

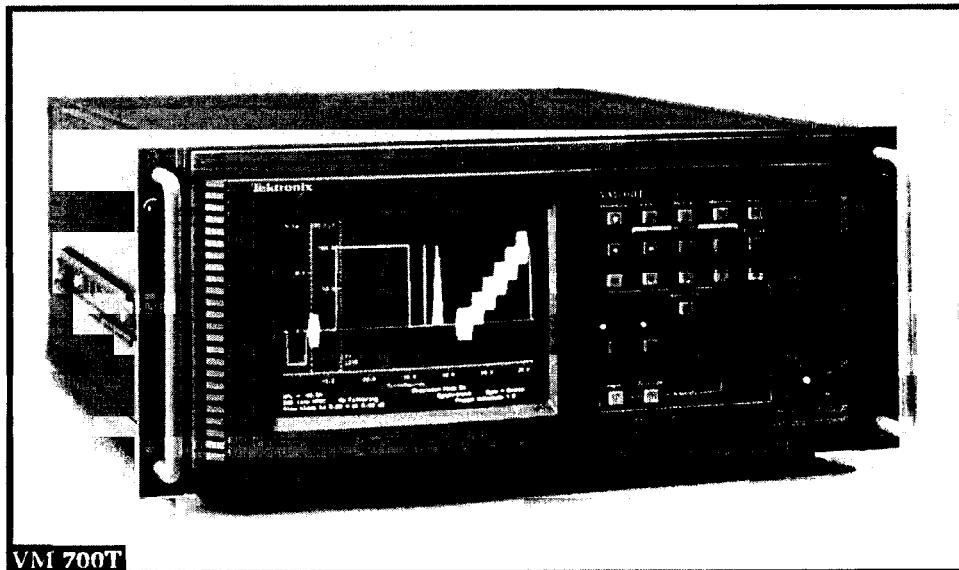
NTSC Video Measurements

VM700T (turbo) Option 01



Features

- Many Capabilities in One Instrument
 - Digital Waveform Monitor
 - Digital Vectorscope
 - Picture Display
 - Group Delay and Frequency Response
 - Noise Measurement Set
 - Automatic Measurement Set
- Auto Mode
 - Unattended Monitoring of NTSC Video Signals From Studios, STLs, Earth Stations, and Transmitters
 - User-specified Limits
- Measure Mode Provides Graphic Display of Measurements
 - ICPM
 - K factor
 - Differential Gain and Phase
 - Chrominance to Luminance Delay
 - Noise Spectrum
 - Group Delay with Sin x/x
 - Color Bars
 - Relative to Reference on Most Measurements
 - Configurable for All Standard Test Signals
- Award-winning User Interface
- State-of-the-art Architecture
- Extremely Fast Update Rate
- Parallel and Serial Printer Ports
- Three Input Channels
- Channel Difference Modes
- External VGA Display Port
- Fully Documented Remote Control Operation
- Hardcopy for Analysis and Documentation



NTSC Video Measurements

Recognized with eight technical Emmy awards and one Oscar for outstanding contributions to the television industry, Tektronix world class core competencies have enabled it to design and deliver the most comprehensive solutions in the industry.

The VM700T is a product of this core competency. Recognized as the defacto industry standard that keeps pace with evolving customer needs, the VM700T is a total solution for your baseband video and audio monitoring and measurement needs. Features such as an extremely fast and fully automatic measurement mode as well as full manual operation provides the first time user as well as the seasoned professional an unequalled value for their test and measurement investment.

AUTOMATIC VIDEO MEASUREMENT SET

The VM700T Auto mode makes standard video transmitter measurements quickly and automatically, including those specified in RS-250C/EIA-250C, NTC-7 and RS170A. Both vertical interval and full field measurements can be made and compared with user-defined limits. A dual limit verification system is employed to generate a caution or alarm message when either limit is violated. Reports can be generated and printed automatically at operator scheduled times or triggered from a conditional event.

GRAPHIC DISPLAYS OF MEASUREMENTS

Measure mode provides virtual real-time graphic displays of measurement results automatically. Vertical interval or full field measurements including noise spectrum, group delay, K-factor, differential gain and differential phase are presented as clever, easy to understand interactive digital displays. Such displays are indispensable when extremely fast measurement update rates (up to 30 times a second) are required to provide instant feedback of critical adjustments and analysis of signal variations. User-definable limits are visually integrated into each graphic display and can be used to trigger a measurement report or a user-definable macro function. Such a function can, for example, dial out through a modem to report measurement results or control a signal router. A relative to reference mode allows normalizing to a signal source or eliminate signal path errors from the desired measurement. Up to 2 video references can be stored in NVRAM. Additionally, after downloading to a PC through the VM700T FTP driver, the video reference can be uploaded to another VM700T for reuse. A running averaging mode can be used to reduce the effect of noise. When additional measurement data is required, a user can custom configure measurement parameters and report format.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.



See Tektronix on the World Wide Web:
<http://www.tek.com>

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A powerful Test Signal search capability quickly and automatically locates and identifies valid test signals required for a selected measurement, eliminating the annoying and time consuming task of manually locating test signals.

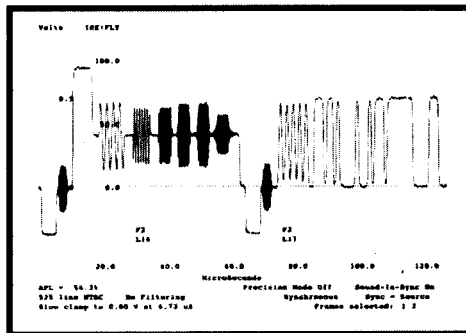
DIGITAL WAVEFORM MONITOR/VECTORSCOPE

The VM700T Waveform mode application provides real time graphics displays of the video signal allowing many additional measurements to be made manually. Easy to use measurement cursors are available to measure time, frequency and amplitude parameters of a video signal. These cursors allow a very quick and precise location of the 10%, 50% and 90% points on any transition.

Cursor mode also employs an automatic calculation in the wave shape in the center of the display. The parameters calculated are sine peak-to-peak amplitude, frequency, and offset from blanking level. This is very useful for frequency response measurements with the Multiburst signal.

The waveform display can be expanded around any point both vertically and horizontally. Since the data is digitized, the display remains bright and easy to read at all expansion factors. The scales automatically expand with the waveform, so all units are correct as displayed. A channel difference mode (A-B, A-C, B-A, B-C, C-A, and C-B) is also provided. A screen memory selection enables Envelope mode, which is useful for looking at teletext, Jitter, or other changes over time.

Vector mode provides the normal vectorscope display. The vectors may be rotated or expanded, with the rotation angle and gain values displayed numerically on the screen.



Vertical interval test signals can be seen very clearly for additional analysis of the signal. These can be printed as support documentation for automatic measurement results.

A unique "Find ColorBars" feature searches all video for ColorBars and displays the vectors if found. The vectors can be referenced to either the selected channel's burst or the burst of one of the other two channels or continuous subcarrier. The phase difference between the selected channel and the reference is always displayed.

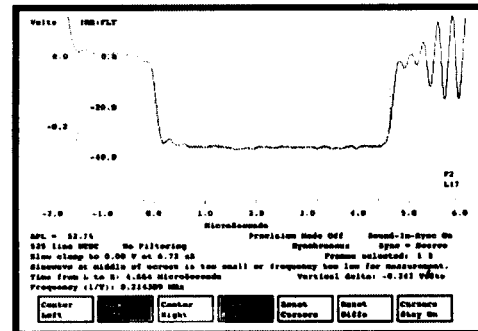
Select Line in both Waveform and Vector modes can be used to quickly specify any line for display or automatic measurement if it is the proper signal.

PICTURE MODE

The signal source can be quickly verified using the picture display. Additionally, a "bright-up" line select mode allows a user to select any video line for use in Measure mode or for viewing in Waveform or Vector mode.

USER PROGRAMMABLE FUNCTIONS

Function mode is an extremely powerful feature that allows a user to store a sequence of user operations as a macro function for later "playback."



Even a single horizontal synchronization pulse can be displayed at a high intensity.

For example, a set of measurements (complete with hardcopy commands) to be made on a transmitter demodulator video output, could be stored as a function labeled "DEM0D." The function "playback" could then be initiated manually, remotely or completely automatically as a user specified timed event. Function files can be stored as a text file on a PC for editing, copying or uploading to another VM700T. Other function capabilities include controlling of external serial devices such as video/audio routers, switchers, signal generators, telephone modems and many other devices which support RS232 communications.

