WFM601A/WFM601E/WFM601M monitors are self contained, half-rack wide, waveform/vector monitors for the 270 MB serial component operating environment. They share a common design philosophy and are specialized for different applications within the television plant. The WFM601A is an operational monitor providing the signal monitoring features useful to the graphics workstation, telecine, or camera setup operator. The WFM601E extends the WFM601 platform to provide a more comprehensive evaluation of the digital transport layer and is used in digital production and master control operating centers. The WFM601M offers all of the video features of the WFM601A and WFM601E, and provides data analysis capabilities for the installation and maintenance engineer.


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Digital transport layer. It allows observation of the analog characteristics (eye pattern and signal level) and digital compatibility (format and range checking) of the serial data stream. The WFM601E provides all video features of the WFM601A and adds an analog waveform display of the incoming data signal.

Features provided by the WFM601E include:

All Video Features of the WFM601A
Eye Pattern View of the Incoming Data Signal
Eye Pattern Timing Cursors with Selectable Jitter Display High Pass Filtering
Eye Pattern Voltage Cursors to Indicate Amplitude of the Incoming Data Signal
Cable Length Readout, Calibrated in Meters
Received Signal Power Readout
Source Signal Level Meter, Independent of Cable Length
Extended Format Checking and Data Error Detection
Display of Field Checksums for Fixed Pattern Testing

Operating adjustments and measurements are made to the same signal parameters. Setup of digital sources is now as easy as if they were analog.

In addition to waveform overlay and parade displays of the three component channels, WFM601 Series monitors provide three Tektronix-patented displays. The Lightning display helps operators quickly set up color difference component recorders using only the color bar test signal. Using the Diamond display, color graphics operators can easily determine whether creative effects are reproducible in legal RGB color space, and will be warned that values outside the diamonds may cause recording, transmission, or reproduction errors. An important new feature in the WFM601A, WFM601E, and WFM601M is the Tektronix Arrowhead display of video signal composite domain gamut limits. This new display clearly illustrates how the component video signal will translate into a luminance + color subcarrier signal to be transmitted as an amplitude modulated NTSC or PAL signal to the home receiver. The creative operator can use this display to assure intended color and luminance values can be maintained through a composite transmission system.

All models provide analog outputs for an RGB or YPbPr component picture monitor, and a switched digital output is also provided for the all-digital plant.

The WFM601A is an operator’s monitor, for use by a person responsible for the look and continuity of the television picture. It instills confidence that creative adjustments can be made without violating transmission standards, thus assuring trouble-free distribution throughout a facility. The WFM601A is the only model of the series providing an analog audio lissajous display.

WFM601E Serial Component Monitor with Eye Pattern

The WFM601E extends the series platform to provide comprehensive evaluation of the digital transport layer. It allows observation of the analog characteristics (eye pattern and signal level) and digital compatibility (format and range checking) of the serial data stream. The WFM601E’s wide bandwidth Eye Pattern display is an amplitude vs. time view of the 270 MB data signal’s analog transmission path. It displays peak jitter and amplitude errors and because it is looking at the actual signal path, provides a useful indication of any reflections due to impedance irregularities. The eye pattern is displayed at video sweep rates to provide correlation with the video signal, and a word correlated mode may be selected by more experienced users to observe pattern dependent crosstalk. Digital signal amplitude and jitter is measured in accordance with proposed SMPTE time constant high-pass filtering, assisted by time and voltage cursors.
A serial signal level meter, calibrated in meters of coaxial cable provides a check to determine how close a system may be running to one important failure point. The voltage level of the data signal at its source is indicated, independent of cable length, to avoid potential equalization errors.

Format checking and reporting are expanded in the WFM601E. Format violations are sensed and clearly reported, and when the EDH signal is present, digital errors in the active or full field picture are reported. A CRC checksum is provided for manufacturing environments where it is common to use fixed pattern test signals to confirm the data integrity of signal processing products. A CRC is calculated for each field of video and displayed on the error screen. If the test signal CRC is known, this allows a data integrity check to be made, allowing limited error checking when EDH is not present in the incoming signal.

