The WFM700 waveform monitor is designed to meet the multi-format monitoring and measurement needs of serial digital program production, post-production and transmission. Its design combines the best of traditional waveform monitors with the advantages of digital technology. Digital processing provides accuracy and repeatability of measurements as well as tremendous flexibility of the user interface. The design of the WFM700 waveform monitor permits the product to be specialized for different applications within a TV facility and provides for feature enhancements by installation of additional modules or software downloads.

WFM700 Series for Monitoring Applications

WFM700HD and WFM700A are operational monitors used in verifying a signal path, setting levels and checking validity of serial digital signals.

- The WFM700HD monitors high definition video
- The WFM700A is a multi-standard, multi-format monitor used in standard definition, high definition and hybrid serial digital operations

Features & Benefits

- New Modular Platform for Configuration as a Monitoring or Measurement Instrument
- Eye Pattern and Jitter Display Available for Both ITU-RBT.601 and SMPTE 292M Standards
- Color Display, 50% Larger than Traditional Waveform Monitor Display
- Additional Picture Monitor and VGA Display Outputs for Ease of System Integration
- Automatic Detection of Input Signal and Reference for Ease of Operation in Hybrid Facilities
- Freeze Mode for Comparison and Adjustment of Signals
- Timing Mode for Simple Alignment of Digital Signals
- Selectable Colorimetry
- Diamond & Arrowhead Displays for Gamut Measurement
- All Digital Processing from Input to Display for Accuracy and Repeatability of Measurements
- Error Logging
- Alarms with Adjustable Thresholds

Multi-format, Multi-standard Waveform Monitors

- WFM700HD • WFM700A • WFM700M

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Multi-format, Multi-standard Waveform Monitors

- WFM700HD • WFM700A • WFM700M

WFM700 Series Monitors for Measurement Applications

The WFM700M is a measurement quality monitor with all of the features of the WFM700A, plus additional eye diagram, jitter, and data measurements. The WFM700M waveform monitor provides for the evaluation of the digital transport layer and digital analysis capabilities important to the design, installation and maintenance of 270 MB and 1.485 GB component digital systems. Eye Pattern and Jitter displays are provided for both standard definition and high definition systems.

The WFM700 family is designed to accommodate changes created by the development of new video formats and new monitoring requirements. All the WFM700 models share a common platform and are differentiated by the modules installed at the time of order. The platform has one additional slot for an additional video input module and one slot reserved for future monitoring applications.

The WFM700 waveform monitor features and performance can also be enhanced through software. The platform has 10/100Base-T Ethernet connectivity that simplifies the process of downloading software and provides an efficient means of monitoring.

System Integration

There is an emerging trend towards using computer monitors to display waveforms. The WFM700 waveform monitor provides the best of both worlds providing both analog component and VGA monitoring outputs. (See System Integration Diagram.)

Monitor 1 – VGA version of Picture monitor output including bright up pulses.

Monitor 2 – Analog component version of Picture monitor output including bright up pulses.

Monitor 3 – Serial digital output of selected input.

Monitor 4 – VGA remote screen display.
WFM700HD
The WFM700HD is for monitoring the high definition digital signal path. The HD formats monitored are shown in the WFM700 Monitoring Formats table. The WFM700HD waveform monitor includes:
► Two terminating inputs for SMPTE 292M serial digital video
► Auto detection of input format
► Selectable colorimetry
► Integrated TFT color LCD display with touch screen
► One VGA output that replicates the integrated display
► Picture monitor output, selectable RGB, YPbPr, with bright up
► Picture monitor output for computer display (RGB H & V sync)
► Looping inputs for bi-level and tri-level sync
► Auto detection of external reference input
► Waveform parade and overlay displays, RGB or Y, Cb, Cr
► Line select
► Field select
► Vector display
► Lightning display for use with color difference signals
► Bowtie for component interchannel timing
► Diamond display for RGB domain gamut limits
► Arrowhead display for NTSC/PAL composite domain gamut limits
► Color picture display
► Freeze mode for comparing input signal levels
► Timing mode for easy alignment of digital signals
► Identification of embedded audio channels
► Error detection and reporting as per SMPTE RP-165 for standard definition and SMPTE 292M for high definition
► Electronic graticules
► Digital cursors
► 49 user presets
► Alarms with adjustable thresholds
► Error logging
► One switched output, follows selected input (serial digital out)
► Picture on waveform, vector, and gamut

