Analog Waveform Monitors

1740A Series • 1750A Series • 1760 Series Data Sheet

1740A Series NTSC, PAL, and dual-standard models in accessory 1700F02 portable cases.

Features & Benefits

- Composite or Component Waveform Monitoring
- Composite Vector Display
- Picture Display
- Stereo Audio Display
- Time Code Phasing and Amplitude
- SCH and Color Framing Display
- Component Vector, Lightning, Diamond, and Bowtie

Applications

- Analog Baseband Video Monitoring for Broadcast and Postproduction Applications

The 1740A/1750A/1760 Series make up a family of analog video waveform/vector monitors with progressive features in support of today's demanding television environment.

Each model in the series provides improved video performance and ease of operation and incorporates application-specific features. The family includes the 1740A Series composite analog waveform/vector monitors, the 1750A Series, which adds SCH and color frame verification capabilities, and the 1760 Series for mixed-format component/composite applications. (While the 1740A and 1750A do provide basic component waveform monitoring capabilities with parade and overlay displays, only the 1760 provides full component monitoring capabilities.)

Each series includes models for NTSC, PAL, or dual-standard NTSC/PAL operation. For NTSC models, the last digit of the model number is '0' (1740A, 1750A, or 1760); '1' for PAL (1741A, 1751A, or 1761); and '5' for dual-standard NTSC/PAL (1745A, 1755A, or 1765).

The family features a common, straightforward operator interface, allowing the operator to take immediate advantage of the instrument's extensive feature set. Each operating mode provides a full set of operating controls, clearly labeled and within easy reach. Key controls are always available, with bezel buttons and knobs identified by intuitive on-screen labels.

Tektronix®

Selection Guide

Product Applications	1740A Series	1750A Series	1760 Series
Composite or Component Waveform Monitoring	X	X	X
Composite Vector Display	X	X	X
Picture Display	X	X	X
Stereo Audio Display	X	X	X
Time Code Phasing and Amplitude	X	X	X
SCH and Color Framing Display		X	Opt. SC
Component Vector, Lightning, Diamond, and Bowtie			X

All family members provide the following standard features:

Eight Video Inputs eliminate the requirement for external input selectors, reducing total system cost in many applications. Since all eight inputs are connected directly to the instrument, signals may be paraded, overlaid, or displayed in comparison modes not normally available with a simple external switcher.

Waveform monitoring is analog for maximum waveform fidelity. There is no digital processing of the displayed signal. The selected input may be displayed in one- or two-line or one- or two-field sweeps on a continuous basis or identified lines of any field may be selected and displayed. Multiple inputs may be displayed at the same time or multiple filters may be applied to one input for signal analysis. Time and voltage cursors may be activated and positioned for reference or measurement.

Composite Vectorscope functions demodulate and display the color components of the NTSC or PAL signal. A microprocessor-controlled phase shifter provides accurate vector positioning and eliminates readjustment when switching between internal and external reference modes. Phase and amplitude cursors with on-screen readout allow system setup to reproduce specific chroma values and specific colors when luminance is similarly set using the waveform-display voltage cursors.

A **Picture Monitor** mode is provided for easy signal identification. This is particularly useful when the instrument is used to monitor many sources, as in a production suite or outside production vehicle. In waveform or vector line select mode, a line bright-up marker in the picture display identifies the selected line.

Stereo Audio Amplitude and Phase are monitored using a calibrated L/R Lissajous display. The operator can quickly see that the program audio will be properly reproduced on both monaural and stereo receivers. Correct phasing between two audio channels is quickly verified by the direction of the display; signal level (left + right) is confirmed relative to the CRT graticule; and stereo separation (left - right) is displayed in quadrature to the level display.

Audio frequency -3 dB bandwidth is 200 kHz. Phase match between the left and right channels is better than 1 degree at 20 kHz. Input is high-impedance bridging, either balanced or unbalanced, to allow signal monitoring of existing audio circuits.

This display of stereo audio is intuitive and easy to use and has gained wide acceptance in new-generation Tektronix vectorscopes.

Longitudinal Time Code is monitored in a frame rate display to allow observation of amplitude, synchronization, and phase with respect to reference vertical. Synchronization is confirmed by the stationary display and time code phase is easily determined by horizontal position of the time code sync word on the CRT.

These monitors provide **multiple display modes**, allowing simultaneous observation of the many important parameters that make up a television signal. For example, vector, waveform, and audio may be displayed together for an indication of signal quality without operator intervention.