ANC data identification includes any embedded audio channels present. Format checking provides confidence that checked parameters meet industry requirements for subsequent data recovery.

**WF6M01M Serial Component Measurement Set**

The WFM601M is a measurement quality serial component monitor with all features of the WFM601E. The WFM601M provides additional digital analysis capabilities important to those involved in the design, installation, and maintenance of 270 MB component digital systems.

**Features provided by the WFM601M include:**

- **All Features of the WFM601E**
- **Logic Analyzer Data Word Listing for Detailed Pixel Analysis**
- **Field/Line/Word Cursors on Waveform and Picture Monitor with Data Value Display**
- **Jitter Demodulator with Numeric Jitter Readout and Video Correlated Jitter Waveform Display**
- **Calibrated Component Analog Signal Outputs**
- **Recovered Clock Output to Reference External Test Equipment**

The logic analyzer data word listing allows evaluation of signals to determine conformance to standards. The Y-Pb-Y-Pb multiplex is clearly delineated providing a comprehensive, understandable look at data which makes up the serial digital signal. Field/Line/Word cursors on the waveform and external picture monitor provide an intuitive operator access to the data values and a clear presentation of equivalent analog voltage levels.
A new jitter demodulator with numeric jitter readout provides a documentable value along with a new display relating jitter to time in the video field or line. A jitter demodulator output is provided for further analysis using an audio frequency spectrum analyzer, TDS Series oscilloscope, or VM700T option 40.

Measurement accuracy component analog signal outputs provide a precision video source for measurement of the analog signal represented by the data channel. The WFM601M's analog outputs accurately represent the data signal in terms of amplitude, frequency response and inter-channel timing. When combined with a VM 700T Option 30, the WFM601M allows comprehensive evaluation of a component video signal from analog to data to analog.

Equipment and system designers will appreciate the WFM601M's recovered clock output. This signal provides a reference clock, AFC'd using known time constants, to external test equipment.

Digital monitors for specific applications

The WFM601A provides real time monitoring features to allow creative adjustment of a camera or graphics work station to provide a standardized video program source. This monitor is used at each operating position to provide traditional waveform, vector, and signal gamut monitoring, and digital error checking to assure generation of standards-compliant contribution video.

The WFM601E adds eye pattern to provide a view of the analog signal path transporting the data signal. It is focused towards master control and editing applications where signals are routed and combined into programs.

The WFM601M adds comprehensive data analysis features for personnel designing, installing, and maintaining digital equipment and systems. Data jitter, signal level, and word value displays provide the tools to maintain standardized serial component signals throughout a plant and the WFM601M’s precision analog outputs allow measurement to the accuracy of of the best analog measurement sets.

WFM601 Series serial component monitors from Tektronix each provide an efficient set of features for a specific application. Every model is economically priced, yet provides an appropriate set of features to make the checks and measurements to assure maximum performance of your television facility.
WFM601 Series  Serial Digital Interface
Characteristics

<table>
<thead>
<tr>
<th>Format</th>
<th>270 MB/s component. Complies with SMPTE 259M and CCIR656.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Type</td>
<td>Passive loop-through, 75 Ω compensated.</td>
</tr>
<tr>
<td>Return Loss</td>
<td>≥ 25 dB 1-270 MHz power on.</td>
</tr>
<tr>
<td>Insertion Loss</td>
<td>≤ 1.5%.</td>
</tr>
<tr>
<td>Transmission Bandwidth</td>
<td>50 kHz -300 MHz ± 1.0 dB.</td>
</tr>
<tr>
<td>Loop-Through Isolation</td>
<td>≥ 50 dB to 300 MHz.</td>
</tr>
<tr>
<td>Serial Receiver Equalization Range</td>
<td>Proper operation with coaxial cable up to 19 dB loss at 135 MHz.</td>
</tr>
</tbody>
</table>

