

## TEKTRONIX

# MSO4104

The Tektronix MSO4104 is a high-performance 1 GHz, 4-channel mixed signal oscilloscope from the MSO4000 series, integrating robust analog and digital analysis capabilities. With a 10.4-inch XGA color display, 16 integrated digital channels, a real-time sample rate of 5 GS/s on all channels, and a deep 10 Mpoints record length, it provides comprehensive debug capabilities for modern embedded systems.

## SPECIFICATIONS

### General

|         |                                                                             |
|---------|-----------------------------------------------------------------------------|
| Display | 10.4 in. (264 mm) liquid-crystal TFT color display, 1024 × 768 pixels (XGA) |
|---------|-----------------------------------------------------------------------------|

### Physical

|                       |                                                                                     |
|-----------------------|-------------------------------------------------------------------------------------|
| Power Supply          | 100 to 240 V ±10% (50/60 Hz at 100 to 240 V, 400 Hz at 100 to 132 V), 250 W maximum |
| Operating Temperature | 0 °C to +50 °C °C                                                                   |
| Dimensions (W×H×D)    | 439 mm × 229 mm × 137 mm mm                                                         |
| Weight                | 5.0 kg                                                                              |
| Cooling Clearance     | 51 mm (2 in.) required on left side and rear of instrument                          |
| Security Lock Slot    | Kensington-style lock slot                                                          |

### Key Performance Specifications

|                                     |                            |
|-------------------------------------|----------------------------|
| Analog Bandwidth                    | 1 GHz                      |
| Number of Analog Channels           | 4                          |
| Number of Digital Channels          | 16                         |
| Max Real-time Sample Rate (Analog)  | 5 GS/s                     |
| Max Real-time Sample Rate (Digital) | 500 MS/s (2 ns resolution) |
| Max Record Length (Analog)          | 10 Mpoints                 |
| Max Record Length (Digital)         | 10 Mpoints                 |
| Max Waveform Capture Rate           | >50,000 wfm/s              |
| Hardware Bandwidth Limits           | 20 MHz, 250 MHz            |

## Vertical System - Analog Channels

|                                         |                                                                                     |
|-----------------------------------------|-------------------------------------------------------------------------------------|
| Input Coupling                          | AC, DC, GND                                                                         |
| Input Impedance                         | 1 M $\Omega$ $\pm$ 1%    13 pF $\pm$ 2 pF, 50 $\Omega$ $\pm$ 1%                     |
| Input Sensitivity Range (1 M $\Omega$ ) | 1 mV/div to 10 V/div                                                                |
| Input Sensitivity Range (50 $\Omega$ )  | 1 mV/div to 1 V/div                                                                 |
| Vertical Resolution                     | 8 bits                                                                              |
| Max Input Voltage (50 $\Omega$ )        | 5 Vrms with peaks $\leq$ $\pm$ 20 V                                                 |
| DC Gain Accuracy                        | $\pm$ 1.5% for 2 mV/div to 10 V/div, $\pm$ 3.0% for 1 mV/div                        |
| Channel-to-Channel Isolation            | $\geq$ 100:1 at $\leq$ 100 MHz and $\geq$ 30:1 at $>$ 100 MHz up to rated bandwidth |
| Position Range                          | $\pm$ 5 divisions                                                                   |

## Vertical System - Digital Channels

|                                   |                                          |
|-----------------------------------|------------------------------------------|
| Input Channels (Digital)          | 16 (D0 to D15)                           |
| Input Impedance (Digital Probe)   | 20 k $\Omega$    3 pF (P6516 probe)      |
| Threshold Selections              | TTL, CMOS, ECL, PECL, User-defined       |
| Threshold Accuracy                | $\pm$ (100 mV + 3% of threshold setting) |
| Max Input Voltage (Digital Probe) | $\pm$ 40 V peak                          |
| Minimum Voltage Swing             | 500 mV peak-to-peak                      |

## Horizontal System

|                                 |                                           |
|---------------------------------|-------------------------------------------|
| Time Base Delay Time Range      | -10 divisions to 5000 s                   |
| Channel-to-Channel Deskew Range | $\pm$ 75 ns                               |
| Time Base Accuracy              | $\pm$ 5 ppm over any $\geq$ 1 ms interval |

## Trigger System

|                            |                                                                                                                                  |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Trigger Modes              | Auto, Normal, Single                                                                                                             |
| Trigger Coupling           | DC, AC, HF Reject, LF Reject, Noise Reject                                                                                       |
| Trigger Holdoff Range      | 20 ns to 8 s                                                                                                                     |
| Pulse Width Trigger        | Trigger on width of positive or negative pulses that are $>$ , $<$ , $=$ , or $\neq$ to a specified period of time (4 ns to 8 s) |
| Runt Trigger               | Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again              |
| Setup and Hold Trigger     | Trigger on violations of setup time and hold time between clock and data present on any of the input channels                    |
| Rise and Fall Time Trigger | Trigger on pulse edge rates that are faster or slower than specified                                                             |
| Video Trigger              | Trigger on all lines, odd, even, or all fields on NTSC, PAL, and SECAM video signals                                             |

