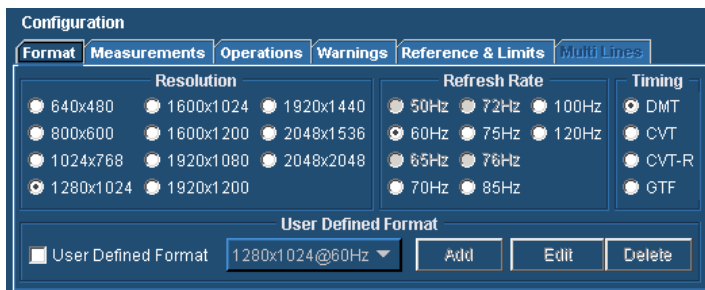


4. Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)

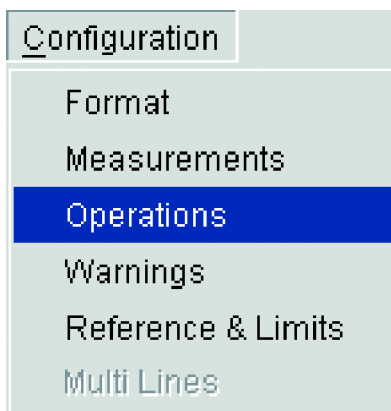
5. Select **Configuration > Format**.



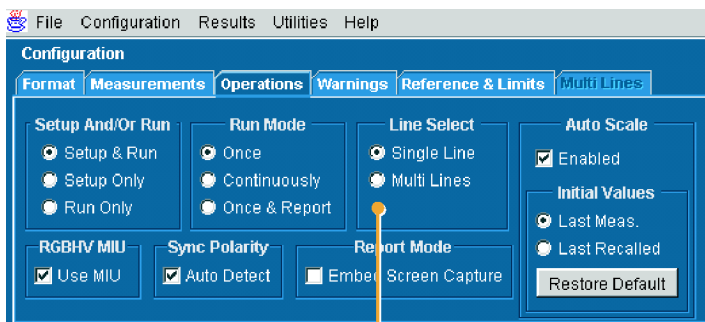
6. Select the settings for **Resolution**, **Refresh Rate**, and **Timing** as necessary.



7. Select **Configuration > Operations**.

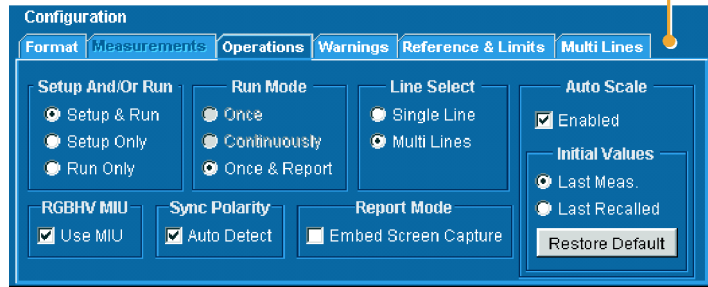


8. Click **Multi Lines** in the Line Select section.

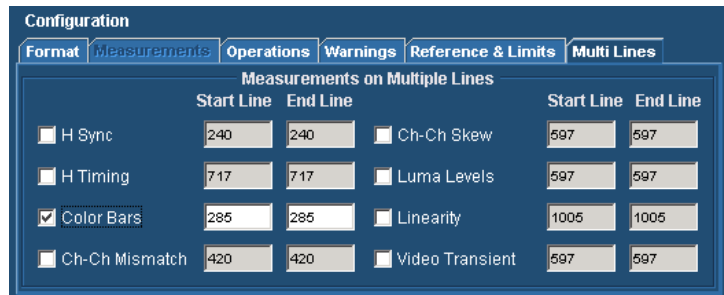


8

- Note that the Multi Lines tab is now selectable and that Measurements is no longer selectable. Click the Multi Lines tab.