In the 1750A, or 1760 with the SCH option, **Subcarrier/Horizontal Phase and Color Framing** are displayed graphically in the patented Tektronix polar SCH display. Sync jitter over the field is displayed as a moving sync vector dot or displayed as a timing error at a vertical rate to identify the relationship over the field time. Correct color framing is quickly verified by the position of the single sync vector dot relative to the color subcarrier vector when the monitor is externally referenced.

The SCH phase of the reference signal is separately sensed to allow reliable SCH and color framing comparison. Using this method of determining relative SCH phase and color framing eliminates the requirement for a precise horizontal timing match between the reference and measured signals and an external color-field identification input is not required.

User Interface

Characteristic of current-generation Tektronix instruments, an intuitive operator interface allows full instrument utilization with minimal reference to the provided user and maintenance manuals. Operating modes, any of eight video inputs, and key control knobs and buttons are always available for direct access from the front panel.

To keep operation easy and straightforward, the 1740A, 1750A, and 1760 family "learns" the user's preferences for waveform, vector, and picture modes (and SCH in the 1750A and 1760 with the SCH option). Returning to one of these modes restores the previous configuration. Changes to a mode configuration are easily made using front-panel buttons, supplemented by screen-labeled buttons and knobs. Knob operations such as position, gain, phase, etc., are stored as well.

The 1740A/1750A/1760 family is easily configured for special monitoring applications, which may be stored in user presets for easy recall. For example, a program line or off-air VITS may be set up as preset number 3. Preset number 3 could be named and later recalled to display line 19 of the selected input in 2H sweep, with voltage cursors marking proper signal levels. Other presets could be used to immediately access and display signals from other points in the system. Different operators could quickly return to preferred monitoring setups after specialized signal checks.

With eight loopthrough video inputs, the 1740A/1750A/1760 family is a versatile central point system monitor. This capability is particularly useful in the production studio, where several machines, cameras, and composite input/output feeds are in use.

As a machine monitor, the instrument may be operated from a central control panel, with waveform, vector (SCH and color framing with the 1750A Series and 1760 Series with SCH), audio, time code, and servo signals easily observed.

High-performance Design

The control system, based on Motorola's rugged MC68332 32 bit microprocessor with internal co-processing, facilitates instrument control and timing functions. Flash EPROMs simplify updating the instrument to the latest firmware configuration.

The 1740A/1750A/1760 family is based on completely new, high-performance analog video system electronics. Application Specific Integrated Circuits (ASICs), developed by Tektronix specifically to maintain signal fidelity in a television test instrument, handle internal signal routing and amplification. Video performance is tightly controlled providing confidence that the signal display accurately represents the signal under test.

As an example of this new video performance level, the series permits observation of the video signal at up to x10 vertical and x25 horizontal magnification. Any part of the signal may be positioned on-screen in any magnification. Overscan performance at any gain setting is virtually distortion-free.

DC Offset (position match) between two or more displayed channels is within 1 IRE or 7 mV. Loopthrough return loss is better than 40 dB to 10 MHz.

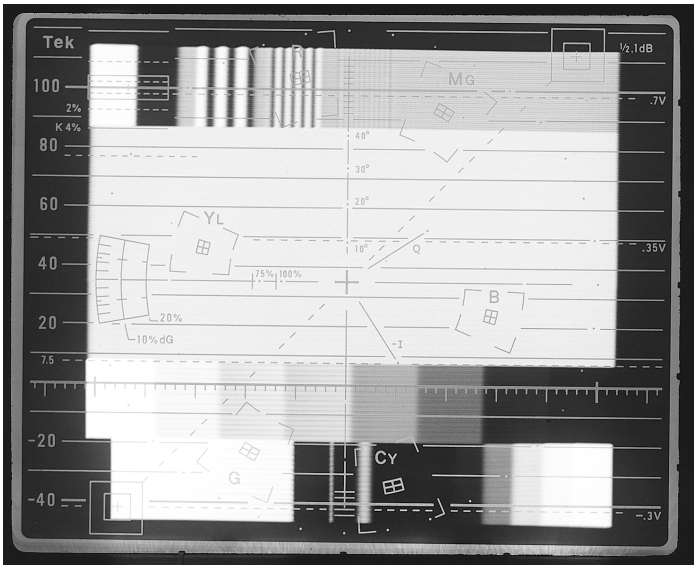
Operational Flexibility

Eight loopthrough video inputs may be connected to the rear panel of the 1740A/1750A/1760 Series, eliminating the need for a dedicated routing switcher bus in many applications. Any of these inputs may be selected singly or in combination from the front panel or through the RS-232 interface. Input selection may also be included in preset configurations recalled using a remote control connector.