Serial Video Diagnostics

- Video Error Detection — Active picture and full field rate resolution. Complies with SMPTE RP165. Sets error flag output through rear panel REMOTE connector.
- Alarm — Front panel alarm lamp, and in some cases an on-screen readout, warns that one of the following serial signal video format errors has occurred:
  - SAV placed incorrectly
  - Line length error
  - Field length error
  - Reserved values used improperly
  - ANC data checksum error
  - ANC data parity error
  - ANC data placement error
  - Absence of serial video signal

On-Screen Diagnostics —
WF M601A, WFM601E, and WFM601M —
Operating line/field rate
Serial video presence
EDH checksum presence
FF CRC errored seconds
AP CRC errored seconds
EDH flag errored seconds
GAMUT errored seconds
Identifies the presence of up to 16 channels of AES/EBU embedded audio.
Reports absence of serial video signal.
WF M601E and WFM601M only —
Identifies the presence of ancillary data (other than audio and EDH) and indicates if a checksum error has occurred.

External Reference

- Input — Analog composite video or black burst.
- Return Loss — ≥ 40 dB to 6 MHz.

Waveform Vertical Deflection

- Deflection Factor — ≤ 2%.
- Variable Gain Range — +12 dB to –6 dB.
- Frequency Response — Luminance channel (Y), to 5.0 MHz ≤ 2%.
  - Color difference (Pb & Pr), to 2.5 MHz ≤ 2%.
- Transient Response — ≤ 1%.
- Voltage Cursor Accuracy — ± 0.5%, 20-30°C.
- Field Rate Tilt — ≤ 1%.
- Line Rate Tilt — ≤ 1%.

Waveform Horizontal Deflection

- Sweep Timing Accuracy —
  - 1 line, 5 μS/div, mag 0.2 μS/div, ± 1%.
  - 2 line, 10 μS/div, mag 1.0 μS/div, ± 1%.
  - 1 field, displays 1 full field.
  - 2 field, displays 2 full fields, and data between them.
- Sweep Linearity — ± 1% center 10 divisions of sweep.
- Timing Cursor Accuracy — ±0.5% @ 25°C.

Horizontal Position Range

Any portion of the synchronized sweep may be positioned on screen in all sweep modes.

Calibrator

Waveform Squarewave —
  - Amplitude: 700 mV ± 1.0%.
  - Frequency: 100 kHz ± 0.1%.

Analog Audio Mode (WF M601A only)

- Input — DC coupled differential.
- Full Scale Selection — 0, 4, 8, 12 dBm full scale, menu selected.
- Full Scale Accuracy — ± 0.5 dB at 1 kHz.
- Maximum Input Voltage — ± 8 V peak.
- Bandwidth — –3 dB, ≥ 500 kHz.
- X & Y Input Phase Matching — ≤ 1° at 20 kHz.
- Input Impedance — 20 kΩ nominal.

Component Vector Mode

- Vertical Bandwidth — ≥ 1.0 MHz ± 100 kHz.
- Horizontal to Vertical Match —
  - ≤ 2° at 500 kHz or 2 MHz.
- Vertical Gain Accuracy — ± 1%.
- Horizontal Gain Accuracy — ± 1%.
- Electronic Graticule Accuracy — ± 1%.
- Display to Graticule Registration — ≤ 0.25 box.
- Vector Display —
  - Pb displayed on horizontal axis.
  - Pr on vertical axis.
Lightning, Diamond and Arrowhead Modes

Vertical Gain Accuracy — ± 2%.

Electronic Graticule Display — Y is displayed vertically.

Lightning Mode —
P_b is displayed horizontally on top half of the display.
P_r is displayed horizontally on bottom half of the display.

Diamond Mode —
Green plotted vs. Blue on top half of the display.
Green plotted vs. Red on bottom half of the display.

Arrowhead Mode — Luminance displayed vertically, black clamped bottom left.
Equivalent subcarrier amplitude displayed horizontally, zero clamped left. Graticule displays 75% color bar, transmitter zero carrier, and 100% color bar limits. Adjustable gamut alarm.

Bowtie Mode

Common Mode Rejection Ratio — ≥ 34 dB at 2.5 MHz.

Accuracy — ±3%.