HARDCOPY

All information on the screen may be printed in high resolution graphics on printers supporting PostScript®, Hewlett-Packard® LaserJet™, DeskJet™, and ThinkJet™, or 24-Pin Epson® graphics via the Centronics compatible parallel port or standard RS-232C interface.

Automatic measurement results in text format can be printed on most ASCII printers using the parallel or serial ports.

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REMOTE OPERATION

The VM700T has a powerful and fully documented remote control language. The VM700T can thus be operated from a remote terminal via RS-232C to monitor unattended transmission systems. In addition, all files can be uploaded to a main computer, and downloaded to other VM700Ts. Two different protocols are supported: FTP (File Transfer Protocol) and TELNET. The user can also select a "no protocol" mode of the RS-232C interface when dealing with low baud rates. However, file transfers can only take place with FTP.

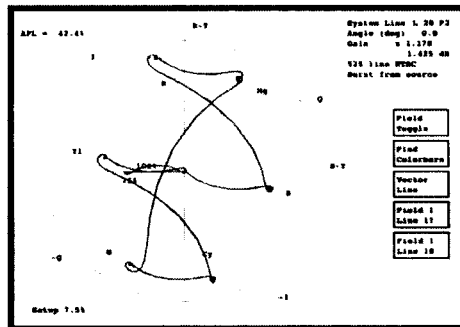
SPECIFICATIONS

The performance requirements cited in this section are valid only within the following environmental limits:

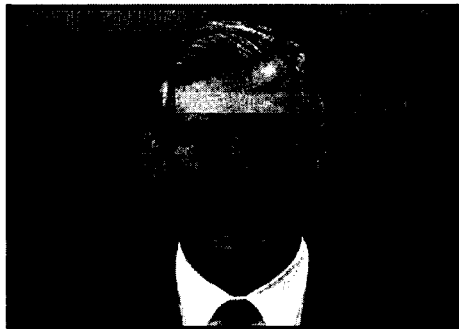
Temperature range of 0 to 50°C, with a minimum warm-up time of 20 minutes. The following tables list each measurement and its performance requirement.

The range specifies the extremes between which a measurement can be made.

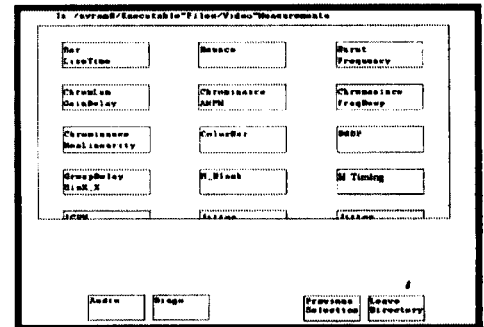
All measurement accuracies specified are valid only with nominal input signals of 1 V pk-pk (± 6 dB) with an unweighted signal-t-noise ratio of at least 60 dB on the incoming signal and a termination accuracy of $\pm 0.025\%$ (Tektronix PN 011-0102-01 or equivalent).



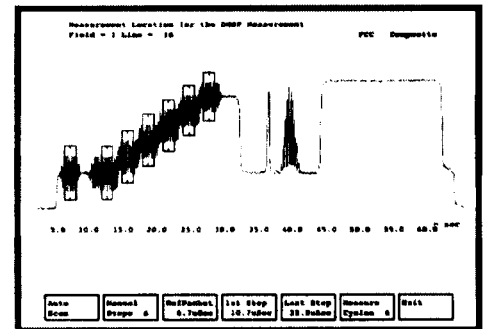
In Vector Mode, the VM 700T becomes a digital vectorscope with an electronic graticule. A "ColorBar Search" feature makes it easy to quickly display a line containing a color bar test signal.



Picture Mode display. (Video courtesy of KOIN-TV, Portland, Oregon)



Main Measure Mode display of available measurements.



Measure Mode DGDSP special position acquisition feature.

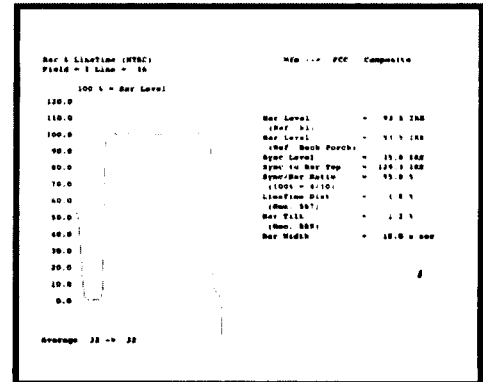
NTSC Video Measurements

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MEASURE MODE*1, 2

BAR LINE TIME

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Bar Level	50 to 200 IRE	±0.5%	±0.2%
Sync Level	20 to 80 IRE	±0.5%	±0.2%
Sync to Bar Top	70 to 280 IRE	±0.5%	±0.2%
Sync/Bar Ratio	10% to 125% 100% nominal	±0.5%	±0.2%
Bar Tilt (Rec 569)	0 to 20%	±0.2%	±0.1%
Line Time Distortion (Rec 567)	0 to 20%	±0.2%	±0.1%
Bar Width	10 µs to 30 µs	±100 ns	NA



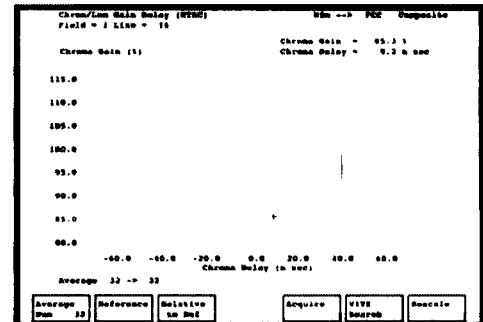
Bar Line Time measurement.

BOUNCE

Measurement	Range	Accuracy
Peak Deviation	0 to 50%	±1%
Settling Time	0 to 10 sec	±100 msec

BURST FREQUENCY*3

Measurement	Range	Relative Mode Accuracy
Burst Frequency Error	±100 Hz	±0.5 Hz



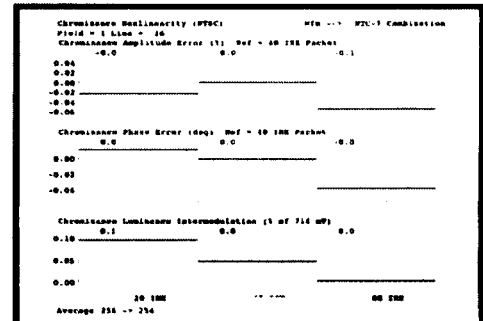
Chrominance to Luminance Gain and Delay measurement.

CHROMINANCE TO LUMINANCE GAIN AND DELAY

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Chrominance to Luminance Delay	±300 ns	±5 ns	±1.0 ns
Chrominance to Luminance Gain Ratio	0 to 160%	±1.0%	±0.1%

CHROMINANCE FREQUENCY RESPONSE

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Reference Amplitude	0 to 100 IRE	±1%	±0.5%
Frequency Response	0 to 100 IRE	±1%	±0.5%



Chrominance Non-Linearity measurement.

CHROMINANCE NOISE

Measurement	Range	Absolute Mode Accuracy
AM Noise	-20 to -80 dB	±1 dB (-20 to -60 dB)
PM Noise	-20 to -70 dB	±1 dB (-20 to -60 dB)

CHROMINANCE NON-LINEARITY*4

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Chrominance Amplitude	0 to 100%	±0.4%	±0.2%
Chrominance Phase	0 to 360 deg	±1 deg	±0.2 deg
Chrominance to Luminance Intermodulation	-50 to +50%	±0.2%	±0.2%

*1 All accuracies for measurements with averaging capabilities assume the default average of 32.

*2 All accuracies for measurements with relative to reference mode assume an average of 256 was used to create the reference.

*3 Requires a reference signal.

*4 Accuracies for chrominance non-linearity amplitude and phase measurements assume an average of 256.