WFM700A
The WFM700A monitor includes all the features of the WFM700HD with the added capability of monitoring both ITU-RBT.601 and SMPTE 292M.
► Composite representation of SD component input

WFM700M
The WFM700M monitor includes all the features of the WFM700A plus:
► Eye pattern display of the selected input signal
► Eye pattern timing cursors
► Eye pattern voltage cursors
► Logic analyzer data word listing for detailed pixel analysis
► Data value display
► Jitter demodulator with numeric jitter readout and video correlated jitter waveform display
► Signal launch power
► Received signal level meter
► Cable length readout
Multi-format, Multi-standard Waveform Monitors

WFM700HD • WFM700A • WFM700M

WFM700 Monitoring formats

<table>
<thead>
<tr>
<th>Standard</th>
<th>Physical Interface</th>
<th>Image Format</th>
<th>Field/Frame Rate 60 Hz</th>
<th>Field/Frame Rate 59.94 Hz</th>
<th>Field/Frame Rate 50 Hz</th>
<th>Field/Frame Rate 30 Hz</th>
<th>Field/Frame Rate 29.97 Hz</th>
<th>Field/Frame Rate 25 Hz</th>
<th>Field/Frame Rate 24 Hz</th>
<th>Field/Frame Rate 23.98 Hz</th>
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<td>292M</td>
<td>1920x1080i</td>
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<tr>
<td>240M/260M</td>
<td>292M</td>
<td>1920x1035i</td>
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<td>ITU-R</td>
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<td>BT.601</td>
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</tbody>
</table>

Characteristics

WFM700 Rear Panel

Power –
Mains Voltage Range: 100 to 250 VAC.
Mains Frequency: 50 or 60 Hz.
Power Consumption:
75 W with 1 Video Input Module.
100 W with 2 Video Input Modules.
VGA O/P – This connector allows the front panel display to be replicated on a remote VGA monitor.
Ethernet Connector – Allows the instrument to be connected to a 10/100Base-T Ethernet circuit for remote control, software enhancements, saving and duplication of system configurations and presets.
Remote Connector – Utilized for contact closures.

Serial Digital Video Interface

Video Inputs – 2 per card – only one active at a time.
Input Type – 75 Ω BNC, internally terminated.
Launch Amplitude Accomodation –
800 mV ±10% for full specification.
800 mV ±50% up to 20 dB cable attenuation.
Jitter Tolerance – 0.2 UI timing jitter, 1 UI alignment jitter as per SMPTE 292.
Return Loss – 15 dB to 1.5 GHz.
Isolation Between Inputs – >50 dB to 1 GHz.

Switched Serial Video Output

Format – 1.485 GB or 270 MB repeat of selected input.
Output Level – 800 mVp-p ±5% into 75 Ω load.
Return Loss – 15 dB to 750 MHz, 10 dB to 1.5 GHz.
Output Type – 75 Ω BNC.

External Reference
Sync Format – NTSC, PAL, 1080i 59.94 Hz, 1080i 60 Hz, 720p 59.94 Hz, 1080p 23.97 Hz, 1080p 24 Hz.
Input Type – 75 Ω BNC passive loop.
Return Loss – 40 dB to 30 MHz.
Hum – Operates with 500 mVp-p.
Signal/Noise – Operates to 28 dB.