Interchannel timing match — ±2.0 nS.

Electronic Graticule Display — Y-P_b displayed on the left half of the display.
Y-P_r displayed on the right half of the display.

Transcoded Analog Outputs

Signal Formats — GBR or Y/P_b/P_r.
Sync amplitude accuracy — 300 mV ±10%.

Analog output impedance — Nominally 75 Ω.

Active Video Accuracy (Y/P_b/P_r) — 700 mV ±3% (WFM601M ±1%).

The following analog output parameters are specified for the WFM601M only:

Frequency response — Y to 5.75 MHz: ≤ 1%. P_b and P_r to 2.75 MHz: ≤ 1%.

Non-Linearity — ≤ 0.5%.

Group delay error — Y at 5.75 MHz: ≤ 5 nS. P_b and P_r at 2.75 MHz: ≤ 10 nS.

Interchannel timing match — Y-P_b and Y-P_r ±5 nS.

Sync to video timing — 525 line rate: 9.037 us ±50 nS. 625 line rate: 9.777 us ±50 nS.

Return Loss — 50 kHz to 5 MHz ≥40 dB.

Power Source

Mains Voltage Range — 90-250 V.
Mains Frequency — 50 or 60 Hz.
Power Consumption — <75 Watts.

CRT Display

Viewing Area — 80 x 100 mm.
Accelerating Potential — Nominally 13.75 kV.
Trace Rotation Range — >± 1° from horizontal.
Graticule — Internal waveform graticule with variable illumination.
Environmental Characteristics

Operating Temperature — 0° to 40° C (+32° to +122° F).
Storage Temperature — -40° to +75° C (-40° to +158° F).
Operating Altitude — to 15,000 ft. (4572 meters). IEC 1010-1 compliant to 2000 meters.
Storage Altitude — to 50,000 ft. (15,240 meters).
Vibration — Mil-T-28800D, Para 1.2.2, class 3.
Mechanical Shock — Nonoperating, 50g’s, 1/2 sine, 3 shocks/surface, 18 total.
Transportation — Qualified under NSTA Test Procedure 1A, Category II (24 inch drop).
Humidity — 95% noncondensing up to 5 days.
Pollution Degree — Degree 2, IEC 1010-1.

Safety

Designed and tested for compliance with —
ANSI/ISA S82.01
CAN/CSA C22.2 No. 1010.1
IEC 1010-1
UL 3111-1
93/68/EEC.

EMI

Tested for compliance with —
47 CFR Chapter 1 (FCC Rules) Part 15, Class A
EN 50081-1
EN 50082-1
EN 60555-2
Must be installed in Tektronix 1700F00, 1700F02, or 1700F05 cabinet to qualify for EMI certification.

Physical Characteristics

Dimensions —
Height: 5 1/4 inches (133.4 mm).
Width: 8 1/2 inches (215.9 mm).
Depth: 18 1/8 inches (460.4 mm).
Weight —
Net: 8 lbs. (3.8 kilograms).
Shipping: 15.7 lbs (7.2 kilograms).

Ordering Information

WFM 601A
Serial
Component Monitor

WFM 601E
Serial
Component Monitor with Eye Pattern

WFM601M
Serial
Component Measurement Set

WFM601 series instruments are supplied with an instruction manual, power cable, spare graticule lamps, spare fuse, and spare air filters. White (P4) phosphor is standard. To meet safety and EMI listing requirements order a cabinet or rack mount from the Optional Accessories list.

Options

Option A1 — Universal Europe locking power cord.
Option A2 — United Kingdom power cord.
Option A3 — Australia power cord.
Option A5 — Switzerland power cord.

Optional Accessories

070-9836-00 — Service manual, WFM601A/WFM601E/WFM601M.
1700F00 — Plain cabinet, no handle or feet.
1700F02 — Portable cabinet with handle, feet, tilt bail and front panel cover.
1700F05 — Dual rack mount.
1700F06 — Blank panel for unused half of dual rack mount.
1700F07 — Drawer for unused half of dual rack mount.
011-0163-00 — Wideband 75 Ω termination.