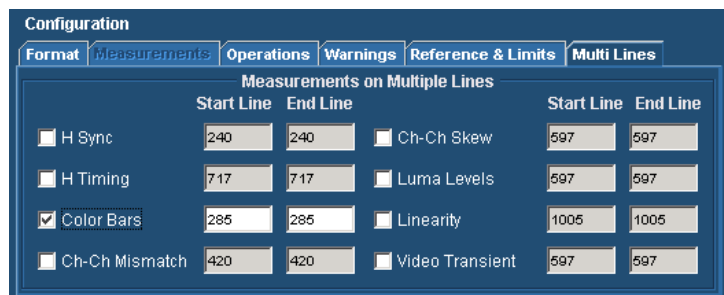
The Multi Lines tab enables you to specify which measurements are taken and the range of lines across which they are taken.



For each measurement there are two entry boxes: Start Line and End Line. Use these two boxes to specify the range of lines across which you want the measurement taken.



- To select a measurement to be taken, click the checkbox next to the measurement name.



11. Enter line numbers in the **Start Line** and **End Line** boxes.

The screenshot shows the 'Measurements on Multiple Lines' section of the Configuration dialog. It contains a table with checkboxes and input fields for Start Line and End Line values.

	Start Line	End Line		Start Line	End Line
<input type="checkbox"/> H Sync	240	240	<input type="checkbox"/> Ch-Ch Skew	597	597
<input type="checkbox"/> H Timing	717	717	<input type="checkbox"/> Luma Levels	597	597
<input checked="" type="checkbox"/> Color Bars	285	287	<input type="checkbox"/> Linearity	1005	1005
<input type="checkbox"/> Ch-Ch Mismatch	420	420	<input type="checkbox"/> Video Transient	597	597

After you have selected the measurements you want to take, you must specify the name of the file into which the measurement results will be saved.

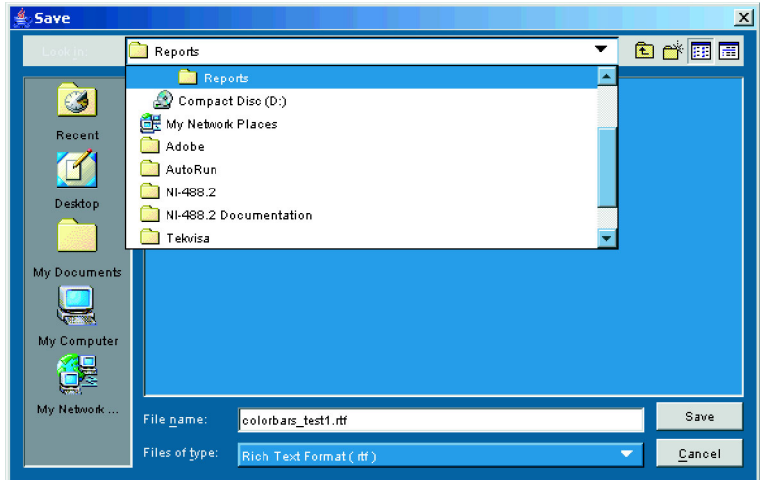
12. To specify the parameters of the file in which the results will be saved:
- Click **Utilities > Generate Report**. This displays the Generate Report panel.

The screenshot shows the 'Utilities: Generate Report' dialog. The 'Report File' section is active, showing a 'File Name' field with the path 'C:\VM5000PC\Reports\Tek0.rtf' and a 'Browse' button. There is also a 'Description' field and a 'Get Default' button. The 'Format' section on the left has radio buttons for RTF, PDF, and CSV. The 'Measurements' section has radio buttons for 'All' and 'Selected'. A 'Generate Report' button is at the bottom right.