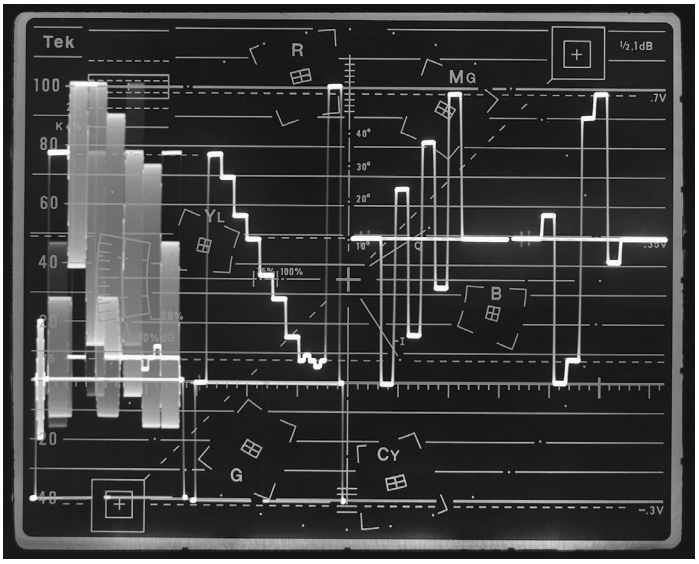
A separate external input may be selected to synchronize the display, allowing relative SCH and color framing comparison between two input signals or with the house reference. Because a separate SCH evaluation is done on the reference signal, SCH and color framing displays are accurate over a wide input range.

Signal standards can be automatically selected, NTSC 525/60 or PAL 625/50, in dual-standard 1745A/1755A/1765 models. A CRT graticule suitable for both standards is provided. A microprocessor-controlled phase shifter may be activated to rotate the vector display to the correct position on the display. Once set for each standard, the instrument displays the correct vector rotation when the video standard is changed.

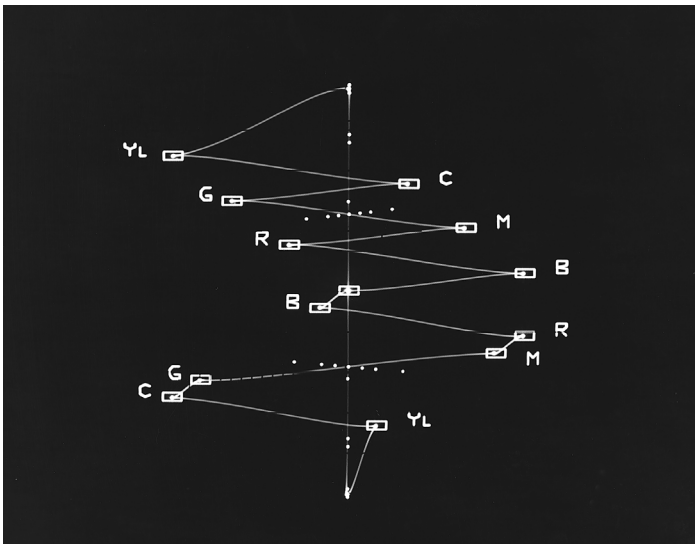
A new universal input power supply is a part of these monitors. AC mains in the range of 90 to 250 V, 50 or 60 Hz, are accommodated automatically. This new power supply will also operate from a nonsinusoidial supply, allowing battery operation using an external, high-efficiency switching inverter. A snap-lock power cord appropriate to the country of use is supplied with each instrument.



Picture display is a standard feature of all models.



Multi-input waveform parade may be offset to display component signals.



1760 Series Lightning Display allows observation of key component values using just color bars.

Characteristics

Waveform Vertical Deflection

Deflection Factor – 1.0 V (0.2 V x5 gain, 0.1 V x10 gain) input displayed within 1% of 140 IRE (1.00 V) graticule.

Overscan – <7 mV variation in base line of chroma when positioned anywhere between sync tip and 100% white.

Variable Gain Range – 0.2x to 1.4x.

DC Offset Between Channels – <1 IRE (7 mV).