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COLOR BAR

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Luminance Level	0 to 100 IRE (0 to 714.3 mV)	±0.5 IRE	±0.2%
Chrominance Level (excluding gray and black)	0 to 100 IRE (0 to 714.3 mV)	±1.0% of nominal	±0.2%
Chrominance Phase	±180 deg of nominal	±0.5 deg of nominal	±0.1 deg

SMPTÉ COLOR BARS NOMINAL VALUES

Color	LUM (mV)	Chroma P-P (mV)	Phase (degrees)
Yellow	494.6	444.2	167.1
Cyan	400.4	630.1	283.4
Green	345.9	588.5	240.8
Magenta	256.7	588.5	60.8
Red	202.2	630.1	103.4
Blue	108.1	444.2	347.1

DIFFERENTIAL GAIN AND PHASE

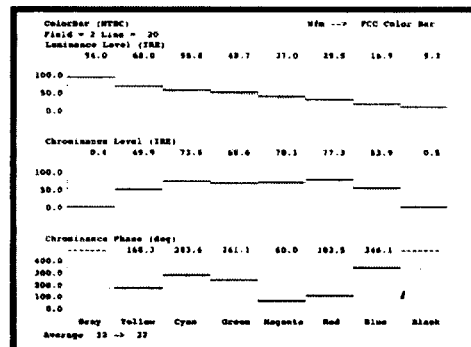
Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Differential Gain	0 to 100%	±0.3%	±0.03%
Differential Phase	0 to 360 deg	±0.3 deg	±0.03 deg

FREQUENCY RESPONSE AND GROUP DELAY

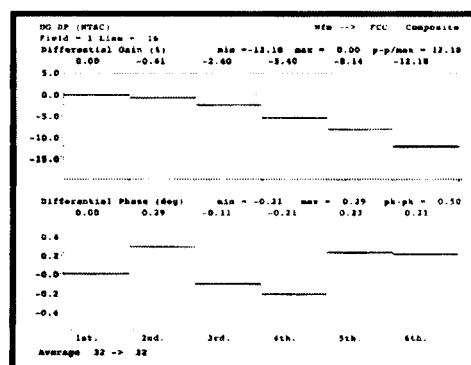
Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Frequency Response	±40 dB	±1.0 dB	±0.3 dB
Group Delay	±1.0 μs	±20 ns	±5 ns

HORIZONTAL BLANKING

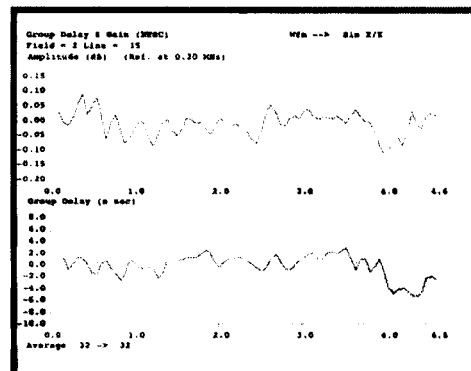
Measurement	Range	Absolute Mode Accuracy
Blanking Start	0.1 to 4.2 μs	±50 ns
Blanking End	6.8 to 12.2 μs	±50 ns
Blanking Width	6.9 to 16.4 μs	±50 ns



Color Bar measurement.



Differential Gain and Phase measurement.



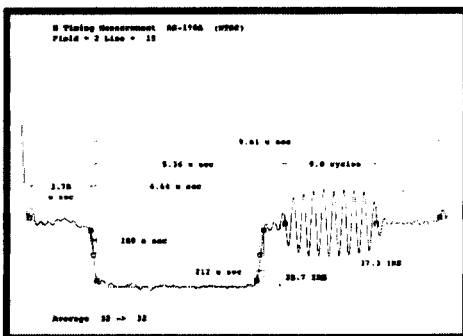
Frequency Response and Group Delay measurement using Sin X/X.

NTSC Video Measurements

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HORIZONTAL TIMING

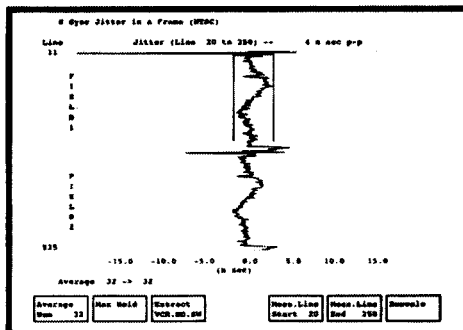
Measurement	Range	Absolute Mode Accuracy
Burst Level	10 to 80 IRE	±0.5%
Horizontal Sync Rise and Fall Time	80 ns to 1 µs	±10 ns
Horizontal Sync Width	3 to 7 µs	±10 ns
Burst Width	6 to 13 cycles	±0.1 cycles (FCC) ±0.5 cycles (RS-170A)
Sync to Burst Start (RS-170A)	4 to 10 µs	±150 ns
Sync to Burst End (FCC)	4 to 10 µs	±25 ns
Front Porch	0.1 to 3.5 µs	±10 ns (FCC) ±10 ns (RS-170A)
Sync to Setup	8.8 to 13.0 µs	±10 ns
Breezeway (FCC)	0.1 to 5 µs	±25 ns
Sync Level	20 to 80 IRE	±0.5%



Horizontal Timing measurement.

INCIDENTAL CARRIER PHASE MODULATION

Measurement	Range	Accuracy
ICPM (requires zero Carrier Pulse and the quadrature output of the demodulator on Channel C)	0 to 90 deg	±1.0 deg



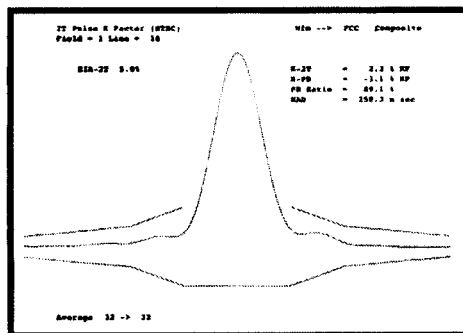
H Jitter.

JITTER

Measurement	Range	Absolute Mode Accuracy
Jitter (2 Field)	±20 µs	±10 ns
Jitter Long Time	±20 µs	±10 ns

K - FACTOR

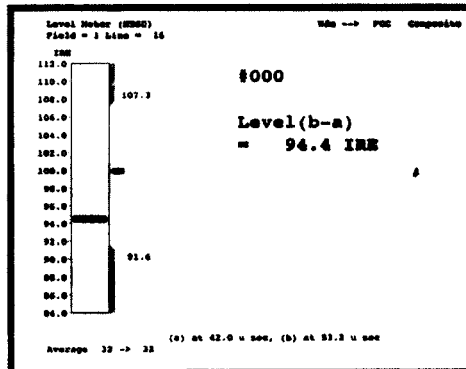
Measurement	Range	Absolute Mode Accuracy
2T Pulse K-Factor	0 to 10% Kf	±0.3%
KPB	10 to 5% KPB	±0.3%
Pulse to Bar Ratio	10 to 125%	±0.7%
Pulse Half	100 to	±5 ns
Amplitude Duration (HAD)	500 ns	



K-factor measurement.

LEVEL METER

Measurement	Range	Accuracy
Level Meter	0 to 1.4 V	±3.5 mV



Level Meter measurement.

LINE FREQUENCY

Measurement	Range	Accuracy
Line Frequency	±3%	±0.1%
Field Frequency	±3%	±0.1%

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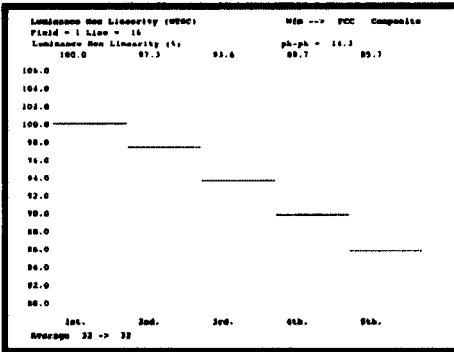
LUMINANCE NON-LINEARITY

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Luminance Non-linearity	0 to 100%	±0.4%	±0.2%

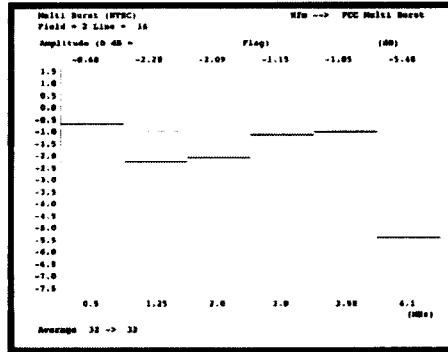
MULTIBURST *5

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Reference Flag or Packet Amplitude	30 to 130 IRE	±1%	NA
Other Packets	-40 to +6 dB	±0.1 dB	±0.03 dB

*5 Total Harmonic Distortion on packets must be ≤46 dB.