Serial SD Only Monitor Output

Content – Follows Active Input With Brightups – SD only Digital version of RGB/YPrPb analog pix monitor output on Ref board.
Rate – 270 Mb/s.
Signal Level – 800 mV ±5% into 75 Ω, internal adjustment.
Return Loss – 20 dB, 5 MHz to 270 MHz.
Output Type – 75 Ω BNC.
Picture Monitor Outputs
Signal Format, BNC Outputs – Y, Pb, Pr with sync on Y, RGB with sync on all, HD and SD. HD sync is tri-level.

Signal Format, VGA D-sub Outputs – Same signal as on BNC outputs, also have TTL H and V drive.

Impedance – 75 Ω unbalanced.

Active Video Accuracy – 700 mV ±5% p-p (Y-Pb-Pr mode).

Black (Blanking) Output Level – 0 mV ±20 mV for HD and SD.

Frequency Response, SD – Y, G, B, and R ±5% to 5.75 MHz.

Frequency Response, HD – Y, G, B, and R ±5% to 30 MHz.

Waveform Vertical Deflection
Vertical Measurement Accuracy Using Graticule or Cursor –
At 1x, ±0.5% of 700 mV full scale model.
At 5x, ±0.2% of 700 mV full scale model.
At 10x, ±0.1% of 700 mV full scale model.

Gain – X1, X5, X10, variable.

Variable Gain Range – 0.25x to 14x.

Frequency Response, HD*1 –
Luminance Channel (Y): 50 kHz to 30 MHz within 0.5% of response at 50 kHz.
Chrominance Channels (Pb, Pr): 50 kHz to 15 MHz within 0.5% of response at 50 kHz.
LOWPASS: At least 10 dB attenuation at 15 MHz.

Frequency Response, SD*1 –
Luminance Channel (Y): to 5.75 MHz ±0.5%.
Chrominance Channels: to 2.75 MHz ±0.5%.

*1For monochrome signals, R, G bandwidth equals Y bandwidth.

Waveform Horizontal Deflection
Sweep Accuracy – ±0.5%, all rates, fully digital system.
Sweep Linearity – 0.1% of time displayed on screen, fully digital system.
Rates – 1 Line, 2 Line and 1 Field, 2 Field
MAG – 10X Line, 20X Field.
Line Select – Selected Line in 1 Line, selected 1st line in 2 Line or Parade.

Eye Pattern Display
Type – Equivalent Time Sampler.

Signal Bandwidth – 50 kHz to 2.5 GHz at –3 dB point.
Risetime – 130 ps maximum for 20 to 80%.
Inherent Jitter – 60 ps maximum peak to peak.

Jitter Attenuation, Three Selectable Modes –
10 Hz HPF: <10% for frequencies > 20 Hz –3 dB at ≈ 10 Hz.
100 Hz HPF: <10% for frequencies > 300 Hz –3 dB at ≈ 100 Hz.
1000 Hz HPF: <10% for frequencies > 3 kHz –3 dB at ≈ 1 kHz.

Display Modes, SD – Overlay.
10 Eye.

Display Modes, HD – Overlay.
20 Eye.

Jitter Display
Type – Demodulated recovered clock.

Digital Readout –
Accuracy: 0.1 UI, ±10% of reading.

Note: Bandwidth selection is set in Jitter Waveform Mode.

Jitter Waveform –
Accuracy: 10% of reading.
Bandwidth Selection: 10 Hz to 5 MHz, 1 kHz to 5 MHz, 10 kHz to 5 MHz, 100 kHz to 5 MHz.

Jitter Output – 120 mV/UI, 10% into 75 Ω load.
Multi-format, Multi-standard Waveform Monitors

RGB Gamut Error Detection
Detection Level –
High Limit, 90 to 108% in 1% steps.
Low Limit, −8 to +5% in 1% steps.

Arrowhead (NTSC/PAL Composite Gamut Limit Display Mode)
Composite Limit Detection Level –
Detection Level ±0.5%.
90 to 135% in 1% steps.