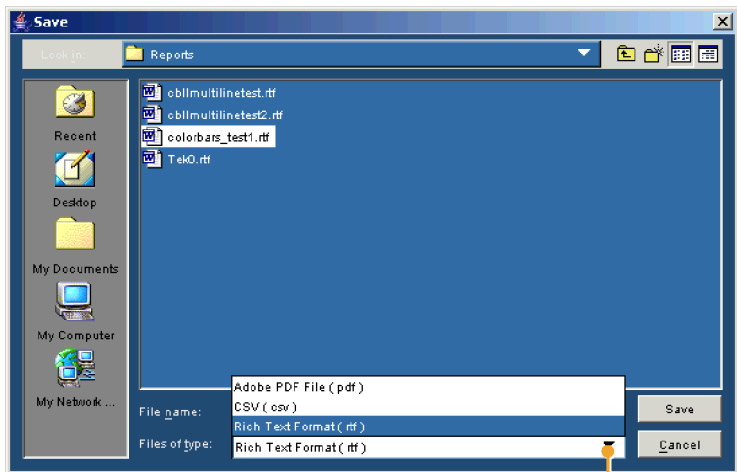
13. To change the filename and save location, click **Browse**. This displays the **Save** dialog.

This screenshot is identical to the previous one, showing the 'Utilities: Generate Report' dialog with the 'Report File' section active and the 'File Name' field containing 'C:\VM5000PC\Reports\Tek0.rtf'.

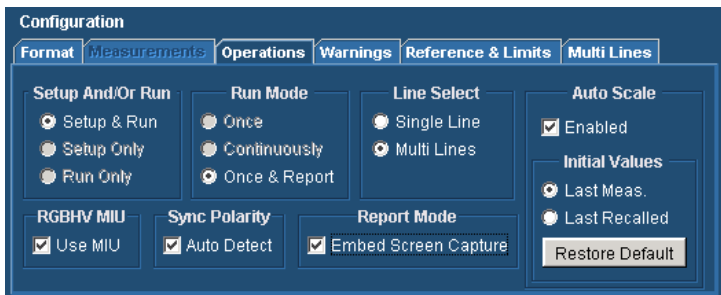
- Enter the filename or navigate to the desired location to save the file.



- Select the format of the report from the options listed under **Files of type**.



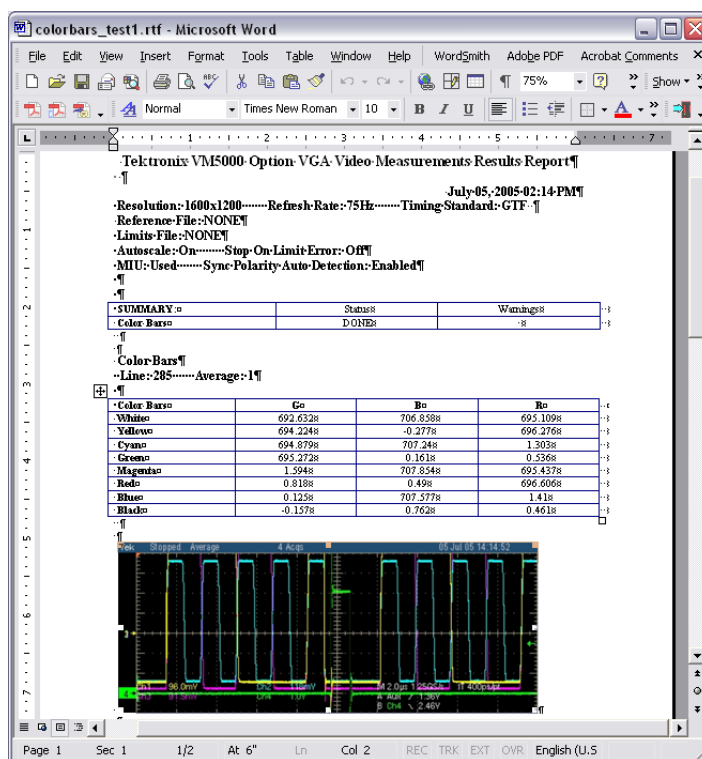
- Click **Save**.
- If you want to save a screen capture of the signal in the report, select **Configuration > Operations** to display the Operations panel. Select **Embed Screen Capture** under **Report Mode** (only available if **Files of type** is set to **Rich Text Format**).