Luminance Non-Linearity measurement.



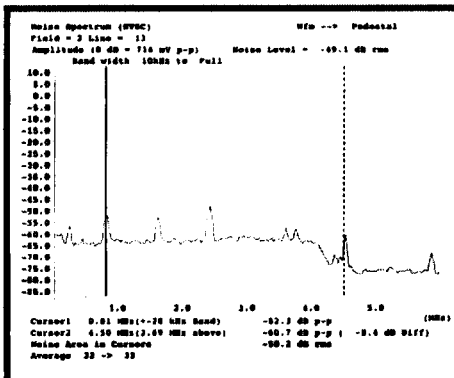
Multiburst measurement.

NOISE SPECTRUM

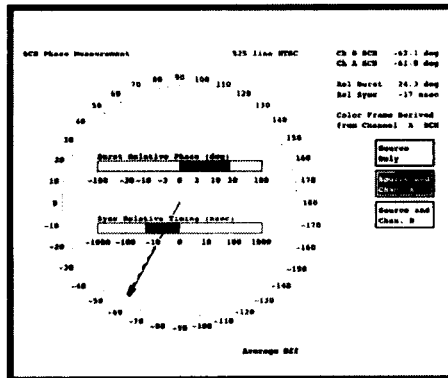
Measurement	Range	Absolute Mode Accuracy
Unweighted Signal-to-Noise Ratio (5 MHz Low Pass)	-20 to -80 dB	±0.4 dB (-20 to -60 dB) ±1.0 dB (-60 to -70 dB)
Weighted Signal-to-Noise Ratio (5 MHz Low Pass and Unified Weighting)	-20 to -80 dB	±1.0 dB (-20 to -0 dB) ±2.0 dB (-60 to -70 dB)

SCH PHASE

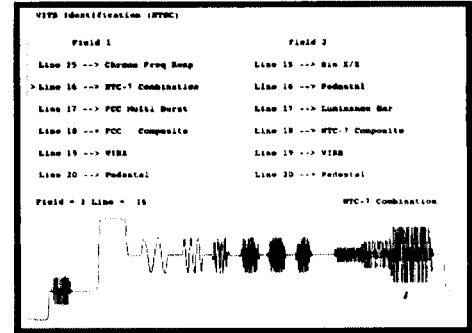
Measurement	Range	Absolute Mode Accuracy
SCH Phase	±90 deg	±5 deg
Sync Timing	±1 μS	±10 nS
Burst Timing	±180 deg	±5 deg



Noise Spectrum measurement.



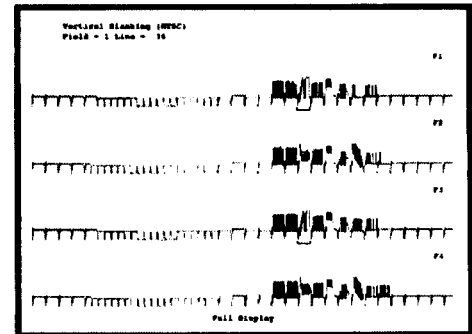
SCH Phase measurement.



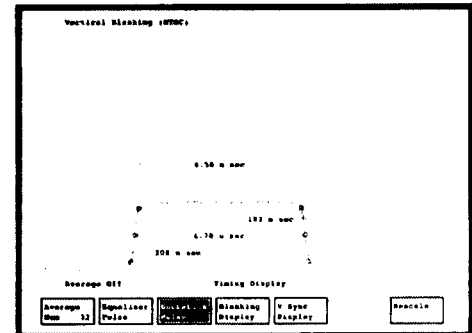
VITS ID display.

VERTICAL BLANKING

Measurement	Range	Absolute Mode Accuracy
Equalizing Pulse Width	80 ns to 1 μs	±10 ns
Serration Pulse Width	80 ns to 1 μs	±10 ns



Vertical Blanking display.



Vertical Blanking Serration Pulse measurement.

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Auto Mode

RS-170A HORIZONTAL BLANKING INTERVAL TIMING MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Color Burst Width	6 to 13 cycles	±0.1 cycles	Horizontal Blanking
Front Porch Duration	0.5 to 2 µs	±20 ns	Horizontal Blanking
Horizontal Blanking Width	6 to 30 µs	±50 ns	Horizontal Blanking
Horizontal Sync Rise Time and Fall Time	80 to 120 ns, 120 to 300 ns 300 ns to 1.0 µs	-10 to +30 ns, ±20 ns ±30 ns	Horizontal Blanking
Horizontal Sync Width	1 to 8 µs	±10 ns	Horizontal Blanking
SCH Phase	±90 deg	±5 deg	Horizontal Blanking
Sync to Setup	5 to 18 µs	±20 ns	Horizontal Blanking
Sync to Start of Burst	4 to 8 µs	±140 ns (0.5 cycles) ±20 ns	Horizontal Blanking

RS-170A VERTICAL BLANKING INTERVAL

Measurement	Range	Accuracy	Test Signal
Equalizing Pulse Width	1 to 20 µs	±10 ns	Vertical Blanking
Serration Width	1 to 20 µs	±10 ns	Vertical Blanking
Vertical Blanking Width	19 to 29 lines	-0.1 lines to +0.2 lines	Vertical Blanking

FCC HORIZONTAL BLANKING INTERVAL TIMING MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Breezeway Width	0.2 to 3.5 µs	±25 ns	Horizontal Blanking
Color Burst Width	6 to 13 cycles	±0.1 cycles	Horizontal Blanking
Front Porch Duration	0.5 to 2 µs	±10 ns	Horizontal Blanking
Horizontal Blanking Width	6 to 30 µs	±10 ns	Horizontal Blanking
Horizontal Sync Rise Time and Fall Time	80 to 120 ns 120 to 300 ns, 300 ns to 1.0 µs	-10 to +30 ns ±20 ns, ±30 ns	Horizontal Blanking
Horizontal Sync Width	1 to 8 µs	±10 ns	Horizontal Blanking
Sync to Setup	5 to 18 µs	±20 ns	Horizontal Blanking
Sync to End of Burst	6 to 15 µs	±20 ns	Horizontal Blanking

FCC VERTICAL BLANKING INTERVAL TIMING MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Equalizing Pulse Width	25 to 100%, of nominal horizontal sync pulse width	±0.3%	Vertical Blanking
Serration Width	1 to 20 µs	±10 ns	Vertical Blanking
Vertical Blanking Width	19 to 29 lines	-0.1 lines to +0.2 lines	Vertical Blanking

AMPLITUDE AND PHASE MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Average Picture Level (APL)	0 to 200%	±3.0%	Full Field
Bar Top	0 to 90% of Maximum Carrier	±0.1%	FCC/NTC-7 Composite
Bar Amplitude	0 to 200 IRE	±0.3 IRE	FCC/NTC-7 Composite
Chrominance to Luminance Delay (Relative Chroma Time)	±300 ns	±5 ns	FCC/NTC-7 Composite
Chrominance to Luminance Gain (Relative Chroma Level)	0 to 160%	±1%	FCC/NTC-7 Composite
Differential Gain	0 to 100%	±0.3%	FCC/NTC-7 Composite
Differential Phase	0 to 360 deg	±0.3 deg	FCC/NTC-7 Composite
Luminance Non-linear Distortion	0 to 50%	±0.4%	FCC/NTC-7 Composite
Relative Burst Gain	±100%	±0.3%	FCC/NTC-7 Composite
Relative Burst Phase	±180 deg	±0.3 deg	FCC/NTC-7 Composite
Burst Amplitude (% of sync)	25 to 200% of sync	±1.0%	Horizontal Blanking
Burst Amplitude (% of Bar)	10 to 80% of Bar (10 to 80 IRE when Bar is not used)	±0.4% (±0.4 IRE)	Horizontal Blanking
Sync Amplitude (% of Bar)	20 to 80% of Bar (20 to 80 IRE when Bar is not used)	±0.3% (±0.3 IRE)	Horizontal Blanking

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AMPLITUDE AND PHASE MEASUREMENTS (CONTINUED)