Error Detection and Alarms
General Alarms –
RGB gamut.
Composite Gamut.
Input Signal Missing.
Input Format Mismatch.
Cable Length Error.
Signal Launch Amplitude Error.
High Temperature.
Adjustable Thresholds.
Input Format Change.
Input/Ref Format Mismatch.

Serial Data Alarms –
SD EDH As Per RP-165.
HD Line CRC As Per SMPTE 292M.
Active Picture CRC.
Full Field CRC.
Missing EAV/SAV.
Line Length Error.
Field Length Error.
Data Range Error.
Anc. Data Format Error.
Embedded Audio Missing.
Embedded Audio Format Error.
HD Line CRC Error.
Error Seconds Readout.
Ancillary Data Missing.

General Specifications
Environmental –
Temperature:
0°C to +50°C (operating).
−20°C to +60°C (nonoperating).
Humidity:
20% to 80% RH below 32°C, noncondensing (operating).
Altitude:
to 3,000 m (operating).
to 12,000 m (nonoperating).

Safety – Designed and tested for compliance with:
ANSI/ISA s82.02.01.
Can/CSA C22.2 No. 1010.1.
IEC 61010-1.
UL 3111-1.
93/68/EEC.
EN 61010-1.

EMI – Tested for compliance with:
FCC, CFR Title 47, Part 15, Class A.
EN 55103-1/2, Class B Emissions.

Physical Characteristics

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<th>in.</th>
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</table>
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Ordering Information

The following models are complete with one video input module providing 2 video inputs.

Instruments:

One of the following can be ordered to increase the number of video inputs to 4. There is a limit of 2 video input modules in a single instrument. Monitoring and measurement modules can be mixed in any model. For modules to be installed at the time of order, option 88 must appear as a line item on the order. The modules can be installed in the field.

Modules:
- WFM7HD – Serial Digital monitoring module for SMPTE 292M.
- WFM7A – Serial digital monitoring module for ITU-R BT.601 & SMPTE 292M.
- WFM7M – Serial digital measurement module for ITU-R BT.601 & SMPTE 292M.

Options

Customer must select either Option 01 or 02 at no charge.
- Opt. 01 – Provides WFM7F02.
- Opt. 02 – Provides WFM7F05.
- Opt. 88 – Module installation and test at time of order.
- Opt. AC – China power cord.

Optional Accessories:
- WFM7F00 – Plain cabinet.
- WFM7F02 – Portable cabinet includes handle, feet, tilt ball and front panel cover.
- WFM7F05 – Dual rackmount for 1700 series, WFM601 series, WFM700 series, 760A and 764.

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Contact Tektronix:

ASEAN Countries (65) 356-3900

Australia & New Zealand (2) 9888-0100

Austria, Central Eastern Europe, Greece, Turkey, Malta & Cyprus +43 2236 8092 0

Belgium (32) 715 89 70

Brazil and South America (55) 3741-8360

Canada (1) 661-5625

Denmark (44) 850 700

Finland +358 (9) 4783 400

France & North Africa +33 1 69 86 81 81

Germany +49 (221) 94 77 400

Hong Kong (852) 2585-6688

India (91) 80-2275577

Italy +39 (2) 25086 501

Japan (Sony/Tektronix Corporation) 81 (3) 3448-3111

Mexico, Central America, & Caribbean 52 (5) 666-6333

The Netherlands +31 23 56 95555

Norway +47 22 07 07 00

People’s Republic of China 86 (10) 6235 1230

Poland (48) 22 521 5340

Republic of Korea 82 (2) 528-5299

South Africa (27) 651-5222

Spain & Portugal +34 91 372 6000

Sweden +46 8 477 65 00

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Taiwan 886 (2) 2722-9622

United Kingdom & Eire +44 (0)1344 392000

USA 1 (800) 426-2200

For other areas, contact: Tektronix, Inc. at 1 (503) 627-1924

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