## Acquisition Modes

|                  |                                                                                                 |
|------------------|-------------------------------------------------------------------------------------------------|
| Sample Mode      | Acquire sampled values                                                                          |
| Peak Detect Mode | Captures glitches as narrow as 200 ps at all sweep speeds                                       |
| Averaging Mode   | From 2 to 512 waveforms                                                                         |
| Hi-Res Mode      | Real-time boxcar averaging reduces random noise and increases vertical resolution               |
| Roll Mode        | Scrolls waveforms right to left across screen at sweep speeds slower than or equal to 40 ms/div |

## Waveform Measurements and Analysis

|                        |                                                                                                                  |
|------------------------|------------------------------------------------------------------------------------------------------------------|
| Measurement Statistics | Mean, Min, Max, Standard Deviation                                                                               |
| Reference Levels       | User-definable reference levels for automatic measurements, specified in percent or units                        |
| Gating                 | Isolate a specific occurrence within an acquisition for measurement, using either the screen or waveform cursors |
| FFT Window Functions   | Rectangular, Hamming, Hanning, Blackman-Harris                                                                   |

## Display and Controls

|                 |                                                           |
|-----------------|-----------------------------------------------------------|
| Waveform Styles | Vectors, Dots, Variable Persistence, Infinite Persistence |
| Graticules      | Full, Grid, Cross Hair, Frame, IRE and mV                 |

## Power and Environmental

|                    |                      |
|--------------------|----------------------|
| Operating Altitude | 3,000 m (10,000 ft.) |
|--------------------|----------------------|

## Physical Specifications

|                     |        |
|---------------------|--------|
| Dimensions (Height) | 229 mm |
| Dimensions (Width)  | 439 mm |
| Dimensions (Depth)  | 137 mm |
| Weight (Shipping)   | 9.5 kg |

## Compliance and Standards

|                       |                                                  |
|-----------------------|--------------------------------------------------|
| Safety Certifications | UL61010-1, CAN/CSA-C22.2 No. 61010-1, EN 61010-1 |
|-----------------------|--------------------------------------------------|

## Connectivity

|                     |                                                                                |
|---------------------|--------------------------------------------------------------------------------|
| USB Device Port     | 1 x USB 2.0 Type-B on the rear panel for PictBridge printing or USBTMC control |
| LAN Port Connector  | RJ-45 connector, 10/100Base-T Ethernet                                         |
| Video Out Connector | DB-15 female D-Sub connector to show display on an external monitor            |

## Standard Accessories

|                         |                                                           |
|-------------------------|-----------------------------------------------------------|
| Standard Passive Probes | 4x P6139A (500 MHz, 10X, 8 pF)                            |
| Standard Digital Probe  | 1x P6516 16-channel mixed-signal probe with accessory kit |

**Power**

|                       |                                                          |
|-----------------------|----------------------------------------------------------|
| Power Consumption     | 250 W maximum                                            |
| Input Voltage Range   | 100 to 240 V AC ±10%                                     |
| Input Frequency Range | 47 to 66 Hz (100 to 240 V), 360 to 440 Hz (100 to 132 V) |

**Search & Navigation**

|                           |                                                                                 |
|---------------------------|---------------------------------------------------------------------------------|
| Wave Inspector Navigation | Dedicated front-panel controls for zoom/pan, play/pause, search, and user marks |
|---------------------------|---------------------------------------------------------------------------------|

**Digital Channels**

|                           |                                    |
|---------------------------|------------------------------------|
| MagniVu Timing Resolution | 60.6 ps                            |
| MagniVu Record Length     | 10k points centered on the trigger |

**Display**

|                    |                         |
|--------------------|-------------------------|
| Display Resolution | 1024 × 768 pixels (XGA) |
|--------------------|-------------------------|

**Interfaces**

|                 |                                    |
|-----------------|------------------------------------|
| Probe Interface | TekVPI Probe Interface             |
| GPIO Interface  | Optional (via TEK-USB-488 adapter) |

**Software & Connectivity**

|                  |                                                                   |
|------------------|-------------------------------------------------------------------|
| Software Support | OpenChoice Desktop, IVI Drivers, e*Scope Web-based Remote Control |
|------------------|-------------------------------------------------------------------|

**TECHNOLOGY**

Mixed Signal Oscilloscope

**APPLICATIONS**

Embedded design and debug, serial bus analysis, power measurement, and general electronic system troubleshooting

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