Measurement	Range	Accuracy	Test Signal
Blanking Level	0 to 90% of Maximum Carrier	±0.2%	Horizontal Blanking
Sync Variation	0 to 50% of Maximum Carrier (0 to 50% of Bar when Zero Carrier is not used and 0 to 50 IRE when Zero Carrier and Bar are not used)	±0.3% for Zero Carrier (±0.3% for Bar and ±0.3 IRE for no Zero Carrier and no Bar)	Horizontal Blanking
Blanking Variation	0 to 50% of Maximum Carrier (0 to 50% of Bar when Zero Carrier is not used and 0 to 50 IRE when Zero Carrier and Bar are not used)	±0.3% for Zero Carrier (±0.3% for Bar and ±0.3 IRE for no Zero Carrier and no Bar)	Horizontal Blanking

FREQUENCY RESPONSE MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Multiburst Flag Amplitude	0 to 90% of Maximum Carrier (20 to 130% of Bar when Zero Carrier is not used and 20 to 130 IRE when Zero Carrier and Bar are not used)	±0.5% for Zero Carrier (±0.5% for Bar and ±0.5 IRE for no Zero Carrier and no Bar)	FCC Multiburst or NTC-7 Combination
Multiburst Packet	0 to 100% of Flag	±1% of Flag NTC-7 Combination	FCC Multiburst or Amplitudes

INCIDENTAL CARRIER PHASE MODULATION

Measurement	Range	Accuracy	Test Signal
ICPM (requires Zero Carrier Pulse and the quadrature output of the demodulator on channel C)	0 to 30 deg	±1.0 deg	FCC or NTC-7 Composite

COLOR BAR MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Color Bar Amplitude Errors	±100% of nominal	±1.0%	FCC Color Bars
Color Bar Phase Errors	±180 deg from nominal	±0.5 deg	FCC Color Bars
Color Bar Chrominance to Luminance Gain Ratio	0 to 200% of nominal	±2%	FCC Color Bars

NTSC Video Measurements

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OUT-OF-SERVICE MEASUREMENTS

Measurement	Range	Accuracy	Test Signal
Field Time Distortion	0 to 40%	±0.5%	Field Square Wave

WAVEFORM DISTORTION MEASUREMENTS

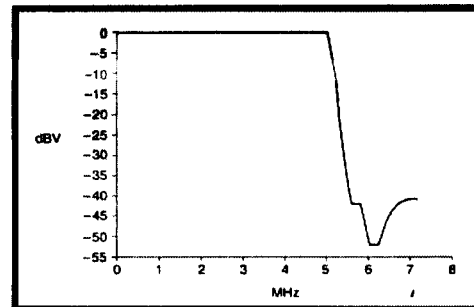
Measurement	Range	Accuracy	Test Signal
Line Time Distortion	0 to 40% of Bar	±0.2%	FCC or NTC-7 Composite
Pulse to Bar Ratio	10 to 125%	±0.7%	FCC or NTC-7 Composite
Short Time Waveform Distortion (IEEE 511)	0 to 25% SD	±0.5% SD	NTC-7 Composite
Chrominance Non-linear Gain Distortion	5 to 35 IRE (20 IRE chroma) 45 to 160 IRE (80 IRE chroma)	±0.4 IRE	NTC-7 Combination
Chrominance Non-linear Phase Distortion	0 to 360 deg	±1.0 deg	NTC-7 Combination
Chrominance to Luminance Intermodulation	±50 IRE	±0.2 IRE	NTC-7 Combination
2T K-Factor	0 to 10% Kf	±0.3% Kf	FCC or NTC-7 Composite

VIRS MEASUREMENTS

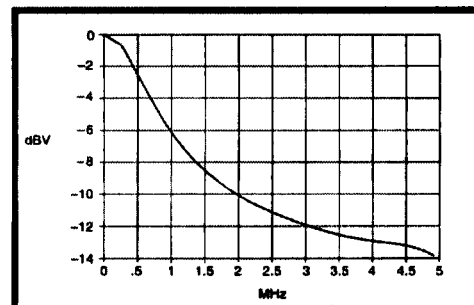
Measurement	Range	Accuracy	Test Signal
VIRS Setup (Reference Black)	-20 to 130% of Bar (-20 to 130 IRE when Bar is not used)	±0.2% (±0.5 IRE when Bar is not used)	VIRS
VIRS Chrominance Reference Amplitude	0 to 200% of burst amplitude (0 to 80% of Bar when burst is not used and 0 to 80 IRE when burst and bar are not used)	±1% (±0.1% when burst is not used and ±1 IRE when burst and Bar are not used)	VIRS
VIRS Chrominance Phase Relative to Burst	±180 deg	±0.5 deg	VIRS
VIRS Luminance Reference	30 to 100% of Bar (30 to 100 IRE when Bar is not used)	±0.2% (±0.2 IRE)	VIRS

SIGNAL-TO-NOISE RATIO MEASUREMENTS

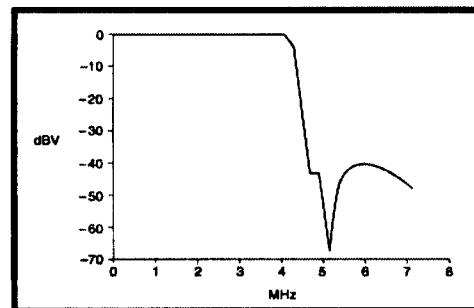
Measurement	Range	Accuracy	Test Signal
Unified Unweighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
Unified Luminance Weighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
NTC 7 Unweighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
NTC 7 Luminance Weighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
Periodic SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line



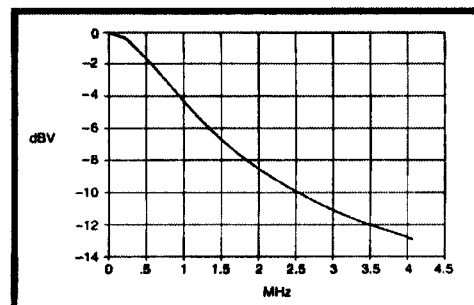
Unified Unweighted filter response curve per CCIR Recommendation 567.



Unified Luminance weighted filter response curve per CCIR Recommendation 567.



NTC 7 Unweighted filter response.



NTC 7 Luminance weighted filter response.

NTSC Video Measurements

VM700T (turbo) Option 01

MEASUREMENT METHODS – AUTO-MODE

The following paragraphs describe the measurement methods for each measurement. Each timing measurement method is written for the FCC method. If there is an RS-170A method for that same measurement, and the RS-170A method differs from the FCC method, the RS-170A requirement is enclosed within square brackets in the FCC description.

HORIZONTAL INTERVAL TIMING

MEASUREMENTS

These timing measurements are made within the active picture area, averaging the results over 32 lines starting at line 50 and skipping 1-frame plus 5 lines for each successive sample (i.e., average over line 50 of first field, line 56 of second field, line 62 of the third field, etc.).

- **Breezeway Width:** Measured from the 10% point on the trailing edge of horizontal sync (nominally -4 IRE) to the leading half-amplitude point of the burst envelope.
- **Color Burst Width:** Measured from the leading half-amplitude point on the burst envelope [leading zero crossing of the first half-cycle of burst that exceeds 50% of burst amplitude] to the trailing half-amplitude point on the burst envelope [trailing zero crossing of the last half-cycle of burst that exceeds 50% of burst amplitude].
- **Front Porch Duration:** Measured from the 10% point on the trailing edge of setup (+4 IRE nominally) to the 10% [50%] point on the leading edge of sync (nominally -4 [20] IRE).
- **Horizontal Blanking Width:** Measured between the points on the leading and trailing edges of horizontal blanking that are at an amplitude of 10% [50%] of sync above blanking level (nominally +4 [+20] IRE).
- **Horizontal Sync Rise Time and Fall Time:** Measured between the 10% and 90% points on the leading and trailing edges of horizontal sync, respectively (nominally -4 IRE and -36 IRE).
- **Horizontal Sync Width:** Measured between the 10% [50%] points on the leading and trailing edges of horizontal sync (nominally -4 [-20] IRE).