Maximum Operating Signal Input Voltage – -1.8 V to +2.2 V, DC + peak AC.

Absolute Maximum Input Voltage – -8.5 V to +8.5 V, DC + peak AC.

Signal Input Impedance – ≥20 kΩ.

75 Ω Loopthrough Return Loss – ≥40 dB to 6 MHz.

Frequency Response –
Flat: Within ± 2% to 10 MHz (x1 gain).
Luminance filter gain of flat response: Within 1% at 50 kHz, <3 dB attenuation at 1 MHz, ≥40 dB attenuation at F_{sc}.
Chrominance filter, bandwidth 1.5 MHz ±0.3 MHz: Gain within 1% of flat response at F_{sc}, attenuation >25 dB at 2 × F_{sc}.
Differentiated step filter: >40 dB attenuation at F_{sc}.

Transient Response –
Preshoot, overshoot, ringing, field rate tilt, line rate tilt, differential gain: 1% or better.
Pulse-to-bar ratio: 0.99:1 to 1.01:1.

Pix Out –
Gain unity: ±3%.
Frequency response: ±3% to 6 MHz when terminated in 75 Ω.
Differential gain: ≤1%.
Differential phase: ≤1°.

Return Loss – >30 dB to 6 MHz.

DC Restorer – Slow ≤10%, fast ≥95% attenuation at 50 Hz and 60 Hz.
Offset error: <1 IRE (7 mV).
Fast settling time: ≤6 video lines.
Blanking shift with 10% to 90% APL change: ≤1 IRE (7 mV).
Blanking shift with presence or absence of burst: ≤1 IRE (7 mV).

Waveform Horizontal Deflection

Sweep – Synchronization triggered by Horiz and Vert sync pulses. Freeruns without input.

Timing Accuracy 1 Line, 5 µs/div – ±1%.

2 Line, 10 µs/div – ±1%.

Linearity 1 or 2 Line – ±1%.

Magnified Sweep Accuracy – 1 line x25.

0.2 µS/div – ±1%; 2 line x10.

1.0 µS/div – ±1%.

Magnified Sweep Linearity, 1 or 2 Line Magnified – ±1%. Horizontal position range, any portion of the synchronized sweep can be positioned on-screen in any sweep mode.

External Horizontal 0.5 V/div – ±2%.

RGB/YRGB – Staircase input amplitude 12 V_{p-p} maximum, DC + peak AC not to exceed -12 V or +12 V, 10 V = 9 div ±1 div display. Field or line rate front-panel selectable.

Cursor Signals

Waveform Mode Accuracy –
Voltage: ±0.5%.
Timing: ±0.5% for line rate sweeps.

Vector Mode Accuracy –
Amplitude: ±0.5 IRE (0.5%).
Phase: ±0.5°.

Calibrator Signals

Waveform Squarewave –
Amplitude: 1.0 V ±0.5%.
Frequency: 100 kHz ±0.1%.

Waveform Sinewave –
Amplitude: 1.0 V ±0.5%.
Frequency: Nominal subcarrier for standard in use.

Vector Mode

Input Requirements – 1 V_{p-p} ±6 dB composite video signal or black burst.

Chrominance Bandwidth – 1 MHz ±200 kHz.

Display – Phase accuracy within 1.25°. Gain accuracy within 2.5%. Quadrature phasing within 0.5°.

Subcarrier Regenerator –
Pull-in range:
NTSC: ±50 Hz.
PAL: ±10 Hz.
Pull-in time: ≤2 s.
Phase shift with ±50 Hz NTSC or ±10 Hz PAL F_{sc} change: ≤2°.
Phase shift with ±6 dB burst amplitude change: ≤2°.
Phase shift with video input change: ≤1°.
Phase shift with variable gain +3 dB to -6 dB: ≤0.5°.
Burst jitter: ≤0.5° RMS.
Clamp stability: ≤1/64 in. (0.4 mm).
Phase control range: 360° continuous rotation.
Differential gain: ≤1%.
Differential phase: ≤1°.

SCH Mode (1750A Series)

Absolute Accuracy – ±5° at 25 °C.

Relative Accuracy – Typically within 2°.

Acquisition Time – <1 s.

Stable Display – With displayed video to external reference timing from -2 µs to +1 µs.

Display Range – ±70° internal reference, 360° external reference.

Component Vector Mode (1760 Series)

Vertical Bandwidth – -3 dB at ≥1.0 MHz.