18. Select the **Run** button to take the measurements.

After you select Run, the VM5000 displays the results page for the first of the selected measurements and begins taking measurements. The displayed Line Number increments after each measurement is taken until the measurement for each of the specified lines has been taken. The process repeats for each selected measurement.

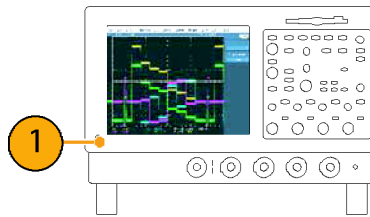
19. To view the results of the measurements, open the report file using the appropriate application.



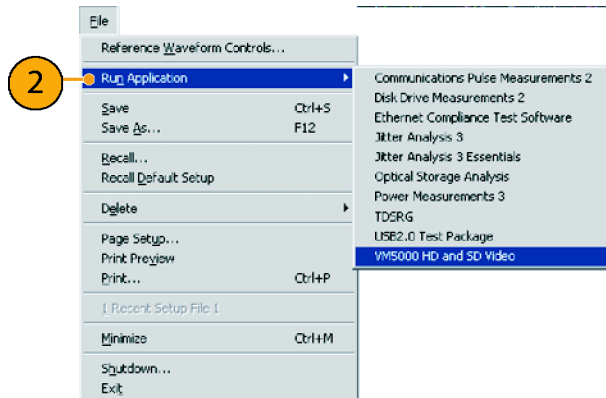
Displaying the Input Signal as a Picture

The VM5000 can display the input signal as a picture.