- **SCH Phase:** Phase at the middle of burst relative to the 50% point on the sync leading edge.
- **Sync to Setup:** Measured from the 10% [50%] point on the leading edge of sync (nominally -4 [-20] IRE) to the point on the trailing edge of blanking that is equivalent to 10% of sync (nominally +4 IRE).
- **Sync-to-Start-of-Burst:** Measured from the 50% point on the leading edge of sync (nominally -20 IRE) to the leading zero crossing of the first half-cycle of burst that exceeds 50% of burst amplitude.
- **Sync-to-End-of-Burst:** Measured from the 10% point on the leading edge of horizontal sync (nominally -4 IRE) to the half-amplitude point on the trailing edge of the burst envelope.

VERTICAL INTERVAL TIMING

- **Equalizing Pulse Width:** Measured between the 10% [50%] points on the equalizing pulse (nominally -4 [-20] IRE).
- **Serration Width:** Measured between the 10% [50%] points of serration (nominally -4 [-20] IRE).
- **Vertical Blanking Width:** Measured between the points on setup [active picture] at a level equal to 10% [50%] of sync amplitude (nominally +4 [+20] IRE), where setup [active picture] immediately precedes and follows the vertical blanking interval.

COLOR BAR MEASUREMENTS

- **Color Bar Amplitude Error:** Measured as deviation of the peak-to-peak amplitude of each color bar from the nominal value for that color bar expressed as a percent of the nominal value. Six values reported.
- **Color Bar Phase Error:** Measured as deviation of the phase of each color bar from the nominal phase for that color bar, relative to burst phase. Six values reported.

- **Color Bar Chrominance-Luminance Gain Ratio:** Measured as ratio of chrominance level to luminance level of each color bar, relative to the nominal ratio for each color bar. Six values reported.

Color	Amplitude	Phase	C/L Gain Ratio
Yellow	67.36%	167.59 deg	1.0092
Cyan	94.74%	283.54 deg	1.8045
Green	89.04%	240.67 deg	2.0123
Magenta	89.04%	60.67 deg	2.8957
Red	94.74%	103.54 deg	4.2106
Blue	67.36%	347.59 deg	8.1652

FCC Color Bars Nominal Values

(Source: FCC Rule 73.699, Figure 14).

AMPLITUDE AND PHASE MEASUREMENTS (FCC OR NTC-7 COMPOSITE VITS)

- **Bar Top:** Measured as the ratio of the bar top to Zero Carrier amplitude to the blanking (at back porch) to the Zero Carrier amplitude. Result expressed as a percent of Max Carrier.
- **Bar Amplitude:** Measured from the reference blanking level (at back porch) contained within the test line to the level at the center of the bar.
- **Burst Amplitude:** VITS not required. Burst amplitude must be at least 10 IRE. Measured as peak-to-peak amplitude of the color burst at burst center.
- **Chrominance-Luminance Delay Inequality (Relative Chrominance Time):** Measured as the time difference between the luminance component and chrominance component of the modulated 12.5T pulse.
- **Chrominance-Luminance Gain Inequality (Relative Chrominance Level):** Measured as the peak-to-peak amplitude of the chrominance component of the modulated 12.5T-pulse.
- **Differential Gain:** Measured as the absolute amplitude difference between the smallest and largest staircase chrominance packets. Result expressed as a percent of the largest packet amplitude.

NTSC Video Measurements

VM700T (*turbo*) Option 01

- **Differential Phase:** Measured as the largest difference in phase between any two staircase chrominance packets.
- **Luminance Non-linear Distortion:** Measured as the difference between the largest and smallest step amplitudes of the staircase at the center of each step. Result expressed as a percent of the largest step amplitude difference.
- **Relative Burst Gain:** Measured as the difference between the peak-to-peak amplitude of burst and the staircase chrominance packet located at blanking. Result expressed as a percent of the packet amplitude.
- **Relative Burst Phase:** Measured as the difference in phase between the color burst and the staircase packet located at blanking.
- **Sync Amplitude:** Measured from the tip of the horizontal sync pulse to blanking level.
- **Blanking Level:** Measured as the ratio of the blanking (at back porch) to Zero Carrier amplitude to the sync tip to Zero Carrier amplitude. Result expressed as a percent of Max Carrier.
- **Sync Variation:** Measured as the peak-to-peak variation of the horizontal sync pulse amplitude within every third line of a field.
- **Blanking Variation:** Measured as the peak-to-peak variation of the blanking level within every third line of a field.

FREQUENCY RESPONSE MEASUREMENTS (FCC MULTIBURST OR NTC-7 COMBINATION VITS)

- **Multiburst Flag Amplitude:** Measured from back porch blanking to the center point of the flag top.
- **Multiburst Amplitude:** Measured as the peak-to-peak amplitude of each of the multiburst packets. Six results reported.

WAVEFORM DISTORTION MEASUREMENTS (FCC OR NTC-7 COMPOSITE VITS)

- **Line Time Distortion:** Measured as the peak-to-peak amplitude change of the bar top, excluding the first microsecond and the last microsecond.
- **Pulse-to-Bar Ratio:** Measured as the peak amplitude of the 2T pulse, expressed as a percent of the bar amplitude.
- **Short-Time Waveform Distortion:** Measured as a weighted function of time, the result is the peak deviation from flatness within 1 microsecond of the center of a bar transition. ANSI/IEEE Std.-511-1979, Section 4.4, Appendix B.
- **Chrominance Non-linear Gain Distortion:** Measured as the peak-to-peak amplitude of the first (nominally 20 IRE) and last (nominally 80 IRE) chrominance packets in the 3-level chrominance signal, referenced to the peak-to-peak amplitude of the middle packet (nominally 40 IRE).

- **Chrominance Non-linear Phase Distortion:** Measured as the difference between the largest and the smallest deviation in phase among the 3-level chrominance test signal subcarrier packets.
- **Chrominance to Luminance Intermodulation:** Measured using the 3-level chrominance test signal. Result is the maximum amplitude departure of a filtered part of the luminance pedestal from a part of the pedestal upon which no subcarrier has been superimposed.
- **2T Pulse K-factor:** Measured as the greatest weighted amplitude of a positive-going or negative-going echo-term half-wave which is within one microsecond before the 2T pulse leading edge half-amplitude point or within one microsecond after the 2T pulse trailing edge half-amplitude point. Result expressed as a K-factor which is the ratio of the weighted amplitude of the echo-term half-wave to the sampled amplitude of the 2T pulse.

NTSC Video Measurements

VM700T (turbo) Option 01

VIRS SETUP (REFERENCE BLACK):

- **VIRS Chrominance Reference Amplitude:** Measured from the blanking level included in the test signal to setup level.
- **VIRS Chrominance Phase Relative to Burst:** Measured as the amplitude of the VIRS chrominance packet, expressed as a percent of burst (or percent of bar if no burst).
- **VIRS Luminance Reference:** Measured as the difference between the VIRS chrominance packet phase and color burst phase.

SIGNAL-TO-NOISE RATIO MEASUREMENTS

- **Unweighted SNR:** Measured as the ratio of bar amplitude to the unweighted rms amplitude of the noise on a quiet line.
- **Luminance Weighted SNR:** Measured as the ratio of bar amplitude to the luminance weighted rms amplitude of the noise on a quiet line.
- **Periodic SNR:** Measured as the ratio of bar amplitude to the peak-to-peak value of the periodic noise.

OUT-OF-SERVICE MEASUREMENTS

- **Long Time Distortion:** Measured as the peak overshoot and settling time in a flat field test signal switched from 10% to 90% APL in less than 10 μ sec.
- **Field Time Distortion:** Measured as the peak-to-peak amplitude change of the 100 IRE field squarewave top. The first and last 250 μ sec are excluded. Expressed as a percent of the field squarewave amplitude.

Characteristics

POWER REQUIREMENTS

Mains Voltage Range – 87 VAC to 132 VAC or 174 VAC to 250 VAC.

Mains Frequency – 47 Hz to 63 Hz.

Power Consumption – 250 W.

ENVIRONMENTAL

Operating Temperature Range – 0°C to 50°C ambient.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19
Height	222	8.75
Depth	556	21.9
Weight	Kg	lb
Net	~20	~45

ORDERING INFORMATION

For pricing information contact your local Tektronix representative.

VM700T OPTION 01

NTSC Video Measurement Set

Includes: Instruction manual; 75 Ω terminators (3) 011-0102-00; power cord.