Horizontal-to-Vertical Bandwidth Matching – No eye opening at 500 kHz or 2 MHz.

Display-to-Graticule Registration – ≤0.25 box.

Component Lightning Mode (1760 Series)

Y – Displayed vertically.

P'b – Displayed horizontally on top half of display.

P'r – Displayed horizontally on bottom half of display.

Component Diamond Mode (1760 Series)

B+G – Displayed vertically vs. B-G horizontally on top half of display.

-(R+G) – Displayed vertically vs. R-G horizontally on bottom half of display.

Component Bowtie Mode (1760 Series)

Common Mode Rejection Ratio – ≥34 dB at 3 MHz.

Y - P'b (CH1 - CH2) – Displayed on left half of display.

Y - P'r (CH1 - CH3) – Displayed on right half of display.

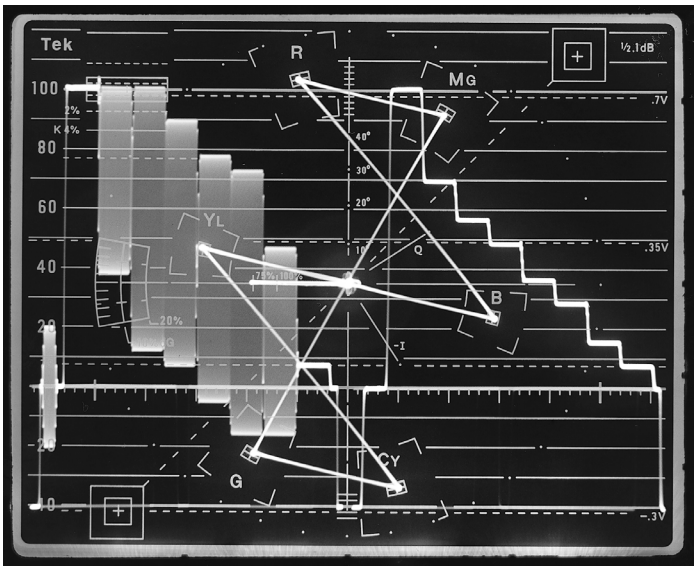
Component Transcoded GBR Outputs (1760 Series)

Input Format – GBR, SMPTE, MII, or Betacam, menu selected.

GBR Output Impedance – Nominally 75 Ω.

DC Level – Back porch clamped to 0 V.

Gain Accuracy – Unity ±3%.



Signals may be displayed in combination modes.

Audio Mode

Full Scale – 0, 4, 8, and 12 dBm, menu selectable.
Full Scale Accuracy – ±0.5 dB at 1 kHz.
Maximum Input Voltage – ±8 V_{p-p}.
Bandwidth – -3 dB, 200 kHz.
X and Y Input Phase Matching – <1 degree at 20 kHz.
Input Impedance – 20 kΩ nominal.

Time Code Mode

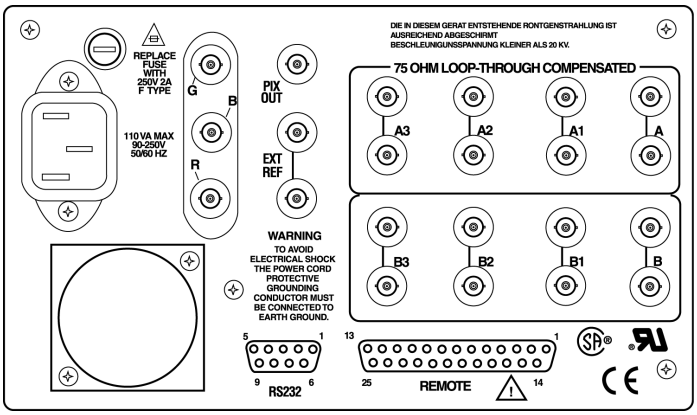
Input – Longitudinal time code, differential.
Full Scale – 0, 4, 8, and 12 dBm, menu selectable.
Maximum Input Voltage – ±8 V_{p-p}.
Input Impedance – >20 kΩ.

CRT Display

CRT Viewing Area – 80 mm × 100 mm.
Accelerating Potential – Nominally 13.75 kV.
Trace Rotation Range – >1° from horizontal.
Graticule – Internal with variable illumination.

Power Source

Mains Voltage Range – 90 to 250 VAC.
Mains Frequency Range – 50 or 60 Hz.
Power Consumption – 110 VA maximum.