1. Power on the instrument.



2. Select **File > Run Application > VM5000 HD and SD Video or VM5000 VGA Video.**

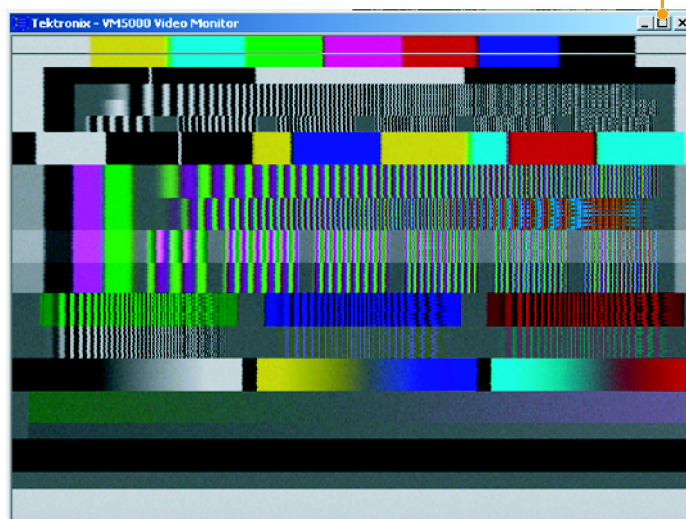


3. Connect a signal to the inputs. (See page 8, *Connecting Input Signals.*)

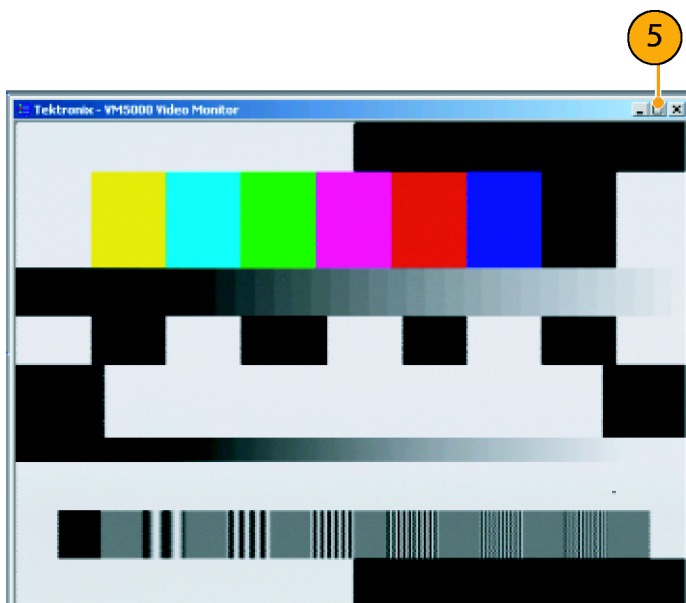
4. Select the picture button. This launches the video monitor window.



5. Click the maximize button to expand the picture to full screen.



Option SD/HD

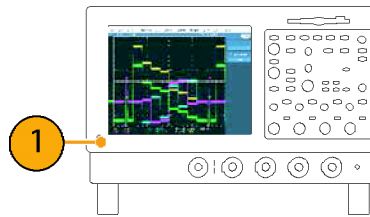


Option VGA

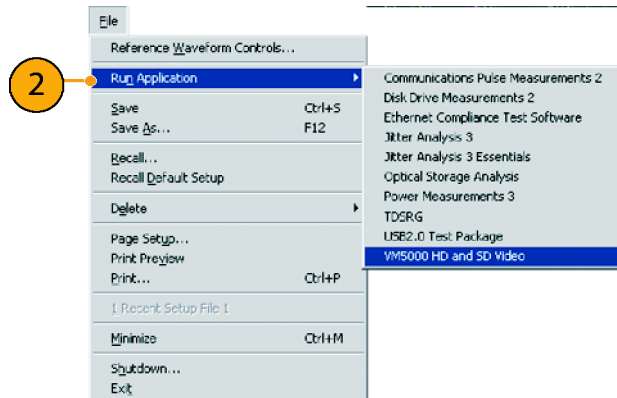
Displaying the Input Signal in a Vectorscope Window – Options SD/HD Only

The VM5000 can display the input signal in a vectorscope window so that you can quickly see the color range of the signal.

1. Power on the instrument.



2. Select **File > Run Application > VM5000 HD and SD Video**.

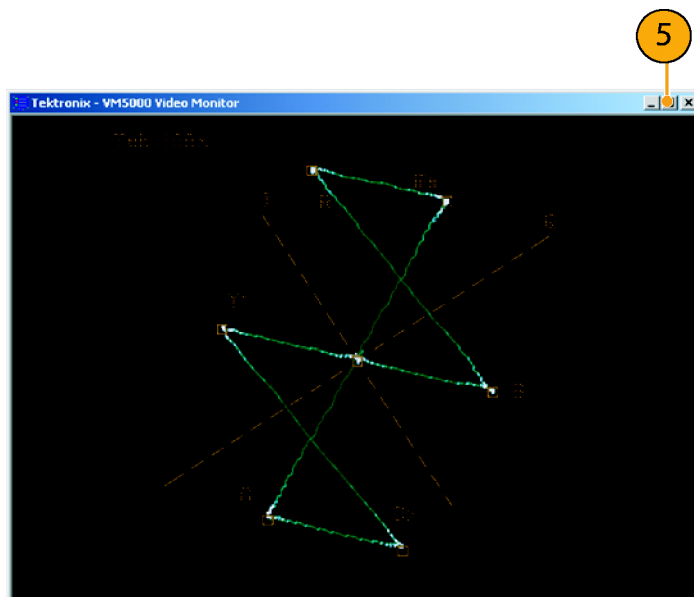


3. Connect a signal to the inputs. (See page 8, *Connecting Input Signals*.)

4. Select the Vectorscope button.
This launches the video monitor display window.



5. Click the maximize button to expand the vectorscope display to full screen.



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