ADDITIONAL OPTIONS

- Opt. 11** – PAL Measurements.
- Opt. 01/11** – Dual Standard Measurements.
- Opt. 20** – Teletext Measurements.
- Opt. 21** – Camera Measurements.
- Opt. 30** – Component Measurements.
- Opt. 40** – Audio Measurement Module.
- Opt. 41** – 6 Channel Audio Measurement Module.
- Opt. 42** – Audio to Video Delay Measurement.
- Opt. 48** – GPIB Interface.
- Opt. 1C** – Cabinet Version.
- Opt. 1B** – Echo/Rounding Measurements.
- Opt. 1P** – Printer.
- Opt. 1T** – Calibration – NIST/MIL Traceable.
- Opt. 1Z** – Probe Adapter (067-1429-00).
- Opt. 3Z** – Probe Adapter (3 each of 067-1429-00).

VM700T SOFTWARE UTILITIES

VMBKUP – VM700T Backup Utility.

VMREMGR – Remote Graphics Software for the VM700T.

VMT – VM700T Remote Control Software.

OPTIONAL ACCESSORIES

VM7FC1 – Field-installable conversion kit to convert rackmount unit to cabinet.

VM7FR1 – Field-installable conversion kit to convert cabinet to rackmount unit.

MEASUREMENT SERVICE OPTIONS

- Opt. C3** – Three years of Calibration Services.
- Opt. C5** – Five years of Calibration Services.
- Opt. R3 (VM700T/VM100/VM101 only)** – Repair warranty extended to cover three years.
- Opt. R5 (VM700T only)** – Repair warranty extended to cover five years.
- Opt. S1** – One year upgrade to "On-site" Service.
- Opt. S3** – Three year upgrade to "On-site" Service.
- Opt. S5** – Five year upgrade to "On-site" Service.
- Opt. IN** – Product Installation Service.

MEASUREMENT SERVICE OPTIONS

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For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.



See Tektronix on the World Wide Web:
<http://www.tek.com>

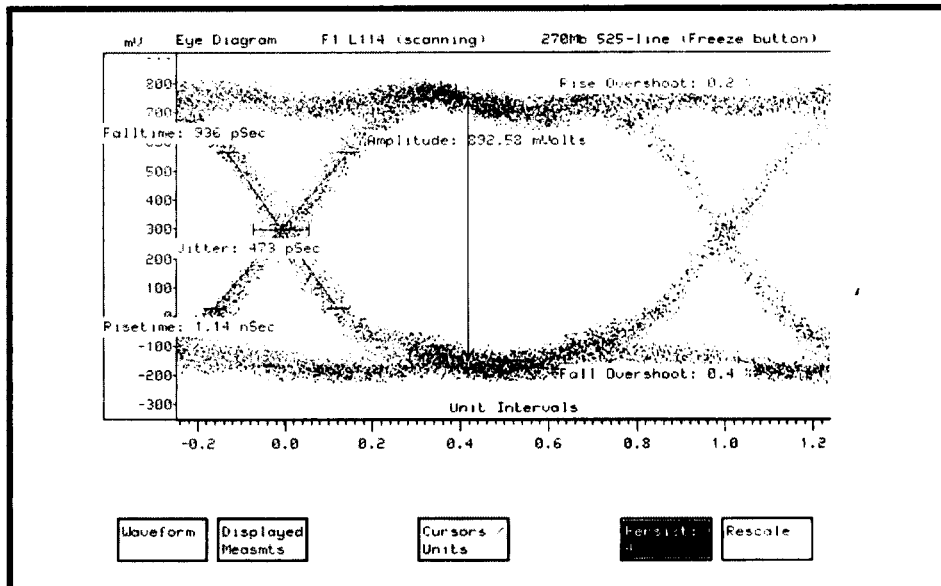
Serial Digital Video Measurement Sets

VM700T (turbo) Option 1S/2S



Features

- Automatic Analysis of 270 Mbit Component, 143 Mbit Composite and 360 Mbit Component Serial Digital Video Signals
- Continuous Real-Time Format Analyzer With Event Logging and Frame Capture
- Eye Diagram Display with Automatic Limit Violation Detection
- Jitter Measurements with Wide Band Spectral Analysis
- Ancillary Data Analyzer with Full Frame Data Distribution Display
- Conformance Testing to SMPTE 259M
- AES and Embedded Digital Audio Measurements
- Parade, Stacked and Overlay Displays With Interpolated Waveforms
- SMPTE RP-165 Digital Error Detection and Reporting
- Audio-to-Video Delay Measurements on AES or Embedded Audio
- Picture Mode with Relative to Reference Capability
- Relative to Reference Modes
- Longitudinal Time Code Input for Time Stamping Error Events
- Video Wander Measurement



SERIAL DIGITAL OPTIONS

Options 1S and 2S are new VM700T, VMTB and VMUPG upgrade options that add a state-of-the-art serial digital video acquisition and analyzer module to a VM700T, Turbo version VM700A or standard VM700A video measurement set, providing the capability to display, capture and analyze the 270 and 360 Mbit 525 line and 625 line serial component and 143 Mbit 525 line serial composite digital video signal with unprecedented ease and accuracy. Now, for the first time, comprehensive analysis of analog video signals and serial digital video signals is possible in a single package that is the recognized leader in automatic video measurement sets worldwide. The features built into the new VM700T/A series SDI analyzer module are the result of years of experience with professional television organizations, and in the designing and manufacture of advanced waveform/vector monitors and automatic analyzers for the serial digital video operating environment.

EASE OF USE

The new VM700T/A Serial Digital Video measurement option benefits from the proven display technology and user interface that won a technical Emmy for excellence. All SDI (Serial Digital Interface) measurement functionality was designed with the highest degree of automation possible. The seasoned professional video equipment manufacturer to the first time SDI design engineer will find the VM700T/A SDI analyzer option innovative, accurate, fast and above all easy to use.

MANY CAPABILITIES

The VM700T/A Serial Digital Video Analyzer module installs directly into a VM700T or Turbo version VM700A. I/O connections are accessible on the instrument rear panel and include two SDI inputs, a re-clocked SDI output (switches with the active SDI input), an AES digital audio input, a Longitudinal Time Code input for time stamping logged error files, and a loop-through analog black-burst input for timing reference. SDI measurement applications can be selected through the instrument front panel, touch panel interface or RS232C or GPIB remote control drivers. Simple to complex SDI measurement functions can be created directly from the VM700T touch panel interface. Functions can be enabled manually, automatically using the system's internal clock, or via remote control. Users who need to create and distribute VM700T SDI measurement functions to additional VM700Ts will appreciate the FTP interface that allows file transfers.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.



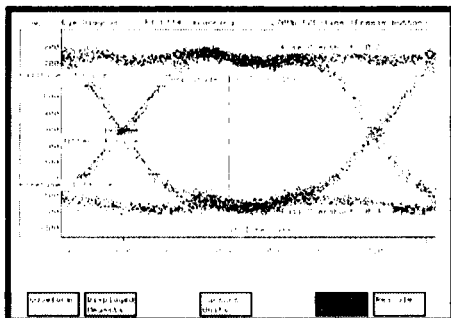
See Tektronix on the World Wide Web:
<http://www.tek.com>



ISO 9001 Tektronix Measurement products are manufactured in ISO registered facilities.