1760 Series rear panel. Eight loopthrough inputs may eliminate need for a separate routing switcher bus.

Environmental

Temperature –
Nonoperating: -55 °C to +75 °C.
Operating: 0 °C to +50 °C.
Altitude –
Nonoperating: To 15 km (50,000 ft.).
Operating: To 2,000 m (6,500 ft.).
Vibration – Meets the sine vibration test condition requirements for environmental class 3 of military specification MIL-T-28800D.
Shock (Nonoperating) – 50 g, 1/2 sine, 11 ms duration, 3 shocks/surface.
Transportation – Qualified under NSTC test procedure 1A, category II (24 in. drop).
Humidity – Will operate at 95% relative humidity for up to 5 days. Do not operate with visible moisture on the circuit boards.

Certifications

EMC – Certified to the EMC Directive 89/336/EEC.
Safety –
Approved to: UL1244, CSA231.
Complies with: EN61010-1, IEC61010-1.

Physical Characteristics

Dimensions	mm	in.
Height	133.4	5.25
Width	215.9	8.5
Length	460.4	18.125
Weight	**kg**	**lb.**
Net	3.8	8
Gross Shipping Weight	7.2	15.7

Ordering Information

1740A
NTSC Waveform/Vector Monitor.

1741A
PAL Waveform/Vector Monitor.

1745A
NTSC/PAL Waveform/Vector Monitor.

1750A
NTSC Waveform/Vector/SCH Monitor.

1751A
PAL Waveform/Vector/SCH Monitor.

1755A
NTSC/PAL Waveform/Vector/SCH Monitor.

1760
NTSC/Component Waveform/Vector Monitor.

1761
PAL/Component Waveform/Vector Monitor.

1765
NTSC/PAL/Component Waveform/Vector Monitor.

All Include: User manual, spare fuse, and air filter. To meet safety listing requirements, order a cabinet or rackmount from optional accessories list.

Opt. 74 – White CRT phosphor for these models: 1740A, 1745A, 1750A, 1755A, 1760, 1761, 1765.
Opt. SC – SCH/Color framing option for 1760/1761/1765.

Optional Accessories

Item	Description
1700F00	Plain cabinet; for half-rack 1700 Series and WFM601 Series, safety controlled.
1700F00A	Rackmount insert; for WFM700 Series, half-rack 1700 Series, and WFM601 Series.
1700F02	Portable cabinet; includes handle, feet, and tilt stand.
1700F06	Filler panel; covers unused rack space in WFM7F05.
1700F07	Drawer; half-rack, fits WFM7F05 dual-rack cabinet.
WFM7F05	Rack adapter; dual side-by-side for WFM700 Series, 1700 Series, and WFM601 Series.
040-1488-xx	Kit to add Opt. SC to 1760/1761/1765.
016-0475-xx	Viewing hood.
200-3897-xx	Snap-on front cover.

Service

Opt. R5 – Repair Service 5 Years.

CE

ISO 9001

Product(s) are manufactured in ISO registered facilities.

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900

Austria +41 52 675 3777

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777

Belgium 07 81 60166

Brazil +55 (11) 40669400

Canada 1 (800) 661-5625

Central East Europe, Ukraine, and the Baltics +41 52 675 3777

Central Europe & Greece +41 52 675 3777

Denmark +45 80 88 1401

Finland +41 52 675 3777

France +33 (0) 1 69 86 81 81

Germany +49 (221) 94 77 400

Hong Kong (852) 2585-6688

India (91) 80-42922600

Italy +39 (02) 25086 1

Japan 81 (3) 6714-3010

Luxembourg +44 (0) 1344 392400

Mexico, Central/South America & Caribbean 52 (55) 54247900

Middle East, Asia, and North Africa +41 52 675 3777

The Netherlands 090 02 021797

Norway 800 16098

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

Poland +41 52 675 3777

Portugal 80 08 12370

Republic of Korea 82 (2) 6917-5000

Russia & CIS +7 (495) 7484900

South Africa +27 11 206 8360

Spain (+34) 901 988 054

Sweden 020 08 80371

Switzerland +41 52 675 3777

Taiwan 886 (2) 2722-9622

United Kingdom & Ireland +44 (0) 1344 392400

USA 1 (800) 426-2200

For other areas contact Tektronix, Inc at: 1 (503) 627-7111

Updated 30 October 2008

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

27 Jul 2009 24W-07169-4d