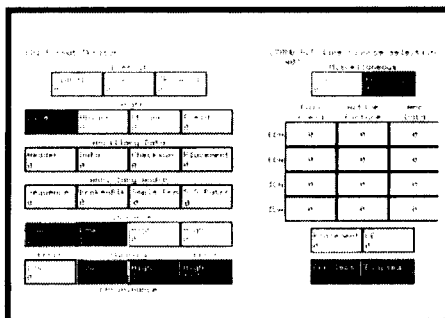
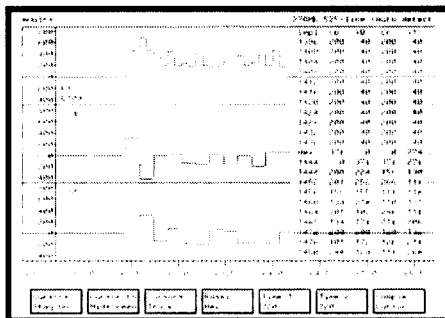
Serial Digital Video Measurement Sets

VM700T (turbo) Option 1S/2S



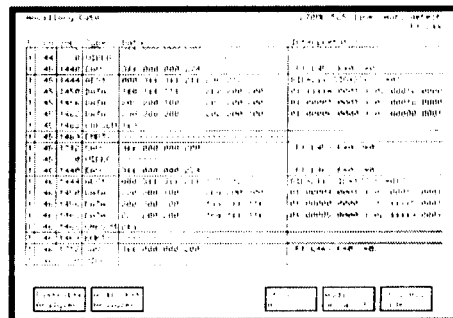
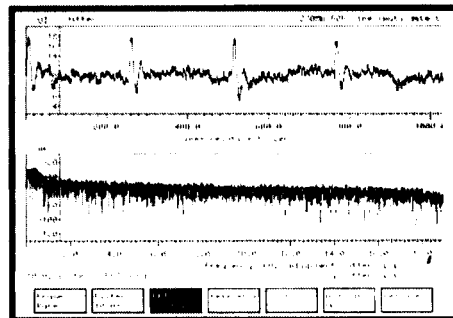
EYE DIAGRAM

A fundamental requirement of any serial digital video measurement set is the ability to verify the electrical characteristics of the SDI transport layer. The VM700T SDI option allows comprehensive analysis of the serial digital transport layer with a high resolution, equivalent time sampled Eye Pattern Diagram. The Eye Pattern application allows direct observation and verification of the analog characteristics of the serial data signal while simultaneously providing full automatic measurements of all critical signal parameters. Signal level, rise and fall time, rise and fall overshoot, Jitter, and DC offset of the serial data stream are continuously measured and plotted on the VM700T/A crisp, high resolution CRT display. All Eye parameter measurements are continuously compared against user programmable limits providing instant notification of an out-of-tolerance condition. An additional Eye monitoring display allows quick visual indications as well as logging of all out of limit errors. For a more detailed analysis of the Eye Diagram, voltage and timing cursors are available allowing for direct manual measurements. Selection of 10Hz and 1kHz filters, equalizer on-off, an automatic cable length meter and the ability to select or deselect specific portions of the Eye Waveform for display complete this application.



SDI JITTER TESTING

Jitter in the serial digital signal can occur as it is processed by distribution amplifiers, routing switchers and other digital processing equipment that operate directly on the signal exclusively in its serial form. The VM700T SDI Jitter application provides analysis of SDI Jitter in multiple ways. Peak-to-peak alignment and timing jitter of the SDI transport layer are continuously measured and displayed in either UI (Unit Intervals) or time. As recommended by SMPTE practices 1 Hz and 1 KHz selectable clock recovery bandwidths are available. Isolation of Jitter sources is the first step in diagnosis and elimination. Therefore, the VM700T SDI analyzer includes a Jitter spectrum display with over 100 times the spectral range of any competitive device for detailed analysis and identification of all Jitter frequency components. Additionally, a unique Jitter waveform display provides the means to identify line or frame correlated Jitter. Cursors are provided to allow precise measurement of Jitter events in both frequency and time. An extremely useful relative to reference mode is also provided allowing up to two Jitter measurement references to be stored internally and used for difference measurements with one of the two SDI inputs.

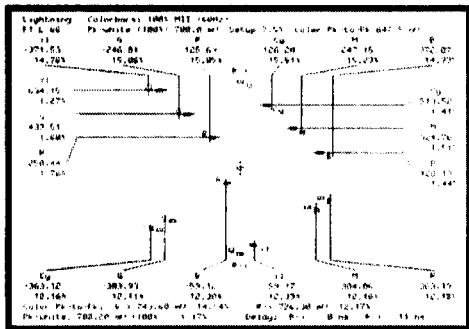


REAL-TIME FORMAT MONITOR

Monitoring for SDI format violations helps ensure trouble free communication between serial digital devices. Random errors in timing signal placement or other types of data errors, for example, can mean trouble in a data recovery circuit. The VM700T SDI format analyzer provides the continuous, real-time format monitoring capability required to quickly diagnose those hard to find format errors in the serial digital signal. A wide range of individual checks are performed with error conditions quickly identified in a highly visible, easy to read monitoring display. Monitoring checks include loss of signal, loss of lock, video line, blanking and field length errors, EAV/SAV misplacement, ancillary data errors, audio ancillary data errors, illegal luminance and chrominance values with selectable search areas, 8/10-bit validation, RP-165 validation, errored seconds with time counter, event logging, frame capture on user definable events, and pattern search provide a total validation of the SDI signal format.

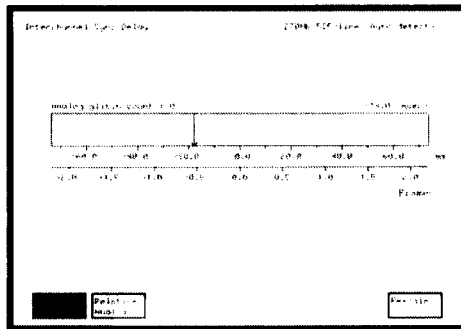
Serial Digital Video Measurement Sets

VM700T (turbo) Option 1S/2S



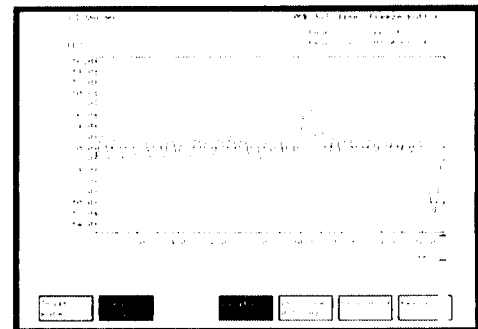
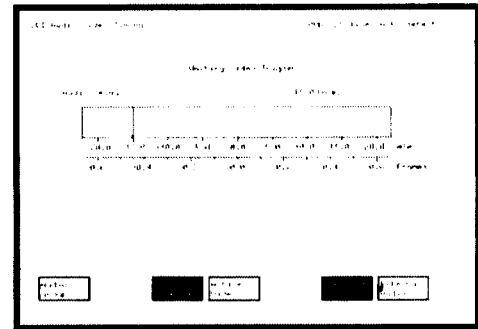
ANCILLARY DATA ANALYZER

Once problems are identified by the Real-Time Format Monitor, the Ancillary Data Analyzer can be automatically enabled to provide a more detailed level of analysis and diagnosis capability. The primary display of the Ancillary Data Analyzer provides a complete analysis of all data, including field, line and sample number, data type, data values and interpretation of data value. Data errors are immediately sensed, logged and indicated in easy to see "bright up" boxes. A "Find Errors" window scans forwards or backwards in the display buffer, locating and providing a detailed text interpretation of all data errors. A "Find Data Pattern" search mode can be programmed to automatically search and locate specific data patterns as opposed to time intensive manual searches. The Ancillary Data Analyzer may also be optimized to display only specific data types, for example AES Audio packets or EDH data, ensuring the display remains simple and easy to interpret. To help debug buffer overflow problems in audio devices, the Ancillary Data Distribution Analyzer provides real-time verification of the ancillary data distribution pattern within a video frame.



SDI WAVEFORM MODE

The SDI Waveform mode further extends the capabilities of the VM700T SDI option by providing a real-time display and analysis of the decoded video waveform. Overlay, Parade and Stacked waveform displays of individual video lines in equivalent analog form allows complete evaluation of the video signal, including the ancillary data region, in a traditional manner. Setup of digital sources is now as easy as if they were analog. Waveforms can be displayed in either "Bar" style, similar in look and feel to a logic analyzer display, or with interpolation, providing a smoother analog look and feel. The "Bar" display style is useful when using the user selectable sample cursors to provide readouts of video sample values. Samples may be displayed in 8 bit or 10 bit mode in Hex, Binary or Decimal number base. Timing cursors may be used to determine the exact timing of any two points on the video waveform. The interpolated waveform mode is extremely useful for evaluating the analog characteristics of the component digital signal. Pulse shape, frequency response, insertion gain, rise and fall times and Inter-channel timing of the decoded signal can be quickly assessed.



SDI LIGHTING DISPLAY

Pressing the VM700T front panel Vector button selects the Tektronix-patented Lighting display. The Lighting display helps operators quickly setup color difference component recorders using only the color bar test signal.

INTERCHANNEL TIMING

The Interchannel Timing application is designed to quickly measure time delay between two SDI sources or between one SDI source and the analog black-burst reference input. Timing measurements are made in real-time and in-service without special test signals. An easy to read auto-scaling display indicates time delay in time or video frames.